UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

DOTTORATO DI RICERCA IN SCIENZE FILOSOFICHE
XXXVI CICLO

CURRICULUM DI BIOETICA

Reimagining Relationships.
Biocultural Diversity and a Relational Ethical Approach for a Peaceful Anthropocene

Tutor
Prof. Domenico Fulgione

Candidata
dott.ssa Sofia Belardinelli

Coordinatore
Prof. Domenico Conte

ANNO ACCADEMICO 2023-2024

La crisi consiste appunto nel fatto che il vecchio muore e il nuovo non può nascere.

(Antonio Gramsci (1975) *Quaderni dal carcere*. Roma: Einaudi. Q. 3, §34, p. 3)

What we do about ecology depends on our ideas of the man-nature relationship.

(Lynn White Jr. (1967) The historical roots of our ecological crisis. Science, 155(3767))

In the end, when all the accounting is done, conservation will boil down to a decision of ethics based on empirical knowledge: how we value the natural world in which we evolved and now, increasingly, how we regard our status as individuals.

(Edward O. Wilson (1989) Conservation: The Next Hundred Years. In: *Conservation for the Twenty-First Century*, D. Western, M. Pearl (eds.). New York and Oxford: Oxford University Press, p. 7)

Abstract

The environmental crisis we face today is deeply rooted in a flawed narrative about the relationship between humans and the broader natural world. To redirect our current maladaptive trajectory, reimagining these narratives is imperative. This study critically challenges the prevalent perception of humans as separate from nature, unravelling its historical and cultural roots entrenched within modern Western thought. In seeking possible alternatives to this perspective, I delve into the conceptual development of this dualistic understanding of the natural world, also examining its social and political implications. Moreover, I trace the origins and conceptual development of novel disciplines like environmental ethics and ecological sciences, emphasising how their confluence has represented a turning point in heightening public awareness about environmental concerns. Central to this rethinking is the concept of biocultural diversity, bridging the biological and cultural realms. Exploring expressions of biocultural diversity worldwide, including in industrialised countries, illuminates the intertwined history of human cultures and their environments, underlining the reciprocity of relationships between humans and the rest of nature. Human influence on ecosystems, not a recent occurrence but the result of a prolonged coevolution, showcases the centrality of this prolonged interaction for both these dimensions, as the case study of biocultural diversity in the central and southern Apennines of Italy exemplifies. The emphasis on the historical interplay between humans and nature underscores the prospect of peaceful coexistence between humans and the biosphere, contingent upon a nuanced understanding of their complex and multifaceted relationship. Ecological sciences reveal the fundamental role of relationships in the natural world. From an ethical perspective, awareness of the relational nature of the biological world calls for a shift from individual-centric approaches to prioritising relationships per se as the primary focus of ethical concern. This study contends that integrating ecological knowledge with philosophical perspectives holds promise for constructing a new environmental narrative, proposing a relational ontological and ethical approach as a promising framework for environmental ethics in the Anthropocene.

Sinossi

Questo studio approfondisce la complessa relazione tra gli esseri umani e il resto del mondo naturale. La ragione e lo sfondo di questa riflessione è l'attuale crisi ambientale. Essa ha un profondo impatto tanto sul mondo naturale, dei cui equilibri stiamo assistendo a una rapida e drammatica ristrutturazione, quanto sulle società umane, con inevitabili conseguenze di natura economica e politica, caratterizzate da profonde ingiustizie.

Tra gli obiettivi di questo lavoro vi è quello di analizzare le implicazioni etiche della crisi ambientale: quelle che coinvolgono un cambiamento repentino e drammatico degli equilibri ecologici, con tassi di riduzione della diversità della vita ben superiori alla norma, e quelle sociali, con le ingiustizie che si verificano a monte e a valle della crisi umanitaria policentrica innescata dalla crisi ambientale. La ricerca parte dall'ipotesi che la crisi ambientale (e quella sociale ad essa collegata) abbia radici teoriche, prima che tecniche o politiche, e si concentra sulla questione teorica della relazione tra gli umani e il mondo naturale – o meglio, sul modo in cui tale relazione è stata interpretata nella cultura occidentale moderna, oggi dominante a livello globale.

Nel primo capitolo si ripercorre il percorso storico e concettuale che ha portato all'affermarsi di questo modello di pensiero. L'obiettivo, in questo caso, consiste nel rintracciare le radici teoriche dell'odierna crisi ecologica, concentrando l'attenzione soprattutto sulla separazione tra esseri umani e natura compiutosi nella cultura europea in età moderna, che ha avuto un gran peso sui successivi sviluppi del pensiero e della strutturazione delle società occidentali moderne e contemporanee. Questo paradigma viene poi confrontato con le odierne teorie di etica ambientale, che hanno iniziato a mettere in discussione la supposta separazione (ontologica ed etica) tra umani e non umani attraverso la contaminazione con l'ecologia. Queste due discipline sono state fondamentali nel rendere la questione ambientale un tema di dibattito pubblico; anche di esse si traccia una breve 'archeologia' concettuale, sottolineando i punti di convergenza e l'influenza che hanno avuto l'una sull'altra.

Sebbene l'approccio al mondo non umano oggi dominante sia di tipo utilitaristico, e si manifesti prevalentemente in un'attitudine estrattiva e predatoria, è importante ricordare che questo non è l'unico modo possibile per entrare in relazione con l'*altro*. Recuperando le origini storiche di questa modalità di relazione, emerge come questa propensione allo sfruttamento del

mondo naturale non sia una caratteristica universale della nostra specie, ma il prodotto di una specifica temperie storico-culturale: la cultura occidentale di età moderna e contemporanea. Nella storia del pensiero occidentale moderno si è consumato il distacco tra lo studio dell'umano e lo studio del mondo naturale, relegato a mero sfondo delle vicende umane. Accanto a questa visione del mondo, poi affermatasi per via del successo storico e politico del modello europeo nel mondo, sono esistiti, e in parte sopravvivono ancora oggi, altri modi di *essere umani*, altre forme di relazione con il mondo naturale.

Nel secondo capitolo si ricorre al concetto di diversità bioculturale come chiave di lettura per esplorare questi diversi modi di *essere umani*. Il concetto di diversità bioculturale richiama la fondamentale, seppur spesso ignorata, interdipendenza tra noi umani e il resto del mondo naturale. Si tratta di una dipendenza biunivoca: vi è infatti una correlazione evolutiva tra la distribuzione della diversità biologica e della diversità culturale umana. Tale interdipendenza, inoltre, è ancora oggi testimoniata dai popoli indigeni e dalle comunità locali, che, soprattutto nelle aree del pianeta (note come *global biodiversity hotspots*) dove i tassi di diversità biologica sono più alti, svolgono un ruolo essenziale per la preservazione di quest'ultima.

In seguito a una scansione della letteratura scientifica sul tema, si mira a affrontare un vuoto nella ricerca, che riguarda l'analisi della diversità bioculturale nei paesi industrializzati. In queste aree, i tassi di biodiversità sono più bassi rispetto agli *hotspot* globali di biodiversità e anche la diversità culturale si è ormai ridotta, come conseguenza di un prolungato processo di omogeneizzazione acuitosi soprattutto nell'ultimo secolo. Tuttavia, la diversità bioculturale è presente anche nelle aree più industrializzate del pianeta, e le pratiche tradizionali hanno ancora un peso nelle culture e nelle identità locali. Inoltre, sembra possibile ipotizzare che vi sia ancora un legame tra questa dimensione locale (spesso rurale), l'ambiente naturale e la diversità biologica che lo abita.

L'Europa è esemplare in tal senso: seppur in rapida diminuzione, nel Vecchio Continente esistono ancora conoscenze tradizionali legate alla diversità ecologica locale. Nello specifico, l'Italia è un caso di studio particolarmente interessante: per via della sua conformazione geomorfologica, della sua posizione geografica e della complessa storia di 'contaminazioni' che l'ha interessata fin da tempi antichissimi, la Penisola presenta infatti un'interessante eredità sia ecologica che storico-culturale, che si manifesta

come diversità di ecosistemi e nicchie ecologiche, paesaggi naturali e bioculturali, tradizioni materiali e immateriali, prodotti locali.

Nel terzo capitolo viene presentato il caso di studio, individuato nella regione centro-meridionale dell'Italia, e in particolare nelle sue aree interne, come caso d'indagine esemplificativo della diversità bioculturale nei Paesi industrializzati. Le cinque aree selezionate per lo studio comparativo sono state oggetto di indagini sul campo, supportate e ampliate da una ricerca d'archivio e, laddove possibile, da colloqui e interviste semi-strutturate con persone del luogo. Per ognuno dei territori e dei comuni coinvolti è stato analizzato soprattutto il patrimonio culturale legato all'ecologia locale.

L'approfondimento del caso italiano mira a sottolineare, attraverso un esempio concreto, come l'interazione tra le popolazioni umane e l'ambiente naturale non abbia sempre esiti negativi. Guardando alla situazione attuale, è facile indulgere in una narrazione che descrive l'essere umano come separato da e negativo per l'ambiente naturale. Ma, proprio per contrastare la rapida degradazione della biosfera e individuare strade di sviluppo alternative a quella attuale, è importante mettere a fuoco la non ineluttabilità del percorso seguito fino a oggi. Lo studio delle molteplici forme di diversità bioculturale esistenti, e in particolare l'approfondimento delle espressioni dirette che di essa esistono anche in regioni industrializzate come quella europea, suggeriscono che vi sono possibilità alternative. Come lo studio della diversità bioculturale dimostra, l'essere umano non agisce solo come una forza distruttiva nell'ambiente naturale. Al contrario, il suo ruolo ecologico è spesso fondamentale: ad esempio, attività di gestione della natura a basso impatto svolgono un ruolo essenziale nel mantenimento nel lungo periodo degli equilibri ecosistemici, che sono il risultato di prolungate interazioni tra gli esseri umani e le altre specie.

Le scienze ecologiche e gli studi sulla diversità bioculturale sono accomunati da un elemento: la centralità della relazione e dell'interazione nel mondo naturale, e in particolare nel rapporto tra umani e non umani. Questa rinnovata attenzione alle relazioni tra individui, che le discipline scientifiche hanno sviluppato – coerentemente con la propria natura – in modo descrittivo, può essere fruttuosamente applicata anche in ambito filosofico. Nel quarto capitolo si affrontano diversi approcci filosofici che pongono la relazione al centro della propria riflessione, dall'ontologia relazionale all'etica relazionale,

sottolineando la consonanza di queste prospettive con la 'svolta relazionale' registrata, in decenni recenti, proprio nella scienza ecologica.

Questa svolta relazionale appare feconda anche per la riflessione etica: riconoscere il valore della relazione anche su un piano etico, infatti, è non solo coerente con la descrizione del mondo naturale veicolata dalle più recenti teoriche scientifiche e dal patrimonio di conoscenze di molte tradizioni non occidentali, ma può anche offrire una guida per l'azione in un momento di crisi come quello che viviamo oggi. Da una parte, mettere il concetto di relazione al centro della considerazione etica permette di superare la classica dicotomia tra esseri umani e altri viventi, sostituendo così ad ogni tipo di approccio '-*centrico*' (antropocentrismo, biocentrismo, ecocentrismo, etc.) uno '*non-centrico*' e relazionale. Inoltre, da un punto di vista pratico, questo consente di tenere in equa considerazione tutte le esigenze, gli interessi e i valori in gioco, operando i bilanciamenti sempre necessari nel fare i conti con la realtà.

Un'etica ambientale relazionale è inoltre in grado di mettere in luce, meglio di altre prospettive, la bidirezionalità del rapporto tra l'umano e il non umano, caratteristica che emerge anche dagli studi sulla diversità bioculturale. Gli umani hanno bisogno della natura, e la natura ha bisogno degli esseri umani; ciò è tanto più vero in un momento, come quello presente, in cui questa relazione è chiaramente sbilanciata. Oggi, infatti, la nostra specie ha tra le mani il destino proprio e del resto del mondo naturale per come lo conosciamo.

Sono gli stessi strumenti teorici e pratici che hanno portato alla crisi attuale ad avere in sé il potenziale per divenire fondamentali alleati nella tutela del pianeta e della nostra specie. Si tratta, dunque, di elaborare una narrazione che riconosca tanto l'ambivalenza della nostra attività sul mondo naturale quanto la radicale interconnessione tra quest'ultimo e le società umane, che di esso sono parte integrante. Una comprensione più approfondita e un maggiore riconoscimento delle relazioni che legano tra loro i membri delle comunità socio-ecologiche potrebbe dunque essere funzionale alla diffusione di un diverso orientamento etico per l'Antropocene, da un lato più incentrato sulla relazione in sé che sull'agentività o i diritti di particolari soggetti etici, e dall'altro in grado di valorizzare sentimenti di interdipendenza, umiltà e responsabilità. Riconoscere l'intrinseca ambivalenza dell'umano, infatti, da una parte solleva la condanna a una supposta negatività intrinseca della nostra specie nel contesto del mondo naturale, e dall'altra – eliminata la pretesa ineluttabilità di questa condanna – assegna a tutti noi una ponderosa

responsabilità. Il modo in cui entriamo in relazione con il mondo naturale è, in fondo, una scelta, per quanto mediata da condizioni esterne e fattori culturali; si realizza, dunque, in una dimensione di libertà. Trovare il giusto equilibrio, grazie anche al contributo delle scienze ecologiche e della biologia evoluzionistica, per descrivere l'ambivalenza del nostro ruolo nel mondo naturale è fondamentale per trovare una direzione da seguire in un futuro ignoto, in quanto 'non analogo' al passato.

INTRODUCTION ..... **I**

I. Theoretical Roots of a Polycentric Crisis i

II. Biocultural Diversity iv

III. A Relational Approach vii

1. ENVIRONMENTAL ETHICS: NEW PERSPECTIVES ON AN AGE-OLD DEBATE 1

1.1. Environmental Ethics in the Anthropocene: Conceptual Archaeology and Current Issues 1

1.1.1. Introduction: Interconnected crises, interconnected consequences . 1

1.1.2. Dualism: A historical legacy 6

1.1.3. Anthropocene 12

1.1.3.1. A brief overview of the geological dating discussion 12

1.1.3.2. Scientific, political, social ramifications of the Anthropocene concept 15

1.1.4. Humans and nonhuman nature 19

1.1.4.1. Modern science and the progressive objectification, materialisation, and commodification of nature 22

1.1.4.2. Commodification: the natural world as economic resource 25

1.2. How Ecological Sciences Twisted the Debate in Environmental Ethics 33

1.2.1. Ecological sciences in retrospect: A brief historical review 35

1.2.1.1. Beginnings: A science of relations 35

1.2.1.2. Modern Synthesis: The return of mechanistic thinking 39

1.2.1.3. Ecological science and ecology: 'value-ladenness' 42

1.2.2. Environmental ethics in retrospect: A brief historical review 44

1.2.2.1. Who and what has worth? Alternatives along a spectrum 45

1.2.2.2. Environmental ethics and ecological sciences: A dynamic interplay? 48

1.2.3. The intertwining of (ecological) facts and (environmental) values 50

1.3. Can We Imagine a Different Human-Nonhuman Relationship? 55

2. BIOCULTURAL DIVERSITY: A COMPLEX INTERTWINING 59

2.1. Introduction 59

2.1.1. Natural and Cultural: A Blurred Boundary 61

2.2. Biological Diversity 64

2.2.1. General definition and quantitative measures of biodiversity 64

2.2.2. A new evolutionary actor: humans 66

2.2.3. Importance of biological diversity 67

2.3. Cultural Diversity 67

2.3.1. Measuring cultural diversity 69

2.3.2. Languages and dialects 69

2.3.3. Linguistic and biological diversity: parallel extinctions 71

2.3.4. Intangible knowledge and its transmission 73

2.3.5. Food and culinary practices 74
2.3.6. Traditional crafts 76
2.4. Biocultural Diversity in Industrialised Countries 78
2.4.1. Some European examples 80
2.5. Biocultural Diversity from an Evolutionary Perspective 83
2.5.1. Historical co-evolution 85
2.5.2. Present cultural severance 87
2.5.3. Biological and cultural dimensions: An evolutionary entanglement 89
3. BIOCULTURAL DIVERSITY IN ITALY: A CASE STUDY 90
3.1. Italy as a Hotspot of Biocultural Diversity 90
3.1.1. A brief summary of the history of Italian landscape 91
3.1.2. Anthropization of Mediterranean and Italian landscapes 95
3.1.3. Industrialisation, land use intensification, and landscape homogenisation 100
3.2. Biocultural Case Studies in Central and Southern Apennines 104
3.2.1. Methods 106
3.2.1.1. Preliminary steps 106
3.2.1.2. Field surveys and data collection 107
3.2.1.3. Data elaboration 109
3.2.2. Cottanello 109
3.2.2.1. Prati di Cottanello 110
3.2.2.2. Herding 111
3.2.2.3. Typical products and local culture 113
3.2.3. Mount Cervati and Diano Valley 113
3.2.3.1. Agricultural and herding activities 115
3.2.3.2. Culinary traditions 116
3.2.4. Roscigno 117
3.2.4.1. Daily life of a rural community 118
3.2.5. Chestnut groves of Mount Reventino: San Pietro Apostolo 119
3.2.5.1. Rural traditions and local culture 121
3.2.6. Aliano 123
3.3. Results 126
4. A MOULDED PLANET: MANY WAYS OF BEING HUMAN 130
4.1. Co-belonging 130
4.2. Above and Beyond: Overcoming Dualism in Environmental Ethics 132
4.2.1. An ecological planet: relations in nature 132
4.2.2. Two levels of ethical discourse in a relational view of the natural world 134
4.3. Biocultural Earth 139

4.4. A Way Forward 142

ACKNOWLEDGEMENTS – RINGRAZIAMENTI 148

REFERENCES 154

INTRODUCTION

I. THEORETICAL ROOTS OF A POLYCENTRIC CRISIS

The cornerstone around which this work unfolds is the relationship between humans and the broader natural world. The reason and backdrop for this focus is the current climate and environmental crises. These crises involve every dimension of the planetary systems and human societies, manifesting as a generalised deterioration of the natural environment fuelled by human activities.

The repercussions of this planetary alteration, spanning the biological, ecological, physico-chemical, and geological dimensions, can be categorised into two main types. On one hand, we are witnessing the initial stages of a fundamental restructuring of the current configuration of life, which is the outcome of geological and evolutionary processes unfolding across a "deep" timescale, and whose swift modification is caused – as in very few instances in Earth's history – by a single species pursuing its own interests, resulting in activities with global repercussions and enduring effects on all life forms. On the other hand, this transformation has consequences that reverberate also in the social and economic spheres, thus demanding a substantial rethinking of human societal structures that have relied on the regularity of ecological patterns for at least ten millennia, a consistency that is now uncertain.[1]

This work aims to delve into the ethical ramifications of these two sets of implications of the environmental crisis: the abrupt and profound ecological shifts leading to a drastic reduction in biodiversity, and the social dimensions encompassing injustices both preceding and following the polycentric humanitarian crisis triggered by the environmental change. Proceeding with this analysis, it becomes evident that isolating the multifaceted manifestations of the issue is not only challenging but also counterproductive. The diverse factors – historical, cultural, scientific, political, ecological – that have contributed to the present state of affairs cannot be understood without highlighting their interrelations.

[1] E.C. Ellis et al., 'Used Planet: A Global History', *Proceedings of the National Academy of Sciences* 110, 20 (2013), 7978–7985; L. Stephens et al., 'Archaeological Assessment Reveals Earth's Early Transformation through Land Use', *Science* 365, 6456 (2019), 897–902; C. Xu et al., 'Future of the Human Climate Niche', *Proceedings of the National Academy of Sciences* 117, 21 (2020), 11350–11355.

The analysis of the theoretical issue identified as the central point of focus – the relationship between humans and the rest of the natural world – is subject to this requirement as well. By acknowledging that the ongoing environmental crisis stems from a theoretical issue before being a scientific or political one, it becomes possible to identify one of the trajectories leading to the present emergency: our interpretation of the relationship with the non-human world. Simultaneously addressing both ecological and social challenges (the degradation of nature on one hand and the disruption of already unstable global socio-economic balances on the other) seems the most sensible approach to unravel the pathway that has led to this situation, and potentially outline a path forward.

However, for a more thorough contextualisation of the theoretical issue, an additional premise is necessary. This entails clearly defining the entities involved in the analysis: Which 'humans'? Which 'nature'?

In theoretical discourses, not just philosophical, concerning the current situation, the term 'Anthropocene' is now commonly employed.[2] Setting aside the technical aspects of the debate (which involve Earth sciences and the potential formal recognition of the new epoch from a geostratigraphic standpoint),[3] it is essential to note how the use of this term assumes a conceptual framework that uniformly identifies all humans as actors and equally responsible for the current situation. Such an approach, however, overlooks the necessity to make clear distinctions in assigning historical and present responsibilities, and simultaneously disregards the fact that the ongoing crisis will impact individual human and nonhuman beings differently, depending on their contingent living conditions, both in the present and in the future.[4]

---

[2] H. Bergthaller and E. Horn, *The Anthropocene: Key Issues for the Humanities,* London, 2019; C. Bonneuil and J.-B. Fressoz, *The Shock of the Anthropocene: The Earth, History and Us*, 2016; N. Wallenhorst and C. Wulf, eds., *Handbook of the Anthropocene. Humans between Heritage and Future*, 2023.

[3] P.J. Crutzen and E.F. Stoermer, 'The "Anthropocene"', *Global Change NewsLetter* 41 (2000); P.J. Crutzen, 'Geology of Mankind', *Nature* 415, 6867 (2002), 23; W. Steffen, P.J. Crutzen, J.R. McNeill, 'The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature', *AMBIO: A Journal of the Human Environment* 36, 8 (2007), 614–621; J. Zalasiewicz *et al.*, 'The Anthropocene: Comparing Its Meaning in Geology (Chronostratigraphy) with Conceptual Approaches Arising in Other Disciplines', *Earth's Future* 9, 3 (2021), e2020EF001896; S. Perkins, 'Researchers Move Closer to Defining the Anthropocene', *Proceedings of the National Academy of Sciences* 120, 29 (2023), e2310613120.

[4] A. Fremaux, *After the Anthropocene. Green Republicanism in a Post-Capitalist World*, Cham, Switzerland, 2019.

Building upon these premises, in the first chapter of the dissertation, I aim to reconstruct the theoretical underpinnings of the present climatic-ecological crisis, particularly highlighting the detachment between humans and nature that occurred in European culture during the modern age. Such detachment significantly shaped subsequent theoretical advancements as well as the structures of modern and contemporary Western societies.[5] I contend that this viewpoint, which influenced, to varying degrees, the early formulations of environmental ethics, has been partially challenged by the intersection between this discipline and ecological sciences. Formally originating in the 19th century, this branch of the life sciences has contributed to the resurgence of an 'underground stream' within Western thought regarding nature, characterised by a more organic and less mechanistic view of the natural world. This perspective now appears to be gaining traction in certain branches of natural sciences, such as ecology and evolutionary biology, thereby offering fresh insights into understanding the natural world and, consequently, prompting a reconsideration of our relationship with it.[6]

While the predominant approach towards the non-human world follows a utilitarian and often predatory attitude, it is crucial to recognise that this is not the sole possible way to relate to the *other*. By recuperating the historical origins of this relational mode and juxtaposing this historical understanding with contemporary insights from ecological and evolutionary biology, it becomes apparent that this tendency toward exploiting the natural world is not an inherent trait of our species but rather a product of a specific historical and cultural context – specifically, the Western culture of the modern and contemporary age.

Numerous scholars have emphasised the possibility of pinpointing, within the history of modern Western thought, a specific turning point that led to the divergence between the study of humans and the study of the natural world,

[5] J.H. Zammito *et al.*, 'Philosophical Approaches to Nature', in B.A. Lustig, B. Baruch A., M. Gerald P. (eds.), *Altering Nature*, Volume One: Concepts of 'Nature' and 'The Natural' in Biotechnology Debates, 2008, 63–136; R. Boddice (ed.), *Anthropocentrism: Humans, Animals, Environments*, 2011; S. Tonutti, 'Anthropocentrism And The Definition Of "Culture" As A Marker Of The Human/Animal Divide', *Anthropocentrism*, 2011, 183–200; P. Butchvarov, *Anthropocentrism in Philosophy: Realism, Antirealism, Semirealism*, 2015.

[6] Y. Haila, 'Beyond the Nature-Culture Dualism', *Biology and Philosophy* 15, 2 (2000), 155–175; R.Wall Kimmerer, *Braiding Sweetgrass*, Minneapolis, 2013.

relegating the latter to a mere backdrop of human affairs.[7] Concurrently, alongside this worldview, which later spread and gained prominence due to the historical and political worldwide success of the European model, alternative ways of being human and interacting with the natural world have been explored and thrived – and to some extent continue to persist.

Exploring this alterity is intriguing insofar as, on one side, it absolves us from the condemnation of an alleged inherent destructiveness of our species towards nature. On the other side, by eliminating the idea of this condemnation being inevitable, it assigns us a substantial responsibility. Ultimately, the way we engage with the natural world is a choice, and albeit influenced by external conditions and cultural factors, it occurs within a dimension of freedom.

II. BIOCULTURAL DIVERSITY

Chapter two investigates these varying human approaches through the lens of biocultural diversity. This concept, relatively recent in scientific discourse, highlights the crucial yet often disregarded interdependence between humans and the broader natural community.[8] This dependence – of particular significance within this framework – is reciprocal: current research indicates an evolutionary correlation (although the causal direction is not yet conclusively ascertained) between the distribution of biological diversity and the diversity of human cultures (encompassing languages, ecological knowledge, culinary practices, crafts, material and immaterial customs, etc.).[9] Throughout history,

[7] D. Chakrabarty, 'The Climate of History: Four Theses', *Critical Inquiry* 35, 2 (2009), 197–222; Butchvarov, *Anthropocentrism in Philosophy*, cit.; J.A.P.C. Cooper David E.(ed.), *Key Thinkers on the Environment*, London, 2017.

[8] G. Pungetti, 'Biocultural Diversity for Sustainable Ecological, Cultural and Sacred Landscapes: The Biocultural Landscape Approach', in B. Fu and K.B. Jones (eds.), *Landscape Ecology for Sustainable Environment and Culture*, Dordrecht, 2013, 55–76; J. Loh, 'Biocultural Diversity: Threatened Species, Endangered Languages' (2014); L. Maffi and O. Dilts (eds.), *Biocultural Diversity Toolkit*, Vol. 2-Assessing the State of The World's Languages, 2014; L. Maffi, 'Biocultural Diversity', *The International Encyclopedia of Anthropology*, 2018, 1–14; P. Bridgewater and I.D. Rotherham, 'A Critical Perspective on the Concept of Biocultural Diversity and Its Emerging Role in Nature and Heritage Conservation', *People and Nature* 1, 3 (2019), 291–304; P. Bridgewater and S. Upadhaya, 'What is biocultural diversity, and why does it matter?', *The Conversation*, 2022.

[9] C. Grant, 'Analogies and Links between Cultural and Biological Diversity', *Journal of Cultural Heritage Management and Sustainable Development* 2, 2 (2012), 153–163; E. Gómez-Baggethun, E. Corbera, V. Reyes-García, 'Traditional Ecological Knowledge and Global Environmental Change: Research Findings and Policy Implications', *Ecology and Society : A Journal of Integrative Science for Resilience and Sustainability* 18, 4 (2013), 72; T.H. Eriksen, 'The Loss of Diversity in the Anthropocene Biological and Cultural Dimensions', *Frontiers in Political Science* 3 (2021); G. Fedele *et al.*, 'Nature-Dependent

geographic and ecological circumstances, along with the opportunities and constraints they presented, have influenced the cultural expressions of diverse human populations. Simultaneously, sustained and widespread niche construction activities, mediated by a cultural heritage perhaps unique among living beings, have reshaped the planet's geography, ecology, and biology. Moreover, this interdependence persists today, notably within indigenous peoples and local communities, particularly in regions that host high rates of biological diversity, playing an essential role in its preservation.[10]

Acknowledging the complexity and nuanced nature of the concepts discussed, I devoted the initial section of chapter two to a definitional effort. I attempted to articulate a definition – perhaps not exhaustive but at least operational – of the concepts of biological diversity and cultural diversity. Concerning the latter, considering its complexity, I circumscribed the research scope to focus solely on facets of cultural diversity directly associated with the natural environment, those influenced by it, or that significantly alter its evolution. The aim is to draw attention to the long-term interactions between these two dimensions, emphasising their interdependence and reciprocal role in shaping the evolutionary trajectory of humans and their environments.

A comprehensive review of scientific literature concerning biocultural diversity has brought to light a notable research gap. Most publications focus on examining biocultural diversity in relation to indigenous populations and local communities, especially in tropical regions and developing countries. In contrast, there is a conspicuous lack of extensive analysis regarding biocultural diversity in industrialised countries. These regions exhibit lower biodiversity rates compared to global biodiversity hotspots and have experienced a reduction in cultural diversity (measured through the aforementioned proxies) due to prolonged processes of homogenization, particularly over the last century. Despite this decline, biocultural diversity persists even in the most industrialised regions of the planet, and traditional practices still hold significance within local cultures and identities. Furthermore, there appears to be a plausible connection between this local (often rural) dimension, the natural environment, and the biological diversity inhabiting it. Europe serves as an

---

People: Mapping Human Direct Use of Nature for Basic Needs across the Tropics', *Global Environmental Change* 71 (2021), 102368.

[10] S.T. Garnett *et al.*, 'A Spatial Overview of the Global Importance of Indigenous Lands for Conservation', *Nature Sustainability* 1, 7 (2018), 369–374; J.S. Sze *et al.*, 'Reduced Deforestation and Degradation in Indigenous Lands Pan-Tropically', *Nature Sustainability* 5, 2 (2022), 123–130.

exemplary case in this regard: although declining rapidly, traditional knowledge associated with local ecological diversity endures on the continent in various forms. This knowledge holds equal importance to that preserved by communities officially recognised as 'traditional,' still minimally affected by processes of 'Westernization' or globalization, and its presence remains significant even in societies where the social fabric has been profoundly altered.[11]

In this context, Italy stands out as an especially interesting case. Its geomorphological conformation, geographical position (a harbour in the middle of the Mediterranean sea), and complex history of 'contaminations' tracing back to ancient times, endow the Peninsula with rich ecological and cultural legacy. This legacy encompasses ecosystem diversity, a variety of ecological niches, natural and biocultural landscapes, along with a wealth of traditions – both material and immaterial – and local products.[12]

For these reasons, I selected the central-southern region of Italy, particularly its inland areas, as a compelling case study for exploring biocultural diversity in industrialised countries.[13] I conducted field surveys in five selected areas for comparative analysis, combining field research, archival studies, and interviews with local residents, whenever possible. The research findings, detailed in the third chapter of the dissertation, primarily delve into the local cultural heritage interwoven with local ecology. This exploration centred on several proxies, among which linguistic ones (dialect expressions), material

[11] M. Cocks, 'Biocultural Diversity: Moving Beyond the Realm of "Indigenous" and "Local" People', *Human Ecology* 34, 2 (2006), 185–200; B.H.M. Elands *et al.*, 'Policy Interpretations and Manifestation of Biocultural Diversity in Urbanized Europe: Conservation of Lived Biodiversity', *Biodiversity and Conservation* 24, 13 (2015), 3347–3366; M. Agnoletti and F. Emanueli (eds.), *Biocultural Diversity in Europe*, Environmental History, 2016; T. Plieninger *et al.*, 'Fostering Biocultural Diversity in Landscapes through Place-Based Food Networks: A "Solution Scan" of European and Japanese Models', *Sustainability Science* 13, 1 (2018), 219–233.

[12] G. Barbera and R. Biasi, 'I Paesaggi Agrari Tradizionali Dell'albero: Il Significato Moderno Di Forme d'uso Del Suolo Del Passato', *Italus Hortus* 18, 2 (2011), 21–38; M. Agnoletti (ed.), *Italian Historical Rural Landscapes: Cultural Values for the Environment and Rural Development*, Environmental History, 2013; M. Agnoletti, 'Rural Landscape, Nature Conservation and Culture: Some Notes on Research Trends and Management Approaches from a (Southern) European Perspective', *Landscape and Urban Planning* 126 (2014), 66–73; G. Barbera and S. Cullotta, 'The Traditional Mediterranean Polycultural Landscape as Cultural Heritage: Its Origin and Historical Importance, Its Agro-Silvo-Pastoral Complexity and the Necessity for Its Identification and Inventory', in M. Agnoletti and F. Emanueli (eds.), *Biocultural Diversity in Europe*, Switzerland, 2016, 21–48.

[13] C. Troiano *et al.*, 'Traditional Free-Ranging Livestock Farming as a Management Strategy for Biological and Cultural Landscape Diversity: A Case from the Southern Apennines', *Land* 10, 9 (2021), 957.

culture (traditional cuisine, ancient crafts, seasonal practices, medicinal knowledge, agricultural and farming practices), and intangible cultural elements (rituals, secular festivities, musical traditions) across each municipality involved.

III. A RELATIONAL APPROACH

The analysis of the Italian case aims to spotlight, through a set of tangible examples, that the human interaction with the natural environment does not always result in negative consequences. However, to counter the fast degradation of the biosphere and identify alternative paths to the current trajectory, I believe it is especially useful to underscore the non-inevitability of the path followed so far by Western society. Examining the diverse manifestations of biocultural diversity, notably its expressions in industrialised regions like Europe, suggests that alternative pathways do exist.[14]

Humans are not exclusively a destructive force in the natural environment. In fact, their ecological role is often fundamental. Some authors have proposed to describe humans as a hyper-keystone species,[15] capable of substantially reshaping ecological communities and sustaining their equilibrium, and in some cases, even increasing their diversity. This ecologically 'positive' role of human populations is particularly evident in low-impact traditional practices. These activities play an essential role in the long-term maintenance of ecosystem dynamic balances, which are the direct result of prolonged interactions between humans and other species.

A greater awareness of these complex interactions could contribute to an enhanced understanding of the links between human and nonhuman living beings – a theme of paramount importance considering that our present actions impact on the habitability of the entire biosphere. Environmental ethics could also benefit from a deeper understanding of these relationships. Ultimately, this

[14] M. Hourdequin and D.B. Wong, 'A Relational Approach to Environmental Ethics', *Journal of Chinese Philosophy* 32, 1 (2005), 19–33; A. Himes and B. Muraca, 'Relational Values: The Key to Pluralistic Valuation of Ecosystem Services', *Current Opinion in Environmental Sustainability* 35, (2018), 1–7; A.K. Saxena *et al.*, 'From Moral Ecology to Diverse Ontologies: Relational Values in Human Ecological Research, Past and Present', *Current Opinion in Environmental Sustainability* 35, (2018), 54–60; Z. Walsh, J. Böhme, C. Wamsler, 'Towards a Relational Paradigm in Sustainability Research, Practice, and Education', *Ambio* 50, 1 (2020), 74–84; S. West *et al.*, 'A Relational Turn for Sustainability Science? Relational Thinking, Leverage Points and Transformations', *Ecosystems and People* 16, 1 (2020), 304–325.

[15] B. Worm and R.T. Paine, 'Humans as a Hyperkeystone Species', *Trends in Ecology & Evolution* 31, 8 (2016), 600–607.

could pave the way for a new ethical orientation for the Anthropocene, one that emphasises relationships over the agency or rights of specific 'ethical' subjects, as the prevalent accounts in environmental ethics suggest. Such a relational account could hold promise both on a theoretical and a practical level, as I argue more extensively in the fourth and final chapter of this work. Striking the delicate balance to describe the ambivalence of our role in the natural world, aided by insights from ecological sciences and evolutionary biology, is crucial in navigating an uncertain future.

1. ENVIRONMENTAL ETHICS: NEW PERSPECTIVES ON AN AGE-OLD DEBATE

It seems that our most urgent task in facing the ecological crisis is to address the underlying thought patterns, implicit values, and resultant language that determine the self-understanding of the human species and his/her place in the natural and cosmic order.

(Piet Naudé (2017). Can we overcome the anthropocentrism bias in sustainability discourse? *African Journal of Business Ethic*s, 11(2))

1.1. ENVIRONMENTAL ETHICS IN THE ANTHROPOCENE: CONCEPTUAL ARCHAEOLOGY AND CURRENT ISSUES

1.1.1. Introduction: Interconnected crises, interconnected consequences

The common thread that runs through our reasoning is the relationship between humans and the broader natural world. The exploration of this relationship is shaped against the framework of the ongoing "triple plus one" planetary crisis, which encompasses climate change, biodiversity loss, pollution, as well as land degradation.[1] These interconnected crises collectively contribute to the deterioration of the natural environment, primarily caused by human activities, and impair human wellbeing and equality.

The consequences of these crises manifest on two interconnected levels. On the one hand, a fundamental 'restructuring' of the current state of life on Earth is unfolding. Life as we know it is the outcome of long-standing geological and evolutionary processes that have unfolded over a 'deep' temporal scale. However, the rapid and unprecedented alteration we are witnessing today is almost completely 'anthropogenic,' that is, driven by the actions of a single species – humans. Indeed, in pursuit of their own needs, humans[2] are acting in

[1] UNEP, 'Outcomes Document of the Scoping Meeting for the Seventh Edition of UNEP's Global Environment Outlook (GEO-7)', 2022.

[2] It is widely acknowledged that to attribute the present environmental crisis solely to 'humans' or 'humanity' in general is a problematic stance for both ethical and historical reasons. We will delve into the concept of 'differentiated responsibilities' for the multiple planetary crises shortly.

ways that affect the entire planet, with far-reaching and likely irreversible ecological effects.[3]

On the other hand, such transformation leads to the necessity of radically rethinking the societal structures that have developed over the course of the last 12-10,000 years.[4] Human societies have developed relying on stable ecological systems, which are now being challenged by the ongoing environmental changes.[5] In essence, the stability and dynamic equilibrium of these ecological structures are no longer guaranteed,[6] demanding an urgent reconsideration and reorganization of the very foundations of human societies.[7]

In the present discussion, my focus lies on the ethical implications stemming from the ongoing environmental crisis. There are two key aspects to consider. First, the environmental consequences involve the sudden and profound disruption of ecological equilibria, leading to a rapid decline in biodiversity at a rate that far exceeds natural extinction rates. The second aspect regards the social implications, encompassing the upstream and downstream injustices connected to the humanitarian crisis that is or will be initiated by the environmental disruption.[8]

In this regard, it is important to rely on a coherent theoretical framework to structure the debate. I previously mentioned the relationship between *humans* and non-human nature. This is a crucial element of the debate; indeed, it has become increasingly common in scientific literature to refer to the current

[3] IPCC, *AR6 Synthesis Report: Climate Change 2023* [*AR6 Synthesis Report*], 2023, https://www.ipcc.ch/report/sixth-assessment-report-cycle/.

[4] Ellis *et al.*, 'Used Planet,' cit.; Stephens *et al.*, 'Archaeological Assessment Reveals Earth's Early Transformation through Land Use,' cit.; E.C. Ellis, 'Land Use and Ecological Change: A 12,000-Year History', *Annual Review of Environment and Resources* 46, 1 (2021), 1–33.

[5] Xu *et al.*, 'Future of the Human Climate Niche,' cit.; C. Folke *et al.*, 'Our Future in the Anthropocene Biosphere', *Ambio* 50, 4 (2021), 834–869.

[6] W. Steffen *et al.*, 'Planetary Boundaries: Guiding Human Development on a Changing Planet', *Science* 347, 6223 (2015), 1259855; S.J. Lade *et al.*, 'Human Impacts on Planetary Boundaries Amplified by Earth System Interactions', *Nature Sustainability* 3, 2 (2020), 119–128; D.I. Armstrong McKay *et al.*, 'Exceeding 1.5°C Global Warming Could Trigger Multiple Climate Tipping Points', *Science* 377, 6611 (2022).

[7] J. Pretty, 'Interdisciplinary Progress in Approaches to Address Social-Ecological and Ecocultural Systems', *Environmental Conservation* 38, 2 (2011), 127–139; S. Díaz *et al.*, 'Pervasive Human-Driven Decline of Life on Earth Points to the Need for Transformative Change', *Science* 366, 6471 (2019), eaax3100; L.A. Holt, 'Why Shouldn't We Cut the Human-Biosphere Umbilical Cord?', *Futures* 133 (2021), 102821; H.-O. Pörtner *et al.*, 'Overcoming the Coupled Climate and Biodiversity Crises and Their Societal Impacts', *Science* 380, 6642 (2023), eabl4881.

[8] Eriksen, 'The Loss of Diversity in the Anthropocene Biological and Cultural Dimensions,' cit.

epoch as the '*Anthropo*cene,'[9] to stress the dramatic impact that the activities of one species have on the entire planet.[10]

One issue arising from this trend of targeting 'humans' or 'humanity' as a single entity unitarily involved in the environmental crisis is that this approach embraces a conceptual framework that includes all humans indiscriminately, proposing a «'view from nowhere' that puts forward an undifferentiated biological entity and geological agent ('humanity'), uniformly concerned or even implicitly guilty for the mechanisms that gave rise to this geological event» (i.e., the Anthropocene).[11] The main weakness of such an approach, then, is that it neglects the need to both recognise differentiated historical and current responsibilities for the present situation, and to effectively manage the burden of the present and future consequences of this legacy.[12] Indeed, as Fremaux rightly argues, «we are neither all – the poor, the rich, the dispossessed, people from the Global North, people from the South – equally responsible for the Anthropocene, nor are we suffering from it in the same manner».[13]

Therefore, it is crucial to explore the human-nonhuman relationship not through a singular and linear narrative, but rather to frame it as a dynamic conceptual complex encompassing a multitude of spatio-temporal manifestations that have developed over time. Indeed, over the course of human history, diverse societies have explored different forms of interaction with the nonhuman world.[14] This rich diversity in human-nonhuman relationships stands as a valuable legacy that should be adequately appreciated in the face of the present crisis.

---

[9] W. Steffen *et al.*, 'The Anthropocene: Conceptual and Historical Perspectives', *Philosophical Transactions of the Royal Society A* 369, 1938 (2011), 842–867; M.A. Lewis and S.L. Maslin, *The Human Planet. How We Created the Anthropocene*, London, 2016; P. Gibbard *et al.*, 'The Anthropocene as an Event, Not an Epoch', *Journal of Quaternary Science* 37, 3 (2022), 395–399; M.J. Head *et al.*, 'The Great Acceleration Is Real and Provides a Quantitative Basis for the Proposed Anthropocene Series/Epoch', *Episodes Journal of International Geoscience* 45, 4 (2022), 359–376.

[10] Cf. *infra*, § 1.1.3.

[11] Fremaux, *After the Anthropocene. Green Republicanism in a Post-Capitalist World*, cit., 57.

[12] Bonneuil and Fressoz, *The Shock of the Anthropocene*, cit.; IPCC, *AR6 Synthesis Report*, cit.

[13] Fremaux, *After the Anthropocene. Green Republicanism in a Post-Capitalist World*, cit., 58.

[14] IPBES, *Methodological Assessment of the Diverse Values and Valuation of Nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*, Bonn, 2022.

One of my core assumptions is that the present crisis originates from theoretical foundations before manifesting as a practical problem. Indeed, it is the result of a specific worldview that has justified the perpetuation of harmful activities resulting in detrimental effects at every level – both for the natural world and human social structures. It is undeniable that the crisis we currently face affects every living being on this planet, humans and nonhumans alike. I argue that this widespread impact can be ultimately attributed to the pervasive influence of a single theoretical perspective that today permeates and shapes almost every aspect of human life. This unified perspective is closely intertwined with an unprecedented process of globalisation that reaches into every facet of our material and immaterial existence. As a consequence, this condition has contributed to unite our entire species in a common destiny more than ever before.

Nevertheless, it is also crucial to acknowledge that this theoretical model, rooted in a dualistic and anthropocentric worldview, was not universal from its inception, nor is it an inherent or inevitable way of engaging with the '*other*,' as if it were a characteristic deeply embedded in human nature. Instead, it emerged within the confines of a specific society with well-defined spatio-temporal boundaries: modern Western culture.

The understanding of the human-nature relationship that took shape within this cultural context has deep historical foundations, as highlighted by numerous historians. However, it was during the Renaissance period that a strongly anthropocentric view gained traction, diminishing the value of nonhuman nature, and relegating it to a mere instrument for human use and exploitation. The gradual consolidation of the scientific method *à la* Galilei marks the secularisation of a worldview that had long been upheld by the Christian tradition: the notion of the human as the ultimate pinnacle and fulfilment of creation – a perspective that can be traced back to ancient thinkers such as Aristotle. The convergence between religious and scientific, as well as ancient and modern perspectives, holds significant implications for Western philosophical thought in both modern and contemporary times, reinforcing and justifying a detrimental utilitarian and exploitative approach towards the natural world.[15]

[15] The historical underpinnings of the anthropocentric and dualistic attitude towards nature of modern Western thinking will be discussed more in-depth later. Cf. *infra*, § 1.1.4.

Given this philosophical and historical setting, which I will further discuss shortly, the significance of examining the Western misunderstanding regarding humanity's place in the natural realm as a theoretical foundation to the current global challenges may not be immediately obvious. However, upon closer scrutiny, the meaning of this inquiry becomes evident, involving both historical and political factors.

Since the onset of the modern era, the entire planet has undergone a process that can be described as 'Westernisation', marked by brutal colonisation and exploitation on both the environmental and social level. Western countries have asserted their role – and continue to do so – as exporters of democracy and progress, yet this endeavour carries substantial consequences. Alongside the alleged promotion of democracy, this material and cultural colonisation has imposed a new societal structure centred around capitalism, perpetuating what is termed an 'ecological unequal exchange'.[16] This term refers to:

> […] the existence of structural relationships that facilitate unequal material flows in which wealthier and more powerful Global North countries have greater access to both natural resources and the sink capacity for waste in countries within the Global South. In other words, Global South nations are structurally positioned as both a tap for resources and a sink for waste within the world-economic system of extraction, production, and consumption.[17]

Indeed, it is challenging to argue that the current climatic and environmental changes are solely driven by technical or economic factors. The activities that have led to the present state of affairs emerged within a specific cultural context – the Western modern industrial society – that is imbued with an anthropocentric worldview. Bringing attention to the theoretical origins of this exploitative attitude towards everything that is recognised as '*other*' (than human) is of the utmost importance, as it lies at the root of both environmental and social injustices. Without addressing these underlying issues, any meaningful shift towards a new direction remains unattainable.

[16] Cf. J.E. Givens, X. Huang, A.K. Jorgenson, 'Ecologically Unequal Exchange: A Theory of Global Environmental Injustice', *Sociology Compass* 13, 5 (2019), e12693; R.S. Frey, P.K. Gellert, H.F. Dahms (eds.), *Ecologically Unequal Exchange: Environmental Injustice in Comparative and Historical Perspective*, Cham, 2019; J. Althouse *et al.*, 'Ecologically Unequal Exchange and Uneven Development Patterns along Global Value Chains', *World Development* 170 (2023), 106308.

[17] Givens, Huang, and Jorgenson, 'Ecologically Unequal Exchange', cit., 2.

1.1.2. Dualism: A historical legacy

In 2022 the Parco Nazionale Gran Paradiso, Italy's first national natural park, celebrated its 100th anniversary. To commemorate the event, a group of activists proposed an unconventional idea. They suggested that Monveso di Forzo, one of the peaks in the natural park, should be recognised as a 'sacred mountain' to permanently restrict human access. The Manifesto[18] supporting the proposal stated that the aim was to «overturn the current cultural model from one of no-limits to one of off-limits». The proposers claimed that «not all mountains we are able to climb should be climbed or conquered». In their view, abstaining from climbing a peak does not mean depriving oneself. Instead, according to the Manifesto, refraining from climbing the mountain would offer something even more valuable than simply climbing it.

Despite the unusual project's intention to make a case for the shortcomings of the current cultural model, founded on a utilitarian approach to the natural environment, it remains inherently connected to the theoretical dualistic underpinnings of that very model. This connection is evident in the adoption of a well-established view of conservation, which can be traced back to the earliest conservationist movements in contemporary Western culture. One of the main representatives of this view is John Muir, a Scottish-American naturalist and founder of the *Sierra Club* in 1898, who led the American conservationist movement in the early 20th century, contributing to the establishment of some of the US first national parks. Muir's environmental philosophy centred on the idea of recognising rights to nature and, consequently, on the moral necessity of preserving the natural environment. Muir identified nature with *wilderness*, i.e., a pristine environment, not contaminated by human intervention.[19] In his view, wild nature was deemed as sacred, and the first national parks were established to protect this 'virginity' from any human interference, which was perceived as a threat to natural integrity. Thus, in this view, although humans are allowed to enter natural parks – indeed, nature can and should be the object of admiration and love – they are not meant to stay. They are seen as external entities, separate from this 'perfect' nature: they are therefore "visitor[s] who do not remain".[20]

[18] The full text of the Manifesto is available, in Italian, at the following link: https://www.sherpa-gate.com/la-montagna-sacra/.

[19] R. Nash, *The Rights of Nature: A History of Environmental Ethics*, Madison, Wisconsin, 1989.

[20] 88th Congress, Second Session, *The Wilderness Act*, 1964.

While Muir's view was groundbreaking in assigning intrinsic values and a 'right to life' to every element of nature,[21] this enduring dualistic approach, which still today influences conservation science and policy, ultimately perpetuates the dichotomy between humans and nonhuman nature. This separation underpins, at least in part, modern Western culture and serves as the foundation for anthropocentric views of the natural world. As a result, despite Muir's approach being one of the first to introduce a genuine sensibility to the natural world within the occidental culture in recent times, it reinforces the idea of a supposed inherent distinction between humans and the rest of nature. When considering untouched nature as sacred – as the Gran Paradiso proposal does – this divide is further widened, and nature is elevated to a realm beyond human comprehension and experience.

Despite the problems it raises, the pervasiveness of the dualism between 'us humans' and 'the environment' is a widely accepted feature of Western intellectual history. Many authors have extensively illustrated how the inherent separation of nature and culture is a key feature of modern European thought, tracing back to influential thinkers such as Descartes, who famously distinguished between *res cogitans* and *res extensa*. As Haila points out, «the apparent necessity as well as the inadequacy of the Cartesian dualism have been recognized and analysed by a number of authors».[22] This dichotomy highlights another fundamental opposition that holds a central spot in Western thinking, namely the distinction between subject and object, 'the self' and 'the other'.

Various historical analyses of Western philosophical thought highlight the ancient origins of this dualistic and fundamentally anthropocentric approach.[23] In a seminal and highly influential paper, Lynn White traced the origin of this duality back to the sacred texts of the major monotheistic religions.[24] The historian contended that the notion of human superiority over all nonhuman nature finds its roots in the monotheistic narrative wherein humans are deemed to be more similar to God than to nature. For this reason, they are considered

[21] D. Worster, 'John Muir and the Modern Passion for Nature', *Environmental History* 10, 1 (2005), 8–19; P.B. Corcoran, 'John Muir 1838–1914', *Key Thinkers on the Environment*, 2017.

[22] Haila, 'Beyond the Nature-Culture Dualism', cit., 157.

[23] B. Minteer, 'Anthropocentrism', in J.B. Callicott and R. Frodeman (eds.), *Encyclopedia of Environmental Ethics and Philosophy*, 2009.

[24] L. White, Jr., 'The Historical Roots of Our Ecologic Crisis', *Science* 155, 3767 (1967), 1203–1207.

the creatures 'chosen by God' to exert dominion over the world. White argued that this perspective was never truly abandoned, and later permeated the worldview of modern science and philosophy. In essence, adopting an anthropocentric stance entails regarding human beings as *inherently* 'special' or 'unique' when compared to other living or non-living entities in the world – a standpoint bearing significant metaphysical, epistemological, and ethical implications.[25]

While this anthropocentric perspective was already present in ancient times, it gained further prominence during the Scientific revolution of the 16th and 17th centuries. Indeed, modern philosophical thinking has given rise to the notion of an independent and rational human subject, which lies at the core of any matter of inquiry – from natural sciences to epistemology. This aspect holds relevance for ethical analyses in that,

> […] the free, critical, autonomous and rational subject constitutes a fundamental anthropocentric paradigm from which the world is constructed. Insofar as this paradigm fosters the misuse of human power, it turns into anthropocentrism where the self-designed needs of humanity blind us to our relative position in the natural order.[26]

At the same time, a deeply abstracted comprehension of nature gained prominence, which reduced the complexity of the natural world to the notion of *res extensa* – a mere sequence of inanimate entities that, being devoid of any breath of life, are deemed ineligible for any ethical consideration and thus become a 'standing-reserve' at our complete disposal.[27]

[25] Butchvarov, *Anthropocentrism in Philosophy*, cit.; G. Rae, 'Anthropocentrism', in H. ten Have (ed.), *Encyclopedia of Global Bioethics*, Cham, 2017, 1–12.

[26] P. Naudé, 'Can We Overcome the Anthropocentrism Bias in Sustainability Discourse?', *African Journal of Business Ethics* 11, 2 (2017).

[27] M. Heidegger, *The Question Concerning Technology, and Other Essays*, 1977.

Anthropocentric claims in Western philosophy have undergone changes and developments over the centuries, as highlighted in recent literature. Following Thompson,[28] we can distinguish, among many others, three forms of anthropocentrism,[29] each corresponding to different periods in the intellectual discourse concerning the relationship between humans and the non-human world developed in Western culture. The first and oldest form is *ontological* anthropocentrism, which «locates humans at the centre of creation, as the end or reason for which everything else in the material world exists».[30] This type of anthropocentrism, grounded in the cosmological view shared by the three major monotheistic religions, conceptualises nature as a 'Great Chain of

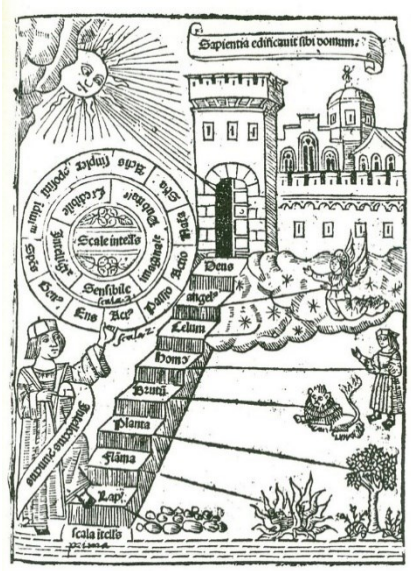

Figure 1 A depiction of the 'Great Chain of Being.'

Being,' with plants occupying the lowest tier and humans residing just one step below the divine. This hierarchical representation was long prevalent not only in religious explanations but also in early modern scientific depictions of the natural world.

This ontological classification, which organises 'creation' according to the alleged degrees of 'perfection' among natural beings, has often served as the conceptual foundation for a second articulation of the concept: *ethical*

[28] A. Thompson, 'Anthropocentrism. Humanity as Peril and Promise', in S.M. Gardiner and A. Thompson (eds.), *The Oxford Handbook of Environmental Ethics*, Oxford, New York, 2017, 77–90.

[29] B. Mylius, 'Three Types of Anthropocentrism', *Environmental Philosophy* 15, 2 (2018), 159–194; L. Droz, 'Anthropocentrism as the Scapegoat of the Environmental Crisis: A Review', *Ethics in Science and Environmental Politics* 22 (2022), 25–49.

[30] Thompson, 'Anthropocentrism. Humanity as Peril and Promise', cit., 78.

anthropocentrism. According to this view, living beings should be assigned different degrees of worth based on their levels of perfection, with humans being the sole recipients of inherent worth. Consequently, lower beings are regarded as 'morally subordinate' to higher beings, a notion that has justified an increasingly pervasive pattern of human exploitation of the natural environment. Hence, anthropocentrism – or as Nimmo suggests calling it, 'humanism'[31] – stands as a defining theoretical discourse within European modern philosophy, which is predominantly focused on investigating both the essence of human beings and their position within the natural world: «What is it to be human? Modernity has furnished a great many answers, but they are finally answers to the same question. In this sense all modern discourses can be understood as discourses of humanity, so that to be modern is to have a human-centred view of the universe».[32]

Thompson identifies the third form of anthropocentrism as '*conceptual* anthropocentrism,' which posits «that human beings can only comprehend the world from a characteristically human perspective».[33] Contrary to the others, I contend that this form, which appears more reasonable and less anthropocentric than the others, should not be categorized as anthropocentrism at all. Indeed, the idea that humans are incapable of perceiving the world from any perspective other than a human one is inherent in our understanding of the world itself. Nevertheless, acknowledging that our knowledge and viewpoints about the world are unavoidably anthropo*genic*, i.e., shaped by our humanity, does not necessitate also embracing an anthropo*centric* perspective. Having an anthropogenic comprehension of the world does not equate to asserting human ontological distinctiveness or moral superiority over other entities. In fact, a substantial distinction exists between a minimal degree of 'epistemological' or 'cognitive' anthropocentrism (which is tied to the way humans experience and describe the outside world, and is unavoidable due to cognitive and evolutionary reasons) and the anthropocentric prejudice that underpins the belief in any supposed human superiority. The latter is the only form carrying

[31] To explain this lexical choice, Nimmo states: «I will refer to this worldview as humanism, or humanist discourse, since 'anthropocentrism' already foregrounds its negative aspects – it is human-centred, it neglects the significance of non-humans; whereas humanism better describes the spirit of the thing in its positive, affirmative aspect – it champions humanity» (R. Nimmo, 'The Making of the Human: Anthropocentrism in Modern Social Thought', in R. Boddice (ed.), *Anthropocentrism*, 2011, 60).

[32] Nimmo, 'The Making of the Human: Anthropocentrism in Modern Social Thought', cit., 60; Butchvarov, *Anthropocentrism in Philosophy*, cit.; Rae, 'Anthropocentrism,' cit.

[33] Thompson, 'Anthropocentrism. Humanity as Peril and Promise', cit., 79.

ethical implications, and thus should be cautiously avoided. From this perspective, ethical stances grounded in anthropocentrism are always unacceptable, as their defence is slippery and may inadvertently lead to recognising unwarranted qualitative disparities between the 'actor' and the recipients of action.[34]

Some environmental ethics accounts have employed conceptual anthropocentrism to make their claims more realistic, or grounded in reality. One notable example is John B. Callicott, one of the most prominent theorists of ecocentrism. While advocating for the recognition of intrinsic value to every natural entity, Callicott acknowledges that any attribution of value, whether instrumental or intrinsic, is inherently anthropo*genic*, meaning that it is inevitably dependent upon human acts of evaluation.[35] Thus, adopting a 'realistic' standpoint, it is necessary to acknowledge that it is impossible to entirely escape a minimal degree of anthropocentrism, which is referred to here as 'conceptual anthropocentrism.'

When examining the ethical implications of anthropocentric claims, the main concern revolves around the fact that, from an ontological and ethical standpoint, intrinsic value is exclusively attributed to humans, while all other non-human entities are deemed as material objects and merely granted instrumental values based on their usefulness to humans. The extent to which this controversial anthropocentric stance lies at the core of the ongoing environmental crisis is a topic of intense debate in contemporary environmental ethics, and many scholars affirmatively support this hypothesis. Fremaux, for instance, asserts that there has been a clear transition from ontological to axiological claims, grounded in the asserted ontological distinction between humans and the rest of the living world:

> The brutality of humanity toward animals is not concealed but legitimised in the name of human's 'singularity.' Indeed, the thesis of 'Human exceptionalism,' that is, the idea that humankind is radically different and apart from the rest of nature and other animals, leads quickly to that of 'human Supremacy,' which has allowed and still allows humanity to exploit nature and

[34] S. Belardinelli and T. Pievani, 'The Ethics of Gaia: Geoethics From an Evolutionary Perspective', in G. Di Capua and L. Oosterbeek (eds.), *Bridges to Global Ethics: Geoethics at the Confluence of Humanities and Sciences*, SpringerBriefs in Geoethics, Cham, 2023, 55–72.

[35] J.B. Callicott, *In Defense of the Land Ethic: Essays in Environmental Philosophy*, 1989; cf. also Thompson, 'Anthropocentrism. Humanity as Peril and Promise,' cit.

people living in wilderness in the most ruthlessly (some would say 'efficiently') way.[36]

1.1.3. Anthropocene

The theoretical discourse concerning our perception of the place humanity holds within the wider natural world is far from disconnected from reality; instead, it bears significant implications for societal, political, and economic matters. According to several scholars, the current – unsustainable – state of affairs owes much to the acceptance of the anthropocentric worldview we have outlined earlier.

Over the past two decades, it has become established to use the notion of 'Anthropocene' to refer to the cumulative set of phenomena that are swiftly and fundamentally altering the Earth due to human activities. Indeed, the defining characteristic of this new geological epoch, often referred to as 'the human epoch,' is the pervasive influence of human actions on the planet.

During these years, a substantial body of literature has emerged exploring the extensive impact of our activities in every corner of the Earth. Scholars have employed different narratives to contextualise this phenomenon. Some consider it a recent occurrence, pinpointing the start of the new epoch to the detonation of the first atomic bomb in 1945; others, instead, view it as a far more ancient phenomenon.[37] These diverse perspectives within the Anthropocene debate have sparked extensive discussions in one of the two primary domains in which it has evolved in recent years. These fields encompass Earth science and geology on one side and humanities, sociology, and, more recently, even the broader public discourse on the other. Indeed, in the former field, which has focused on establishing a scientifically robust geological baseline for the new epoch, heated debates have arisen concerning the contrasting notions of an 'ancient' versus 'recent' impact of human presence on the planet.

1.1.3.1. A brief overview of the geological dating discussion

Initially put forward by chemist Paul Crutzen and ecologist Eugene Stoermer in the early 2000s,[38] albeit with notable precursors,[39] the notion of the

[36] Fremaux, *After the Anthropocene. Green Republicanism in a Post-Capitalist World*, cit., 120.

[37] Cf., among others, E.C. Ellis, *Anthropocene: A Very Short Introduction*, New York, 2018.

[38] Crutzen and Stoermer, 'The "Anthropocene"', cit.; Crutzen, 'Geology of Mankind,' cit.

Anthropocene, which can be understood as «the 'new' (καινός) brought about by the 'human' (ἄνθρωπος)»,[40] was proposed to mark the passage to a new geological epoch. This heralds the conclusion of the Holocene, which began approximately 11,700 years ago and was characterised by remarkable climatic and ecological stability, upon which human societies have relied up to the present day. The concept then became a central topic in the geological academic debate when the Anthropocene Working Group (hereafter, AWG) was established in 2009. This marked the beginning of the scholarly discourse on the possibility of formally acknowledging the Anthropocene as a novel geological epoch. Since then, various perspectives on this proposal have taken shape.[41]

The central focus of this debate revolves around the challenge of determining a suitable GSSP (*Global Boundary Stratotype Section and Point*), commonly referred to as a 'golden spike,' to demarcate the beginning of the new epoch within the geological record's stratigraphic sections. In July 2023, the AWG reached a decision – albeit amid challenges and without unanimous agreement – on the identification of the candidate GSSP which will be used to define the onset of the new epoch.[42]

Practically, this vote marked a turning point in the debate. The identified GSSP, selected among twelve possible candidate sites, is the sediments of Crawford Lake, in Oregon, Southern Canada. These sediments contain traces of plutonium, a radioactive element produced as a result of nuclear bomb fallout, as well as heavy metals and plastic residues. The selection of this GSSP thus serves to corroborate the 'recent Anthropocene' hypothesis, which places the beginning of the new epoch in 1950, coinciding with the onset of the 'Great Acceleration,' as previously agreed upon by the AWG through a voting session

[39] Notably, Stoermer, co-father of the term Anthropocene, had already introduced it to his field community in the late 1980s; furthermore, the concept of an 'Anthropozoic' era had been previously advanced by the Italian geologist Antonio Stoppani in the 19th century. See A. Federau. Anthropocene. In N. Wallenhorst and C. Wulf (eds.), *Handbook of the Anthropocene: Humans between Heritage and Future*, Springer International Publishing, Cham, 2023, 323–326; N. Wallenhorst, Dating Debate. In N. Wallenhorst and C. Wulf (eds.), *Handbook of the Anthropocene*, cit., 349–357.

[40] Bergthaller and Horn, *The Anthropocene*, cit., 2.

[41] For a more complete overview of the different dates proposed to mark the boundary between the Holocene and the Anthropocene, which is beyond the scope of this dissertation, see, among others, N.Wallenhorst, 'Dating Debate', cit.

[42] Perkins, 'Researchers Move Closer to Defining the Anthropocene', cit.

in 2019.[43] This decision, however, has not definitively resolved the disagreements concerning the two interpretations of the Anthropocene epoch[44] mentioned earlier, namely the 'recent' versus 'long' Anthropocene.

There are several reasons that support the proposition of a 'recent' Anthropocene, coinciding with the onset of the Great Acceleration.[45] This period witnessed the accumulation of various anthropogenic physico-chemical signals in the geological record, potentially indicative of a Great Acceleration Event Array (GAEA), as suggested by Waters and collaborators.[46] As Wallenhorst summarises, the evidence that corroborates a 'recent Anthropocene' hypothesis is numerous:

> The Great Acceleration refers to an upswing in the production of manmade sediments. […] Zalasiewicz et al. (2014, p. 4) identify a set of possible stratigraphic markers pertaining to the Great Acceleration: the disruption of the nitrogen cycle with the development of the Haber–Bosch process; technofossils, plastic waste and aluminium spread across the globe; the explosion of human deposits in the ground; the enormous increase in concentration of pollutants linked to the development of industrial activity; the passing of a significant milestone in anthropogenic changes to the biosphere, with numerous species dying out; the acceleration of hydrocarbon consumption, leading to an increase in atmospheric CO_2; fossil traces connected to oil drilling; oil spills in coastal areas; and the construction of massive dams, reclaiming land from river deltas.[47]

And, in the same vein, Zalasiewicz and colleagues assert:

> The phenomena of the Anthropocene are important per se, irrespective of their cause. One may consider just a few of these: (1) the rapid post-industrial increase in atmospheric CO_2 by over a third; (2) the doubling of the surface N and P cycles; (3) the more than order-of-magnitude increases in the diversity of mineral-like substances and in terrestrial erosion/sedimentation rates; and (4) the marked accelerations in introduced non-native species and extinction rates. If these phenomena were due to some drastic natural forcing, such as a bolide

[43] Anthropocene Working Group, 'Subcommission on Quaternary Stratigraphy, Working Group on the "Anthropocene". Results of Binding Vote.' 415, 6867 (2019).

[44] Or event: on this specific debate, see Gibbard, P. *et al.* (2022) 'The Anthropocene as an Event, not an Epoch,' *Journal of Quaternary Science*, 37, 3, 395–399.

[45] Steffen, Crutzen, McNeill, 'The Anthropocene', cit.; J.R. McNeill and P. Engelke, *The Great Acceleration: An Environmental History of the Anthropocene since 1945*, cit.; Head *et al.*, 'The Great Acceleration Is Real and Provides a Quantitative Basis for the Proposed Anthropocene Series/Epoch', cit.

[46] C.N. Waters *et al.*, 'Epochs, Events and Episodes: Marking the Geological Impact of Humans', *Earth-Science Reviews* 234 (2022), 104171.

[47] Wallenhorst, 'Dating Debate', cit., 352–353.

> impact, they would equally well provide justification for a distinctive new geological epoch. Indeed, in such a case, the recognition and definition of this geological time unit, without the baggage of responsibility carried by our own species, would likely be considerably more straightforward. Nonetheless, it is an important feature of the geological meaning of the Anthropocene in that it refers to the manifestation of human effects: the consequence in strata.[48]

Nevertheless, a significant minority of AWG members strongly opposes the decision to define the Anthropocene as a recent occurrence.[49] Indeed, similarly compelling evidence indicates that human activities have been shaping and altering the Earth's surface for far longer than the last 75 years. Erle Ellis, a landscape ecologist who studies the historical interactions between human populations and their local environments,[50] who resigned from the Working Group after this last vote,[51] states that «by placing the start of the Anthropocene around 1950, the AWG ignores all of this evidence that humans have been influencing the landscape for millennia».[52]

1.1.3.2. Scientific, political, social ramifications of the Anthropocene concept

Setting aside the chronostratigraphic debate, it is still intriguing to explore how the Anthropocene concept has gained momentum and has been developed in other disciplinary fields, such as environmental and social sciences, as well as humanities and arts. In recent years, for example, the burgeoning and increasingly interdisciplinary reflections on these themes have paved the way for entirely novel areas of inquiry, such as the promising collaborative field of environmental humanities.

Indeed, regardless of whether the AWG will manage to persuade the IUGS (International Union of Geological Sciences) to include the new epoch into the International Chronostratigraphic Chart,[53] the popularisation of this term has animated a vast array of considerations and debates which are almost completely independent from the scholarly discussion within the Earth sciences surrounding the identification of golden spikes and the establishment of formal

[48] Zalasiewicz et al., 'The Anthropocene', cit., 6.

[49] See, for instance, Gibbard *et al.*, 'The Anthropocene as an Event, Not an Epoch,' cit.

[50] For a more in-depth discussion of Ellis' work, although not directly related to the Anthropocene debate in geology, see *infra*, Chapter 2.

[51] E.C. Ellis, 'Why I Resigned from the Anthropocene Working Group', 2023.

[52] Perkins, 'Researchers Move Closer to Defining the Anthropocene', cit.

[53] Cf. K.M. Cohen *et al.*, 'The ICS International Chronostratigraphic Chart', *Episodes* 36, 3 (2013), 199–204. The latest version of the Chart is available at https://stratigraphy.org/chart#latest-version (accessed 29 August 2023).

onset dates. In this respect – which we consider to be the most captivating and fruitful facet of the topic – the Anthropocene is a cultural complex that encompasses an assortment of concepts, cultural references, and, ultimately, a specific way of comprehending the interplay between the human and non-human world.[54]

In order to gain a more comprehensive understanding of the variety of interpretations and applications of the Anthropocene concept that have been proposed over the past two decades, going back to the two primary interpretations of the concept that have found expression among the members of the AWG becomes essential. The perspective of a 'long Anthropocene,' which suggests that the 'human epoch' comprises a considerably larger portion of human history than just the last few decades, diverges from Crutzen's original proposal. Instead, it conceptualises the Anthropocene's origin as «diachronous, that is, time-transgressive and [which] varies regionally, toward the time when *Homo sapiens* first gained collective capacities to change Earth's ecology in unprecedented ways».[55]

As highlighted in the previous section through Zalasiewicz's quote,[56] the notion of the Anthropocene brings to light a crucial element that may not be adequately emphasised when focusing solely on the geological debate. This element refers to the «baggage of responsibilities carried by our own species», stemming from the profound and irrevocable alterations we have exerted onto the Earth system. These modifications are leading to far-reaching consequences for all life forms on the planet, not just in the present but for centuries and millennia ahead. The broader debate surrounding the Anthropocene, particularly within the humanities, principally revolves around this theme and its related discussions. Indeed, the Anthropocene marks the end of longstanding convictions, including the idea that human history and natural history are separate and independent from each other. This paradigm, alongside several others, has lost its validity, given that humans have now emerged as a geological force, and the destiny of our species is tightly intertwined to that of the rest of the living world, and vice versa.[57]

In this vein, numerous scholars argue that embracing the 'long Anthropocene' perspective enables us to direct our attention to the underlying

[54] Bergthaller and Horn, *The Anthropocene*, cit.
[55] Zalasiewicz et al., 'The Anthropocene', cit., 3.
[56] See *infra*, § 1.1.3.1, pp. 13-14.
[57] Chakrabarty, 'The Climate of History,' cit.

causes – i.e., how humans have progressively modified their interaction with local landscapes and ecological communities – rather than solely focusing on the consequences (i.e., the stratigraphic footprints) of human activities, as proposed by the 'recent Anthropocene' hypothesis. As Zalasiewicz and colleagues put it: «The humanities typically ask for the human causes of the Anthropocene to be considered instead of the effects on geological strata or the Earth System».[58]

Regardless of the individual hypotheses put forth across various disciplines – a detailed synthesis of which can be found in Zalasiewicz et al. (2021) – and their capacity (or lack thereof) to provide a viable alternative to the geochronological notion of a recently emerged Anthropocene, the value of this approach lies in its ability to illuminate the connections between the various elements at play. Indeed, the global transformation we have initiated does not materialise in isolation. Instead, it is a layered and powerful combination of social, political, economic, and environmental factors. Understanding and unravelling this multifaceted phenomenon necessitates contributions from numerous fields. Wallenhorst clearly underlines this point stating that:

> Though indubitably scientific, [the Anthropocene] is also a political concept (which will determine the future direction of the human adventure). It is also one that arouses powerful feelings, as can be seen from the academic articles on the subject – clearly, researchers cannot remain neutral on topics so disquieting as those stirred up by the Anthropocene.[59]

Indeed, sustainability and *un*sustainability alike (as well as their remote causes) encompass dimensions spanning the environmental, social, and economic realms, and this holds even truer when exploring the distant origins of the complex interactions between our species and the planetary system.

Some scholars have extended their arguments to the point of suggesting that the pursuit to define the Anthropocene as a precise geological entity should be abandoned altogether. Evidently, the members of the AWG hold a different viewpoint. Yet, they also acknowledge the potential risk of blurring the discourse by associating an excess of divergent connotations with a single term. This is a prospect outlined, for example, by Zalasiewicz and coauthors,[60] who propose to restrain the use of the term Anthropocene exclusively to its

[58] Zalasiewicz *et al.*, 'The Anthropocene', cit., 14.
[59] Wallenhorst, 'Dating Debate', cit., 355.
[60] Zalasiewicz *et al.*, 'The Anthropocene', cit.

formal geological meaning. On the contrary, those who oppose the formal recognition of the Anthropocene as a geologically distinct entity express concerns that this narrow focus might suffocate the vibrant diversity of the concept's uses, which provide alternatives to the Earth system science's debate aimed at achieving a consensual scientific definition. In line with this perspective, Swindles and colleagues affirm:

> The flexibility afforded by the current absence of formalised ratification by the International Commission on Stratigraphy has resulted in the term being used in creative and imaginative ways, with interpretations and implementations differing between researchers and practitioners from different disciplines and backgrounds. […] If the Anthropocene is formalised as an official geological epoch, then its meaning becomes constrained, invalidating the innovative ways in which the concept is being used and applied. We suggest that the Anthropocene should be used as a purely informal concept to describe our planet's recent history, as characterised by an increasing prevalence and potential dominance of human activities and impacts on the Earth system.[61]

While not endorsing such viewpoint, I do believe that confining the entire debate solely, or primarily, to its technical aspects is not profitable. As Ellis clearly articulated in his letter of resignation from the AWG,

> […] dividing Earth's human transformation into two parts, pre- and post-1950, does real damage by denying the deeper history and the ultimate causes of Earth's unfolding social-environmental crisis. Are the planetary changes wrought by industrial and colonial nations before 1950 not significant enough to transform the planet? The political ramifications of such a misleading and scientifically inaccurate portrayal are clearly profound and regressive.[62]

Instead, acknowledging the validity of the interdisciplinary dialogue surrounding the Anthropocene, particularly for comprehending the phenomenon in its complexity, can serve as a more beneficial approach. Indeed, this perspective illuminates both its causes and outcomes, delving into its multifaceted nature.

In this section, I have provided a brief exploration of the *pro* and *contra* associated with the utilisation of the Anthropocene concept. Drawing from the insights gathered thus far, it is important to acknowledge that the application of the term 'Anthropocene' within the context of this dissertation will be

[61] G.T. Swindles, T.P. Roland, A. Ruffell, 'The "Anthropocene" Is Most Useful as an Informal Concept', *Journal of Quaternary Science* 38, 4 (2023), 453–454.

[62] Ellis, 'Why I Resigned from the Anthropocene Working Group', cit.

approached with the necessary caution. Firstly, I will not refer to the geological facet of the debate, which involves seeking physical evidence to formally recognise the inception of a novel geological epoch from the 1950s. Instead, I will engage with the broader, interdisciplinary approaches to the issue, namely those developed in «a non-chronostratigraphic context» that consider the Anthropocene as «an informal term to denote a broader interpretation of anthropogenic impact on the planet that is markedly diachronous, reaching back many millennia».[63]

Secondly and consequently, I will align to the 'long Anthropocene' hypothesis. My stance is grounded in the conviction that acknowledging the significant role played by the long and deep history of interactions between human populations and their environments in creating the conditions for the current state of affairs[64] is not only more relevant but also more beneficial to a humanistic discourse concerning the relationship between humans and the broader natural realm.

1.1.4. Humans and nonhuman nature

The current situation has made it evident that the human species can show an exploitative attitude towards nonhuman nature. Akin to various other species, humans act as 'ecosystem engineers' – actively modifying the local environment to meet their needs, instead of merely adapting to the existing conditions or relocating to more favourable places.[65] This behaviour seemingly yielded significant consequences even in the distant past, with evidence of substantial human-induced environmental changes at the local and regional scales dating back to at least the Neolithic Revolution, approximately 12,000 years ago.[66]

Uncertainty remains regarding whether this exploitative attitude is inevitable and it invariably leads to dire consequences or not. As a matter of

[63] Anthropocene Working Group, 'Subcommission on Quaternary Stratigraphy, Working Group on the "Anthropocene". Results of Binding Vote', cit.

[64] Cf. E.C. Ellis, 'Ecology in an Anthropogenic Biosphere', *Ecological Monographs* 85, 3 (2015), 287–331.

[65] J. Odling-Smee, K.N. Laland, M.W. Feldman, *Niche Construction: The Neglected Process in Evolution*, Princeton, 2003; B.D. Smith, 'The Ultimate Ecosystem Engineers', *Science* 315, 5820 (2007), 1797–1798; J. Odling-Smee and K.N. Laland, 'Ecological Inheritance and Cultural Inheritance: What Are They and How Do They Differ?', *Biological Theory* 6, 3 (2011), 220–230.

[66] See, as notable examples, S.A. Mensing *et al.*, 'Historical Ecology Reveals Landscape Transformation Coincident with Cultural Development in Central Italy since the Roman Period', *Scientific Reports* 8, 1 (2018), 2138; U. Lombardo *et al.*, 'Early Holocene Crop Cultivation and Landscape Modification in Amazonia', *Nature* 581, 7807 (2020), 190–193.

fact, this pattern has been evident in modern times within Western culture, a result of a deeply ingrained anthropocentric theoretical framework. This approach, as we have seen, perceives nature as an external, material entity designed *for* human domination and exploitation.

Notably, the anthropocentric narrative stands as a foundational principle of the humanistic culture that prevailed in Europe from the beginning of the modern era. As Sabrina Tonutti points out, the essentialist division between humans and the rest of the natural world was deemed a necessary condition for uncovering the 'true essence' of human nature. This endeavour involved identifying unique human attributes by excluding any shared characteristics with other living beings. Tonutti elucidates this point, stating that, «As far as humanism is concerned, the perspective of *humanitas* revolved around the same a priori assumption: the existence of a radical difference between humans and animals».[67]

In essence, a profound disconnection between the humanities and natural sciences took place. Tonutti (2011) further explains, «Humanism turned its back on nature; it assumed *humanitas* as a subject of speculation and totally dismissed humanity's natural dimension. At the same time, it was considered improper for natural sciences to deal with any traits of humanity».[68] The adoption of this radical stance has profoundly influenced the Western worldview for centuries and continues to exert its influence in the present day. In fact, the presumed existence of an inherent, qualitative distinction between humans and nonhumans is deeply entrenched in Western culture, to the extent that it is commonly accepted as an unquestionable *fact*.

> Humans are subjects, while non-humans are objects, it tells us, and from this essential difference all else follows. In truth both parts of this dualism are mutually constitutive, such as to make a nonsense of their separation: A 'subject' can only exist as a subject in a world irreducible to its subjectivity; while an 'object' can only exist as a distinct object, a thing-in-itself rather than part of an indivisible flux, when perceived as such by a subject. But humanist discourse suppresses this dialectical interrelationship, rendering it an asymmetric dualism and inscribing humans and non-humans as incommensurable, as though they belong to different ontological domains or sectors of reality. This in turn enables humanity to be elevated and centralised,

[67] Tonutti, 'Anthropocentrism And The Definition Of "Culture" As A Marker Of The Human/Animal Divide', cit., 186.

[68] *Ivi*, 187.

> while its necessary other – its very conditions of existence – are suppressed and marginalised, relegated to the status of a 'context,' a mere ground upon which the human subject stands.[69]

Of course, it is important to be aware that such an 'asymmetric dualism' finds no reflection in the actual world. Instead, this interpretation resides solely in the eyes of the observer. Different cultures have forged diverse ways of connecting with their environments and the living beings within them, often forming these relationships without the need to designate 'winners' and 'losers.' As the Indigenous ecologist Robin W. Kimmerer – whose insights will frequently resonate throughout this dissertation – accurately emphasises, alternative pathways have been explored.

> We [the Potawatomi people] say that humans have the least experience with how to live and thus the most to learn – we must look to our teachers among the other species for guidance. Their wisdom is apparent in the way that they live. They teach us by example. They've been on earth far longer than we have been, and have had time to figure things out.[70]

The problem lies in the fact that today this approach is a minority view, overshadowed by the dualistic narrative that European colonisers gradually spread across the world. They imposed their religions, languages, ways of interacting with nature, all imbued with dualistic thinking. This dissemination progressively silenced and suppressed any alternative worldviews, often dismissing them as 'primitive'. Many 'alternative ways of being human' were extinguished or reduced to scattered fragments by forbidding religions, languages, knowledge, and traditional practices developed over millennia. The modern scientific pursuit of deepening our understanding of the world has further reinforced this inflexible perspective, portraying the object-centred view of the living world as the sole 'objective' – and therefore 'correct' – way of comprehending reality.

> To name and describe you must first see, and science polishes the gift of seeing. I honor the strength of the [scientific] language that has become a second tongue to me. But beneath the richness of its vocabulary and its descriptive power, something is missing […]. Science can be a language of distance which reduces a being to its working parts; it is a language of objects.

[69] Nimmo, 'The Making of the Human: Anthropocentrism in Modern Social Thought', cit., 61.

[70] Kimmerer, *Braiding Sweetgrass*, cit., 9.

> The language scientists speak, however precise, is based on a profound error in grammar, an omission […].[71]

Certainly, it is worth noting that the currently prevailing dualistic perspective does not encapsulate the entirety of European intellectual history. In fact, numerous philosophies of nature were developed during the modern era, reflecting the diverse range of perspectives that characterised the philosophical discourse of that time. Hence, as various scholars highlight, the narrative universalising dualism as a timeless foundation of the Western approach to the natural world is historically inaccurate. It fails to acknowledge the plurality of views on human-nature relationships that have existed in the past.[72] As Yrjö Haila states: «[…] A belief in a unilinear tradition in views of nature seems less plausible than a view emphasizing discontinuities and breaks. The views of nature and of the relationship between humanity and nature have been very variably founded in the past […]».[73]

Therefore, it can be asserted that the journey towards definitively establishing a worldview that severs our species from the broader natural world has been lengthy and far from straightforward. Had a different worldview prevailed, the course of history might have unfolded differently.

1.1.4.1. Modern science and the progressive objectification, materialisation, and commodification of nature

At this point, I wish to make it clear that my emphasis on the potential value of historical or cross-cultural worldviews should not be misconstrued as an attempt to turn to a supposed 'golden past' for the purpose of devising a definitive solution to the ongoing environmental crisis. Nor do I intend to perpetuate a dichotomy between historical and contemporary viewpoints on nature. Indeed, as many scholars have outlined before, I am well aware that the historical development of the metaphysical notion of 'nature' within Western culture is far from linear, and that the widely debated dualisms between subject

[71] *Ivi*, 49.

[72] Haila, 'Beyond the Nature-Culture Dualism,' cit.; A. Angelini, 'Philosophie biologique et naturalismes : Resituer la nature dans la théorie critique', in A. Charpentier, M. Pagan, M. Dal Pozzolo (eds.), *Repenser la nature : Dewey, Canguilhem, Plessner*, Actes de la recherche à l'ENS, Paris, 2023, 95–108.

[73] Haila, 'Beyond the Nature-Culture Dualism', cit., 161.

and object, nature and culture, nature and society, mechanicism and vitalism, do not represent the whole story.[74]

However, it remains undeniable that a trajectory can be discerned, commencing at least from early modernity, that is characterised by the progressive secularisation and mechanisation of the conception of nature and, subsequently, an increasingly exploitative attitude towards the nonhuman world. This trend may not solely be attributed to shifts in worldviews and philosophical thought; it could also be the result of the parallel rapid advancement of technological skills in Western societies.

A widely sanctioned reconstruction of the process through which nature came to be defined as merely an object, a material entity to be studied and exploited for human purposes, challenges philosophers such as Francis Bacon and René Descartes. Indeed, their works have played a pivotal role in shaping the practice, history, and philosophical discourse surrounding modern and contemporary science. Expanding on this, Haila succinctly summarises:

> It seems that two particular processes were important in the period preceding the Newtonian revolution: the externalization of nature as an object of knowledge in the cognitive sphere, and the externalization of nature as a resource in the practical sphere. Both of these processes rest on the presupposition that nature is a unified and ordered whole obeying a set of identifiable laws which can be formulated in the language of mathematics. Bacon legitimized the view that cognition and exploitation belong together, but Descartes is a particularly important background figure because of his contribution to the methodological development of modern science.[75]

A first, evident consequence of this objectification of nature, recognised solely as a mechanical entity – or *res extensa*, to use Descartes' terminology – is the removal of any normative claims over nature, paving the way for the justified potential manipulation of everything non-human. Over the last centuries, this progression has led to the overturning of the Kantian maxim, from "You must, therefore you can," to "You can, therefore you must." This shift is notably illustrated by the philosopher of biology Hans Jonas in his

[74] See, among others, Haila, 'Beyond the Nature-Culture Dualism,' cit.; Zammito *et al.*, 'Philosophical Approaches to Nature,' cit.; Angelini, 'Philosophie biologique et naturalismes,' cit.

[75] Haila, 'Beyond the Nature-Culture Dualism', 164.

examination of the unprecedented vulnerability of nature in the face of humans, a vulnerability that has surfaced prominently in contemporary times.[76]

As Zammito and colleagues aptly summarised, focusing solely on philosophers of nature like Bacon and Descartes is not incorrect, but is nonetheless a partial perspective.[77] Indeed, as these scholars point out, Francis Bacon's conception of human domination of nature was not boundless; rather, it was constrained by divine laws. These limitations fell as the process of secularisation progressed, ultimately culminating in an extreme interpretation of Bacon's ideas.[78] Furthermore, this circumstance was exacerbated by the connection that was made between the Baconian concept of rightful dominion over nature through science and the strongly mechanistic understanding of the natural world already present in the sixteenth and early seventeenth century, and conclusively solidified by Cartesian natural philosophy. Subsequently, various philosophical accounts, whether explicitly or implicitly, revived this view of nature. These theoretical developments had profound implications for both scientific inquiry and ethical reflection:

> Nature was "dead," an object to be manipulated simultaneously for comprehension and control. The values upon which humankind would carry out this endeavour had to be sought (and justified) elsewhere.[79]

It was, in sum, an "epochal rupture." Nevertheless, two salient *caveats* should be considered. First, it is crucial to recall that the establishment of this mechanistic view of the natural world was not an immediate process; the shift in perspective was neither abrupt nor entirely irreversible. Secondly, and directly linked to the first point, it must be acknowledged that along with the mechanistic worldview, other perspectives continued to exert their influence

[76] H. Jonas, *The Imperative of Responsibility*, University of Chicago Press, Chicago, 1984).

[77] Zammito *et al.*, 'Philosophical Approaches to Nature', cit., 68–76.

[78] On the religious foundations of Bacon's thought, Zammito and colleagues highlight that «Bacon consistently argued that the "domination" of nature was to be held within theologically-defined restraints. […] But in the tradition subsequently established in his name, "when the concept of mastery over nature is thoroughly secularized, the ethical limitations implicit in the pact between God and man, whereby the human race was granted partial dominion over the earth, lose their efficacy." In the absence of this external, religious guarantee, "in the influential intellectual tradition originating with Bacon it has been assumed that mastery over nature considered as scientific-technological progress would be 'automatically' transformed into mastery of nature considered as social progress (a reduction in the source of social conflict)"» (Zammito *et al.*, 'Philosophical Approaches to Nature', cit., 75).

[79] Zammito *et al.*, 'Philosophical Approaches to Nature', cit., 76.

within Western culture.[80] Alternative strands of thought, such as «traditions that were in continuity with Greek and Renaissance philosophies of nature»,[81] persisted and developed later, such as the 'vitalist' account of nature that gained momentum from the end of the eighteenth century, partly as a reaction to the extreme mechanicism and materialism of that time.

1.1.4.2. Commodification: the natural world as economic resource

Nature commodification can be defined, following Gunderson, as «the process of incorporating biophysical entities and/or information about them into economic systems for the purpose of exchanging the good or service for a profit».[82] This process can be contextualised as the logical consequence of the gradual "mechanisation of the world,"[83] a phenomenon that developed concurrently with, and as a result of, the establishment of the modern scientific approach to the natural world.

Although unravelling the causal relations between various theoretical developments and historical processes presents a formidable challenge, it is essential, at the very least, to acknowledge their coexistence and attempt to detect some fundamental connections among them.

So far, we have discussed several pivotal moments in the history of Western philosophy.[84] These include the assertion of dominion over nature through science, the formalisation of the dichotomy between subjects (rational beings, i.e., humans) and objects (anything without a soul, and thus allegedly 'inanimate'), and the later re-emergence of more holistic accounts of the nonhuman world. We have argued that all of these passages contributed to the development of the path that has led to the unprecedented trend of exploitation of natural resources witnessed today globally.

---

[80] Regarding this point, Zammito *et al.* (2008, 77) remark: «The picture that emerges from a historical review is not that of a simple schema in which a unitary notion has been replaced historically in the early modern period by another settled concept that governs contemporary discourse. Instead we find a plurality of concepts that continue to interact in contemporary discussions».

[81] Zammito *et al.*, 'Philosophical Approaches to Nature', cit., 77.

[82] R. Gunderson, 'Commodification of Nature', *International Encyclopedia of Geography*, 2017, 1.

[83] Zammito *et al.*, 'Philosophical Approaches to Nature,' cit.

[84] Cf. *infra*, §§ 1.1.2, 1.1.4.1.

To this list of steps that contributed to the broad adoption of the view of nature as a commodity, we must add a critical event in world history, that is, the beginning of the European colonial era.[85] It has been noted that,

> The conception of translating nature in terms of mathematical structures did not start with Descartes. Nevertheless, it became a universal worldview with the advent of Cartesian science, and this happened because this pragmatic paradigm made possible, without historical precedents, the *appropriation of nature*, including human and nonhuman animals, by human endeavours.[86]

Indeed, the 'appropriation of nature' is the ultimate outcome of a process that began when European explorers, or rather colonisers, first encountered the vast and seemingly pristine territories of the so-called 'New World'. They regarded those lands as their property, ripe for conquest and exploitation without any limits. According to certain analyses, the current environmental crisis can be understood, from the theoretical perspective under consideration here, as the outcome of a convergence of multiple factors that have intersected and interacted over time. These encompass theoretical developments, technological advances, the adoption of a new economic approach, and, within the political domain, the expansion of European domination over nearly the entire world.

As emphasised by Mrozowski, «One of the most widely recognised elements of modern capitalism is commodification, the process by which exchange values and use values are assigned to things».[87] This economic perspective on reality reinforced, to some extent, the reductionist conception of the natural world that first became established during the Scientific Revolution. Furthermore, it is essential to note that these reductionistic and mechanistic approaches hold fundamental connections with anthropocentrism, colonialism, and the view of nature as a commodity for human exploitation.[88]

Within the domain of economic theory, to which the notions of commodity and commodification belong, the process of commodifying nature continued its

[85] T. Piketty, *A Brief History of Equality*, Cambridge, MA, 2022.

[86] P. Brügger, 'Animals and Nature: The Co-Modification of the Sentient Biosphere', in B. Clark and T. Diana Wilson (eds.), *The Capitalist Commodification of Animals*, Research in Political Economy, 35, 2020, 38. Emphasis added.

[87] S.A. Mrozowski, 'Colonization and the Commodification of Nature', *International Journal of Historical Archaeology* 3, 3 (1999), 155.

[88] Mrozowski, 'Colonization and the Commodification of Nature,' cit.; R. Bermejo, 'The Commodification of Nature and Its Consequences', in R. Bermejo (ed.), *Handbook for a Sustainable Economy*, Dordrecht, 2014, 19–33; Fremaux, *After the Anthropocene. Green Republicanism in a Post-Capitalist World*, cit.

advance. This framework gained wide acceptance not only among liberal and neoliberal economists but also, more recently, within alternative paradigms like environmental economics and bioeconomics, which claim to acknowledge the environmental 'externalities' associated with the persistence of the mainstream economic perspective (a notable example of this approach is represented by Dasgupta[89]) but do not challenge the theoretical foundations of neoliberal economics.

As previously mentioned, it is possible to detect an association between such an economic approach to nature and anthropocentrism. As far as I understand, this connection operates as follows: the natural world could not be exclusively viewed as a commodity, a resource to employ in order to satisfy human needs, if it were recognised to possess value beyond its instrumental utility. However, as discussed before, the strong association between anthropocentrism and the view of nature as 'exclusively matter' gave rise to a «'resourcist' mindset which regards mainly and merely the Earth as 'a storehouse' or a 'standing reserve' (Heidegger, 1977 [1953]: 17)».[90]

> Among other things [dualism] provides a cultural rationale for seeing nature in the abstract, an essential step in its classification as a commodity. […] Whether one is dealing with cattle, sheep, land, water rights, slaves, or women, the ability to categorize each as separate from humanity, provides the moral justification for their domination, commodification, and exchange.[91]

Such materialistic, or alternatively, economistic portrayal of the natural realm persisted and spread across disciplinary boundaries, eventually becoming, for many, a commonplace perspective on everything nonhuman.

This approach also influenced the emerging debate over the necessity of protecting nonhuman nature from the harmful consequences of human activities from the early twentieth century onwards. As discussed earlier, even the initial theories concerning the protection and stewardship of nature were not immune from the generally dualistic understanding of the human-nonhuman relationship. The works of John Muir are emblematic in this sense,[92] even though the American naturalist ascribed a certain degree of autonomy from human needs to the natural environment and its living inhabitants, along

[89] P. Dasgupta, 'The Economics of Biodiversity: The Dasgupta Review. Final Report', London, 2021.

[90] Fremaux, *After the Anthropocene. Green Republicanism in a Post-Capitalist World*, cit., 121.

[91] Mrozowski, 'Colonization and the Commodification of Nature', cit., 156.

[92] Cf. *infra*, § 1.1.2.

with inherent worth. The conservation approach derived from this framework focused on safeguarding nature *from* humans, who were considered a threat to the preservation of ecological and biological integrity. This approach, however, had several drawbacks, notably its application resulted, even recently, in significant violations of basic human rights. For instance, it has often provided justification to the dispossession of lands traditionally held and managed by indigenous populations and/or local communities, thus setting the ground for a longstanding link between environmental conservation practices and social injustice.[93] This perspective was largely supplanted by economistic approaches developed from the 1970s onwards (i.e., neoliberal economics), which fully adopted the viewpoint of natural elements as commodities.

The 1960s, and particularly the 1970s, marked a significant shift in both scholarly and public awareness regarding the detrimental impact of industrial societies on the natural environment. However, by this time, the neoclassical economics paradigm was already well-established and had become the dominant model governing both society and the economy. As Gómez-Baggethun and colleagues report quoting Hubacek and van den Bergh,

> By the second half of the 20th century […] environmental resources completely disappeared from the production function and the shift from land and other natural inputs to capital and labour alone, and from physical to monetary and more aggregated measures of capital, was completed».[94]

[93] Awareness on environmental justice has been steadily growing since the 1960s. The US Environmental Protection Agency defines environmental justice as ensuring that all communities within a society receive "the same degree of protection from environmental and health hazard", and providing "equal access to the decision-making process to have a healthy environment in which to live, learn, and work" (https://www.epa.gov/environmentaljustice). Research has established a clear link between social and environmental injustice. This means that the most vulnerable groups, often including cultural, ethnic, religious, or economic minorities, are more at risk of experiencing environmental injustice. This, in turn, results in increased health risks and a lower quality of life for these communities. An up-to-date global assessment of environmental (in)justice is the *Environmental Justice Atlas* (https://ejatlas.org/). Cf. D. Bocarejo and D. Ojeda, 'Violence and Conservation: Beyond Unintended Consequences and Unfortunate Coincidences', Geoforum 69 (2016), 176–183; J. Farrell *et al.*, 'Effects of Land Dispossession and Forced Migration on Indigenous Peoples in North America', Science 374, 6567 (2021), eabe4943; I. Anguelovski and E. Corbera, 'Integrating Justice in Nature-Based Solutions to Avoid Nature-Enabled Dispossession', Ambio 52, 1 (2023), 45–53.

[94] K. Hubacek and J.C.J.M. van den Bergh, 'Changing Concepts of Land in Economic Theory: From Single to Multi-Disciplinary Approaches', *Ecological Economics* 56, 1 (2006), 15, as reported in E. Gómez-Baggethun *et al.*, 'The History of Ecosystem Services in Economic Theory and Practice: From Early Notions to Markets and Payment Schemes', *Ecological Economics* 69, 6, (2010), 1212.

In this context, environmental issues, which were already apparent at that time, were exclusively regarded as 'economic externalities' and consequently addressed through an economistic, monetary-centred approach. In other words, nature and the benefits derived from it (today commonly referred to as 'ecosystem services') were only assigned value when they could be assigned a monetary price.[95] Moreover, they were not attributed any inherent value, as they were believed to be potentially replaceable with other forms of capital. This perspective of assigning only an exchange value to nature raises several issues, as Gunderson summarises:

> First, qualitatively distinct natural entities may not be comparable in quantitative ways, or, they are incommensurable to begin with. Second, this assumption excludes the possibility that natural entities have intrinsic worth irrespective of human thought and action. Even if one assumes only humans can assign value to objects, neoclassical environmental economic models are incapable of accurately taking account of noneconomic values.[96]

For at least two decades now, the concept of ecosystem services has been the most used tool both in scientific assessments and policy analyses for environmental conservation. However, in the way it has been theoretically conceived, this concept aligns with the utilitarian framework of neoclassical (or, at best, environmental) economics. Although it was originally introduced for educational purposes to help the general public understand the economic value of vital societal functions provided by nature and the potential losses associated with their degradation, the notion of ecosystem services was soon 'coopted' for policy assessments, and especially employed for the 'internalization of environmental externalities.'

The final stage in the process of commodifying ecological functions, now rebranded as ecosystem services, is the incorporation of the concept as a policy tool. This manifests in a «series of efforts devoted to cash ecosystem services in real markets through the design and implementation of institutional

[95] The problematic nature of this approach has been first emphasised by ecological economics, a branch of environmental economics that became independent in the late 1980s, advocating for a more complete recognition of nature's values both in relation to human societies and in itself. One of the core assumptions of ecological economics theory is that distinct types of entities or values (e.g., natural and monetary capital) are incommensurable, that is, they cannot be valued through a common measurement unit.

[96] Gunderson, 'Commodification of Nature', cit., 17.

structures for the ecosystem services' appropriation and exchange».[97] In this approach, nature's relevance is solely linked to its direct or indirect utility for human needs. It is worth noting that this utilitarian approach comfortably fits within the anthropocentric, mechanistic, and dualistic framework outlined earlier.

At the beginning, many natural scientists and conservationists enthusiastically adopted this market-oriented approach, thus sanctioning its success, viewing it as a pragmatic way to draw attention to the risks we face and simultaneously address the decline in biodiversity and loss of ecosystem functionality.[98] As Gómez-Baggethun and coworkers assert,

> The reason for this is probably the search for short-term policy action to halt ecosystem services loss where traditional narratives for conservation have failed to influence economic decision making. Because it fits in with the ideological and institutional economic structures in place, market-based policy design has been in an advantaged position to reach decision-making and to get policy proposals implemented.[99]

The ecosystem services framework holds promise in its ability to bridge ecological conservation and economic sustainability by recognising the importance of healthy natural systems for human wellbeing.[100] According to several observers, this approach represents a step forward in conservation theory, signalling the shift from protecting nature *from* humans to protecting nature *for* humans. While still centred on humans, this perspective at least acknowledges a certain level of interconnection and interdependence between our species and the broader living world.[101]

---

[97] Gómez-Baggethun *et al.*, 'The History of Ecosystem Services in Economic Theory and Practice', cit., 1215.

[98] R.B. Norgaard, 'Ecosystem Services: From Eye-Opening Metaphor to Complexity Blinder', *Ecological Economics* 69, 6, Special Section - Payments for Environmental Services: Reconciling Theory and Practice (2010), 1219–1227; J. Keulartz, 'Conservation through Commodification?', *Ethics, Policy & Environment* 16, 3 (2013), 297–307.

[99] Gómez-Baggethun *et al.*, 'The History of Ecosystem Services in Economic Theory and Practice', cit., 1215.

[100] E. Gómez-Baggethun and M. Ruiz-Pérez, 'Economic Valuation and the Commodification of Ecosystem Services', *Progress in Physical Geography: Earth and Environment* 35, 5 (2011).

[101] Along the same lines, Keulartz (2013) emphasises that the ecosystem services framework is rooted in a weakly anthropocentric ethical perspective, and notes that, «Whereas natural resources are perceived to lie passively at our disposal, ecosystem services connote at least some degree of agency, be it only that degree of agency which facilitates such obedient and expedient performance as is permitted servants or slaves» (p. 305).

However, the wide adoption of the ecosystem services framework has also yielded unintended consequences, including the increased commodification of ecological functions and other non-market benefits of nature, such as provisioning and supporting ecosystem services.[102] Another adverse outcome of this approach is that it sanctions the perception of ecosystem services «as exchange values that could be subject to monetization and sale».[103] Furthermore, the almost exclusive focus on ecosystem services contributed to obscuring and hiding «ecological complexity, non-economic values of ecosystems, and power asymmetries underlying environmental trade».[104] The issue, as rightly remarked by Gómez-Baggethun and Ruiz-Pérez, is not that nature is valued in economic terms *per se* – which can serve as an useful tool for supporting conservation efforts – but rather that it is *solely* valued in economic terms.[105] This narrow focus overlooks the complexity and plurality of values and functions that nature holds for human societies and inevitably leads to the commodification of nature. As Keulartz aptly highlights,

> Commodification means abstraction; to be fully interchangeable, biodiversity elements need to be detached from their ecological context, whereas biodiversity is in fact dependent on the existence of multiple interactions between these elements. One is constantly running the risk of 'not seeing the forest for the trees.'[106]

More recent reflections on nature conservation emphasise that our comprehension of the relationship between humans and the broader living world is often biased by our inherently human-centred point of view, thus justifying the utilitarian approach of "protecting nature *for* humans". This argument resonates with the notion of 'cognitive' or 'conceptual' anthropocentrism, which suggests that a minimal degree of anthropocentrism is inevitable in comprehending the nonhuman world. Nonetheless, this recognition does not preclude our ability to acknowledge the existence of alternative worldviews. In this regard, remarkable progress has been made in

[102] There are four categories of ecosystem services: provisioning, regulating, supporting, and cultural ecosystem services. For a more in-depth explanation of this typology, see Millennium Ecosystem Assessment, *Ecosystems and Human Well-Being: A Framework for Assessment*, Island Press, Washington, DC, 2005.

[103] Gómez-Baggethun *et al.*, 'The History of Ecosystem Services in Economic Theory and Practice', cit., 1215. Cf. also Gómez-Baggethun and Ruiz-Pérez, 'Economic Valuation and the Commodification of Ecosystem Services,' cit.

[104] *Ivi*, 621.

[105] *Ivi*, 624.

[106] Keulartz, 'Conservation through Commodification?', cit., 305.

the field of conservation. A groundbreaking work in this direction is the "*Methodological assessment of the diverse values and valuation of nature*,"[107] which introduces a typology of the existing ways of valuing nature. The authors of the report identify four distinct 'life frames' of nature's values, which help framing the diverse values that encompass a wide range of human-nature relationships. These four life frames, ranked from the most to the least anthropocentric, are 'living *from* nature', 'living *with* nature', 'living *in* nature', and 'living *as* nature.'[108]

Neoliberal economics and the relentless pursuit of economic growth have been indisputably demonstrated to have a detrimental impact on the natural world, being recognised as a key driver of nature loss.[109] It is not surprising, then, that conservation approaches adopting a market-driven instrumental view of nature have yielded mixed results, where not documented negative outcomes, both for the preservation of natural species and ecosystems, and because they uphold an anthropocentric, utilitarian attitude towards the nonhuman world.[110] As underscored in the IPBES "*Values Assessment*", «the deterioration of nature and loss of biodiversity are underpinned by societal values and behaviours». Scientific endeavours, including the primary challenge of halting and reversing the current rapid degradation of the biosphere, must be complemented by a comprehensive examination of the theories and values that society ascribes to the natural environment.

To present a viable alternative to conservation strategies solely focused on human gains and losses, a different theoretical framework is urgently required. Incorporating a plurality of values, such as those identified in the IPBES "*Values Assessment*", can facilitate the development of more effective

[107] IPBES, *Methodological Assessment of the Diverse Values and Valuation of Nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*, cit.

[108] C.B. Anderson *et al.*, 'Chapter 2: Conceptualizing the Diverse Values of Nature and Their Contributions to People', in P. Balvanera *et al.* (eds.), *Methodological Assessment Report on the Diverse Values and Valuation of Nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*, Bonn, 2022. For a complete classification and explanation of the 'life frames' of nature's values, see Table 2.1. in Anderson *et al.* (2022), p. 40.

[109] G. Wegner and U. Pascual, 'Cost-Benefit Analysis in the Context of Ecosystem Services for Human Well-Being: A Multidisciplinary Critique', *Global Environmental Change* 21, 2, Special Issue on The Politics and Policy of Carbon Capture and Storage (2011), 492–504; IPBES, *Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*, Bonn, 2019; Dasgupta, 'The Economics of Biodiversity', cit.

[110] Cf. K. Bell, 'Can the Capitalist Economic System Deliver Environmental Justice?', *Environmental Research Letters* 10, 12 (2015), 125017.

conservation strategies based on a plurality of knowledge systems and worldviews.[111] This also entails the inclusion and promotion of non-Western perspectives, which encompass different ways of understanding the interactions and interdependence of people and nature. I will return to this pivotal topic in the following chapters.[112]

1.2. How Ecological Sciences Twisted the Debate in Environmental Ethics

As discussed in previous sections, societal worldviews and the scientific enterprise are not isolated from one another; they develop together and mutually influence each other. In his writings, philosopher of science Karl Popper made it evident that no scientific observation is value-free. Observers never look at 'pure facts;' instead, they invariably interpret them through the lens of their background knowledge, convictions, and ideas. Consequently, scientific research cannot attain a fully objective description of the world because it is always influenced by underlying theories, or, in Popper's terms, it is 'theory-laden.' Moreover, in this perspective, facts and vales are viewed as inseparable.[113]

This emphasis on how the observer's point of view and the broader social context influence how the world is perceived and understood has gained prominence in recent years, notably through the emergence of the Post-Normal Science perspective. This approach was initially introduced in the early 1990s to establish a novel approach to scientific inquiry, tailored to address emerging challenges characterised by complexity and uncertainty, and raised by existential threats like the environmental crisis. The framework of post-normal science (PNS) is particularly useful to unravel scenarios where "facts [are] uncertain, values in dispute, stakes high and decisions urgent."[114] This description aligns seamlessly with the environmental crisis, characterised by a

[111] Cf. K.M.A. Chan *et al.*, 'Why Protect Nature? Rethinking Values and the Environment', *Proceedings of the National Academy of Sciences* 113, 6 (2016), 1462–1465; Himes and Muraca, 'Relational Values', cit.; IPBES, *Methodological Assessment of the Diverse Values and Valuation of Nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*, cit.

[112] Cf. *infra*, Ch. 4.

[113] Cf. K.R. Popper, *Objective Knowledge: An Evolutionary Approach*, 1979.

[114] S. Funtowicz and J.R. Ravetz, 'Science for the Post-Normal Age', *Futures* 25, 7 (1993), 744. See also J.R. Ravetz, 'What Is Post-Normal Science', *Futures* 31 (1999), 647–653.

confluence of probability and uncertainty, a high value load, and the pressing need for immediate action to avert worst-case scenarios.

Hence, a PNS framework is particularly suitable for scientific inquiries and societal considerations concerning the natural world, a domain where the entanglement between facts and values is especially intricate.[115] As Funtowicz and Ravetz aptly point out, «The traditional distinction between 'hard', objective scientific facts and 'soft', subjective value-judgements is now inverted. All too often, we must make hard policy decisions where our only scientific inputs are irremediably soft».[116]

Indeed, given the ongoing catastrophic environmental crisis, knowledge about the composition and functioning of the natural world ca no longer be regarded as an end in itself. Instead, it carries direct social implications by shaping the dominant worldview regarding humanity's place in nature, and consequently influencing critical policy decisions. Ecologist and philosopher Ricardo Rozzi argues that this profound interrelationship between science and society is particularly evident in ecological matters, as ecological sciences and environmental ethics are deeply intertwined and mutually influential.

> […] evolutionary-ecological theories can either reinforce or undermine cultural values and social attitudes. […] Ecologists *are not neutral scientists*, nor are they observers of nature who are passively influenced by their culture; instead, by providing scientific views of nature, ecologists play a central role in shaping social attitudes toward nature. The outcome of scientific influences is not univocal, and social attitudes are influenced by multiple factors, not only science. Nevertheless, some ways of observing and understanding the natural world are more concordant with the styles of life and the kinds of relations that societies establish with the natural world.[117]

To gain a deeper understanding of this complex interconnection, I will first retrace the beginnings of both ecological sciences and environmental ethics, searching for their theoretical foundations to highlight differences and

[115] As Funtowicz and Ravetz put it in their seminal paper on PNS, scientific and societal challenges related to environmental change are characterised by «the interaction of the epistemic (knowledge) and axiological (values) aspects» (Funtowicz and Ravetz, 'Science for the Post-Normal Age', cit., 744). Cf. also K.L. Blackstock *et al.*, 'Implementing Post-Normal Science with or for EU Policy Actors: Using Quantitative Story-Telling', *Sustainability Science* 18, 3 (2023), 1235–1250.

[116] S. Funtowicz and J.R. Ravetz, 'Post-Normal Science', *Internet Encyclopaedia of Ecological Economics*, 2003, 2.

[117] R. Rozzi, 'The Reciprocal Links between Evolutionary-Ecological Sciences and Environmental Ethics', *BioScience* 49, 11 (1999), 919. Emphasis added.

similarities among these two disciplines. Then, I will delineate some points of intersection between the two, with the aim of bringing into light the ways in which progress in each discipline has reflected on the other, fostering a continued, albeit sometimes not fully overt or intentional, dialogic connection.

1.2.1. Ecological sciences in retrospect: A brief historical review[118]

1.2.1.1. Beginnings: A science of relations

Among historians of science, German zoologist Ernst Haeckel (1834-1919) is commonly acknowledged as one of the fathers of the discipline of ecology. He coined the term *Öecologie* in his most comprehensive work, "*Generelle Morphologie der Organismen*", published in 1866. Although Haeckel is widely recognised for this merit, his legacy is subject to debate due to his ambivalent contributions to the emerging fields of evolutionary biology and ecology. In his masterpiece, Haeckel defined ecology as follows:

> By ecology, we mean *the whole science of the relations of the organism to the environment* including, in the broad sense, all the "conditions of existence." These are partly organic, partly inorganic in nature; both, as we have shown, are of the greatest significance for the form of organisms, for they force them to become adapted. Among the inorganic conditions of existence to which every organism must adapt itself belong, first of all, the physical and chemical properties of its habitat, the climate (light, warmth, atmospheric conditions of humidity and electricity), the inorganic nutrients, nature of the water and of the soil, etc.[119]

Prior to Haeckel, and significantly influential to him, was the renowned German explorer and natural scientist Alexander von Humboldt (1769-1859). Humboldt is considered not only one of the key figures for the establishment of biogeography, but also one of the most influential contributors to ecological

[118] Unfortunately, it is unfeasible, within the constraints of this discussion, to present a comprehensive account of the history of ecological science. The subject is remarkably vast and complex, and it would require a dedicated dissertation for a thorough exploration. In this section, I will provide a concise overview of some overarching trends that have, over the course of the 19th and 20th centuries, contributed to the contemporary configuration of ecological science and that appear relevant for the intersection with themes in environmental ethics.

[119] The quote provided here is sourced from Stauffer's 1957 translation, as cited in F.N. Egerton, 'History of Ecological Sciences, Part 47: Ernst Haeckel's Ecology', *Bulletin of the Ecological Society of America* 94, 3 (2013), 226. Emphasis added.

science before Darwin.[120] For example, in his well-known diagram "*Geographie der Pflanzen in den Tropen-Ländern*,"[121] which depicted the distribution of plants along an altitudinal gradient, Humboldt encapsulated a fundamental principle of ecology: the interconnectedness between organisms, their physical surroundings, and the local environmental conditions. This concept was later more formally articulated by Haeckel, over half a century later.

As exemplified by Humboldt's biography, the era of the great scientific explorations worldwide, primarily unfolding during the 18th and 19th centuries, played a pivotal role in shaping the emerging discipline of ecology.[122] Indeed, these explorations, encompassing ecosystems previously uncharted by European observers, coupled with the knowledge available within what was then referred to as 'natural philosophy,' gave rise to significant new observations and the development of key theories.[123] An illustrative example of this intellectual *milieu* is evident in Darwin's reflections, which he documented in his diaries, private notebooks, and the travel notes he published in 1839. These writings contain numerous considerations related to the ecology of the places he explored during his extensively documented five-year voyage around the world on the HMS Beagle. According to the reconstruction proposed by Egerton,[124] several scholars have argued that, based on the "ecological" observations and hypotheses contained in his "*Journal of Researches*"[125] and in his subsequent experiments and published works, Darwin can be regarded as a precursor of ecological science, anticipating some of the central concepts in contemporary ecological theory. As Egerton puts it, «the voyage of the Beagle gave Darwin the opportunity to evolve from a promising neophyte naturalist

[120] F.N. Egerton, 'A History of the Ecological Sciences, Part 32: Humboldt, Nature's Geographer', *Bulletin of the Ecological Society of America* 90, 3 (2009), 253–282.

[121] A. von Humboldt, *Ideen Zu Einer Geographie Der Pflanzen : Nebst Einem Naturgemälde Der Tropenländer : Auf Beobachtungen Und Messungen Gegründet, Welche Vom 10ten Grade Nördlicher Bis Zum 10ten Grade Südlicher Breite, in Den Jahren 1799, 1800, 1801, 1802 Und 1803 Angestellt Worden Sind*, Tübingen, 1807.

[122] A.V. Mohan and K. Tamma, 'The Lasting Contribution of Alexander von Humboldt to Our Understanding of the Natural World', *Resonance* 26, 8 (2021), 1041–1050.

[123] Cf. F.N. Egerton, 'History of Ecological Sciences, Part 53: Organizing Ecologists before 1946', *Bulletin of the Ecological Society of America* 96, 2 (2015), 239–311.

[124] F.N. Egerton, 'History of Ecological Sciences, Part 37: Charles Darwin's Voyage on the Beagle', *Bulletin of the Ecological Society of America* 91, 4 (2010), 398–431; F.N. Egerton, 'History of Ecological Sciences, Part 40: Darwin's Evolutionary Ecology', *Bulletin of the Ecological Society of America* 92, 4 (2011), 351–375.

[125] C.R. Darwin, *Journal of Researches into the Geology and Natural History of the Various Countries Visited by H.M.S. Beagle*, London, 1839.

into a prominent British scientist (Sulloway 1985) who would establish an evolutionary ecology».[126]

Prior attempts had been made to investigate the interconnections between organisms and the environment, as Linnaeus's concept of an "economy of nature" testifies. [127] However, these pre-Darwinian theories, like the 'balance' or 'economy' of nature, were ultimately grounded on a religious interpretation of the natural world, which was depicted as a coherent and harmonious structure, the outcome of one or more intentional acts of creation.[128] Within this creationist perspective on reality, it was impossible to recognise anything other than stability and immutability in nature. Even when the existence of some degree of dynamism and change was acknowledged, thanks to accumulating empirical evidence, natural philosophy remained firmly entrenched within the worldview of creationism and the tradition of Christian natural theology.[129] As Linnaeus himself stated,

> By the Oeconomy of Nature, we understand the all-wise disposition of the Creator in relation to natural things, by which they are fitted to produce general ends, and reciprocal uses. […] Whoever duly turns his attention to the things on this our terraqueous globe, must necessarily confess, that they are so connected, so chained together, that they all aim at the same end, and to this end a vast number of intermediate ends are subservient.[130]

A significant advancement made by Darwin was the abandonment of theological underpinnings in natural explanations. While continuing to employ a vocabulary prone to intentionality, teleology, and references to classical natural philosophy, Darwin firmly anchored his evolutionary theory in scientific observations. Importantly, he excluded any notion of final cause from his theoretical framework. As proposed by Pence and Swaim, it can be argued

[126] Egerton, 'History of Ecological Sciences, Part 37', cit., 423.

[127] C. Linnaeus, 'Oeconomy of Nature', in B. Stillingfleet (ed.), *Miscellaneous Tracts Relating to Natural History, Husbandry, and Physick*, 2nd edition, London, 1762, 32–129; C. Linnaeus, 'Police of Nature', in F.J. Brand (ed.), *Select Dissertations from the Amoenitates Academicae*, vol. 1, London, 1781, 129–166.

[128] F.N. Egerton, 'Changing Concepts of the Balance of Nature', *The Quarterly Review of Biology* 48, 2 (1973), 322–350.

[129] F.N. Egerton, 'A History of the Ecological Sciences, Part 23: Linnaeus and the Economy of Nature', *Bulletin of the Ecological Society of America* 88, 1 (2007), 72–88; C.H. Pence and D.G. Swaim, 'The Economy of Nature: The Structure of Evolution in Linnaeus, Darwin, and the Modern Synthesis', *European Journal for Philosophy of Science* 8, 3 (2018), 435–454.

[130] Linnaeus, 'Oeconomy of Nature', cit., 39–40. The quote provided here is sourced from Pence and Swaim, 'The Economy of Nature,' cit.

that in Darwin concepts such as the 'economy of nature' served only an explanatory role, devoid of any ontological significance for the British naturalist. This means that when Darwin alluded to an 'economy of nature,' he did not necessarily imply the existence of an intrinsic order within nature, nor did he suggest that 'nature' or 'natural selection' were to be intended as personal, agential entities intentionally shaping the course of evolution. Therefore, in Darwin the 'economy of nature' can be understood as an explanatory concept aimed at elucidating how organisms interact with other organisms within specific physical and 'ecological' spatio-temporal niches.[131]

The focus on interactions between organisms and their given environments, a prominent feature of Darwin's theory, was further developed by subsequent authors, such as Haeckel, whom some have described as "the German Darwin."[132] As mentioned earlier, Haeckel had a holistic perspective on the natural world, conceiving it as permeated with interrelations among all its components. Competition and natural selection, in his view, were only one, albeit significant, of the possible manifestations of these continued interactions.[133] In Haeckel's words,

> [The theory of natural selection] shows to us that all infinitely complex interrelations in which the organism is in the outer world, that the permanent interactions with all conditions of existence are not actions of a certain Creator but the necessary action of the existing matter with its movement in time and space. The evolutionary theory explaining mechanically also economic interrelations of organisms as a necessary consequence of acting causes produces the monistic basis of ecology.[134]

[131] It is worth noting here that, when I use terms such as 'ecology,' 'ecological,' and 'niche' in the context of Darwin's thought, I am aware of the historical anachronism. However, I find this approach valuable for the purpose of this section, where I aim to draw a conceptual line connecting historical works in the philosophy of nature and, more recently, evolutionary biology with contemporary ecological science.

[132] U. Kutschera, G.S. Levit, U. Hossfeld, 'Ernst Haeckel (1834–1919): The German Darwin and His Impact on Modern Biology', *Theory in Biosciences* 138, 1 (2019), 1–7.

[133] A.L. Rizhinashvili, 'Ernst Haeckel's "Ecology" in Russia of the First Half of the Twentieth Century', *Theory in Biosciences* 138, 1 (2019), 89–103.

[134] The quote provided here is sourced from E. Haeckel, *Generelle Morphologie der Organismen*. Georg Reimer, Berlin, 1866, translated by E. Kolchinsky, as cited in Rizhinashvili, 'Ernst Haeckel's "Ecology" in Russia of the First Half of the Twentieth Century', cit., 91.

1.2.1.2. Modern Synthesis: The return of mechanistic thinking

However, this "monistic basis of ecology" remained, until very recently, largely unexplored. Instead, a more mechanistic and reductionist perspective gained prominence, particularly in the first half of the 20th century, bolstered by the rise of a gene-centric reinterpretation of evolutionary theory, after the rediscovery of Mendel's work on genetic inheritance. This interpretation, which subsequently formed the core of the Modern Synthesis, left little room for an adequate consideration of the interactions between organisms and their environments, let alone cooperative processes.[135] Rather, it was grounded in the notion that individuals were the primary drivers of evolution, engaged in constant competition for reproduction and survival across all levels, from single genes to populations and species. During the Modern Synthesis era, the field of ecology was, according to several authors, overshadowed and diminished. During this process, the environment was once again reduced to an emergent outcome, or even a byproduct, of small and consistent changes occurring at the genetic and organismic levels, rather than as a prominent actor in the process of evolution.[136]

As it is evident when considering the intellectual roots of anthropocentric accounts,[137] a tension among two contrasting worldviews also surfaces in the history of ecology: the holistic, hierarchical, and interdisciplinary perspective versus the reductionist and mechanistic outlook. This does not imply that the environment was entirely excluded from the biological discourse at the beginning of the 20th century; indeed, some central theories of ecology were developed by proponents of the Modern Synthesis. Nonetheless, it is important to acknowledge a fundamental shift that occurred during that period, which could be tentatively described as 'mathematization.' This refers to the application of concepts and methodologies from physics and mathematics to

[135] Biologist Massimo Pigliucci, one of the first to openly advocate for a 'rethinking' of the Modern Synthesis (MS) and to initiate a discussion on this matter, identifies ecology as one of the four missing elements in the field of evolutionary biology under the Modern Synthesis. He asserts: «Obviously, ecology was implied in the MS, but still today there is a cross-discipline distrust between ecologists and evolutionary biologists, and sometimes dichotomies are created that are rather counterproductive, such as the frequent talk of "ecological" versus evolutionary time scales. […] Perhaps more importantly, ecological theory hardly features in evolutionary studies, except as a background condition» M. Pigliucci, 'Do we need an extended evolutionary synthesis?', *Evolution* 61, 12 (2007), 2745.

[136] Egerton, 'Changing Concepts of the Balance of Nature,' cit.

[137] Cf. *infra*, § 1.1.

ecology and evolutionary biology. To my understanding, this operational shift aimed to harmonise scientific practices across disciplines and ensure that evolutionary biology and its related fields, including ecology, were recognised the same scientific status as 'hard' sciences, despite their historical and contextual nature.

This mechanisation of ecological science, whose traces can already be found in the works of early 20th century ecologists like F.E. Clements, C. Elton, and A. Tansley, was systematically formalised by Eugene and Howard Odum, two of the most influential ecologists of the 20th century. In his "*Fundamentals of Ecology*",[138] E.P. Odum provided for the first time a comprehensive account of ecology as a proper scientific discipline. The methodology employed to make sense of the complexity of the subject involved progressively reducing ecological entities and processes to models and explaining them through the underlying physical mechanisms, such as energy exchanges within and among ecosystems. However, exploring the inner functioning of natural systems through mathematical methods does not necessarily yield an objective representation of the subject. As Russo rightly remarks,

> From an epistemological perspective, is the mathematisation of nature implicit in models immediately legitimate, obvious, and devoid of problematic implications? Can we safely assert that nature "works" according to mathematical principles?[139]

In essence, the contention is that interpreting nature through a mathematical lens does not provide an inherently objective representation; rather, it reflects a specific worldview. The very nature of mathematic formalism being a human construct makes its supposed objectivity impossible. Russo, who strongly criticises the legitimacy of this effort toward mathematising ecology, argues that this approach further complicates the comprehension of ecosystems:

> The relationship between the two fundamental components of ecological analysis –living organisms and the environment – is reduced to a mathematical function, to be verified by means of experimental practices that are increasingly detached from nature. […] The result is an ecological science that loses its ability to understand its object even from a methodological standpoint (Russo 2000, p. 47).[140]

[138] E.P. Odum, *Fundamentals of Ecology*, 1st edition, Philadelphia, 1953.
[139] N. Russo, *Filosofia ed ecologia*, Napoli, 2000, 31. My translation.
[140] *Ivi*, 47. My translation.

Although Odum's representation of ecosystems does not entail dissecting its subject into smaller and smaller components to comprehend their functioning, it can still be regarded as reductionist. This form of reductionism transpires as it simplifies and abstracts the complexity of ecological processes into models and generalisations. This approach is evident in Odum's definition of 'ecosystem,' as provided in the third edition of "*Fundamentals of Ecology*":

> Living organisms and their nonlinving (abiotic) environment are inseparably interrelated and interact upon each other. Any unit that includes all of the organisms (i.e. the "community" in a given area interacting with physical environment so that a flow of energy leads to clearly defined trophic structure, biotic diversity, and material cycles (i.e., exchange of materials between living and nonliving parts) within the system is an ecological system or ecosystem. […] The ecosystem is the basic functional unit in ecology, since it includes both organisms (biotic communities) and abiotic environment, each influencing the properties of the other and both necessary for maintenance of life as we have it on the earth.[141]

At play here is the application of cybernetics to ecology, a methodology that, on the one hand, aids in understanding *how* things function but fails to address the remote causes of the processes under investigation. On the other hand, it once more reduces the organism or ecosystem to a machine.[142] The predicament lies in the contradiction between the holism pursued through a cybernetic approach and the inherent nature of cybernetic systems, which are fundamentally encompassed by a mechanistic and reductionist interpretation. As Bergandi points out, «Odum seems to assert that an approach is holistic as long as it does not need to analyse all the components of a system to understand it as a whole. Thus, it is reasonable to assume that Odum equates reductionism with exhaustiveness».[143]

---

[141] E.P. Odum, *Fundamentals of Ecology*, 3rd edition, Philadelphia, 1971, 8.

[142] In the words of Odum: «Ability to describe and predict behaviour of ecological systems by the use of models depends largely on a principle of all systems: that of *hierarchical organization* (or principle of integrative levels). This principle […] states simply that it is not necessary to understand precisely how a component of a system is structured from simpler subcomponents in order to predict how it will behave. Thus, it is not necessary to have full comprehension of biochemistry in order to describe the physiology of cells, nor is it necessary to understand physiology completely in order to describe the dynamics of animal populations» (Odum, *Fundamentals of Ecology*, 1971, 277). Cf. also D. Bergandi, 'Fundamental of ecology de E.P. Odum: véritable "approche holiste" ou reductionnisme masqué?', *Bulletin of Ecology* 24, 1 (1993), 57–68; Russo, *Filosofia ed ecologia*, cit.

[143] Bergandi, 'Fundamental of ecology de E.P. Odum: véritable "approche holiste" ou reductionnisme masqué?', cit., 65.

At the same time, however, it is crucial to recognise the merits of Odum, not only for granting scientific legitimacy to a long-overlooked discipline but also for bringing ecology to the centre of the public discourse. This spotlight not only emphasised the theoretical significance of the field but also underscored its practical and political dimensions. As Odum himself acknowledged, starting from the 1960s a new collective awareness began to emerge regarding the interconnections between the natural and human worlds, which had long been considered separate and isolated realms. «Although "ecology" is frequently misused as a synonym for "environment,"», Odum stated, «popularization of the subject is having the beneficial effect of focusing attention on man as part of, rather than apart from, his natural surroundings».[144]

The integration of the scientific discipline with other fields of study, such as social sciences and economics, along with its engagement in the broader public debate, paved the way for the gradual dissemination of a new perspective on nature, markedly different from the one of the Modern Synthesis. However, the outcomes of this integration were mixed. While, as highlighted by E.P. Odum, this contributed to a broader adoption of the holistic approach,[145] on the other hand it also led to the predominance of a 'mathematical' or 'economistic' view of the natural world. This direction significantly influenced the subsequent development of emerging environmental policies (such as the ecosystem services approach) by endorsing a simplified and reductionist understanding of the relationship between humans and the nonhuman world, as well as of the natural world itself.

The convergence of concepts and knowledge from a burgeoning scientific discipline with the public debate and the rise of environmentalist political and intellectual movements also carried another implication: the blending of scientific concepts with ethical considerations and values.

1.2.1.3. Ecological science and ecology: 'value-ladenness'

As briefly mentioned in the previous paragraph, a new environmentalist movement began to gather momentum in the 1960s. Due to space limitations, it suffices to note here that within this multifaceted movement, two distinct aspects can be discerned. The first is the social and political dimension, which

[144] E.P. Odum, 'The Emergence of Ecology as a New Integrative Discipline', *Science* 195, 4284 (1977), 1290.

[145] By 'holism,' Odum meant studying an object not only by analysing its components but by thoroughly considering the relations between them and the higher organizational levels that composed it as a whole.

stimulated the rise of new political movements and significantly contributed to the development of international environmental policy. The second can be labelled as the 'academic' dimension, in which the scientific (evolutionary and ecological) exploration of the natural world and the ethical reflection on these subjects initiated a challenging yet promising dialogue. This latter dimension will be the primary focus of this and the subsequent sections.

Environmental philosophy, as it evolved since the 1960s, extensively drew upon ecological science to argue for the interdependence of humans and the broader living world. To quote scholar and environmental activist Lynley Tulloch, «environmentalisms[146] take the principles of interaction, relationships and systems from ecological science to situate humans within the nonhuman world, stressing their dependence on the earth».[147] In addition to adopting scientific principles for the purpose of shaping a new 'ontological' representation of the natural world, environmental philosophy has also shaped its ethical arguments (e.g., what counts as an environmental problem, what actions should be taken and what principles should be prioritised) against the backdrop of ecological science.

During the latter half of the 20th century, a growing number of biologists and ecologists became increasingly vocal about their concerns regarding the rapid degradation of the natural environment.[148] As evidence of the profound impacts of human activity on the biosphere accumulated, scientists felt a heightened sense of responsibility to extend their role beyond the mere description of facts and to provide suggestions and guidance for actionable solutions.

Hence, this growing entanglement of scientific descriptions and values had a profound impact on both ecological science and the broader concept of 'ecology,' which denoted both environmental awareness and a variety of social and political movements. This intertwining also blurred the boundaries between the two domains, making it increasingly challenging to discern between factual observations and value-based perspectives. Grounding their claims in ecological science, a diverse array of philosophical and ethical positions emerged. Some argued for the need for humans to recognise their

[146] To be intended as both in their theoretical elaboration and as political movements.

[147] L. Tulloch, 'On Science, Ecology and Environmentalism', *Policy Futures in Education* 11, 1 (2013), 100.

[148] A notable example of this novel political commitment of scientists are prominent personalities like, among others, E.O. Wilson, Paul Ehrlich, S.J. Gould.

interconnectedness with nature and acknowledge their non-central place within the biosphere, challenging the notion of human superiority. On the contrary, others contended that human beings not only stand apart from nature but even pose a threat to a supposed 'balance' of nature, which, in their view, could only be preserved when natural environments remain entirely untouched by human influence. Such developments were not merely theoretical; rather, they had tangible impacts on reality. The implications of these debates are evident, for instance, when analysing the evolution of policy decisions aimed at addressing the escalating environmental crisis in recent decades.[149]

1.2.2. Environmental ethics in retrospect: A brief historical review

Although we have briefly covered environmental ethics in previous sections of this chapter, it is beneficial to provide a concise overview of the foundational texts and theoretical contributions that have significantly shaped the development of the field in its initial stages, since the mid-20th century. The summary that follows will not cover every aspect comprehensively but aims to consider influences from diverse fields, encompassing the works of biologists and ecologists in addition to philosophers. Furthermore, I will explore the related evolution of the public discourse surrounding the environmental crisis that developed in Western countries from the early 1960s.

Rachel Carson's "*Silent Spring*", first published in 1962, is widely regarded as one of the most influential, if not *the* most influential, work in raising awareness of environmental issues.[150] This book sparked intense public debate about the legitimacy of the prevailing approach to nature, which was considered merely as a resource to be exploited to the point of exhaustion. During those years, attention also heightened regarding the finite nature of the planet and the limited resources upon which all living beings, not just humans, depend.

A notable example of consciousness-raising on this subject is the famous popular science book "*The population bomb*", published in 1968 by biologists Paul and Anne Ehrlich. Although the book was heavily criticised and some of the claims contained in it did not prove entirely accurate, it marked a significant milestone in emphasising the finite nature of our planet and the

[149] This point is further discussed in § 1.2.3.

[150] M.H. Lytle, *The Gentle Subversive: Rachel Carson, Silent Spring, and the Rise of the Environmental Movement*, 2007.

resources on which we rely, and the intrinsic unsustainability of the contemporary development model.[151] This approach was subsequently formalised by another seminal publication for the environmentalist movement: the report "*The limits to growth*", published in 1972 and edited by the "Club of Rome," a scientific and political think tank founded by the Italian industrialist Aurelio Peccei in 1965. [152]

The texts mentioned here may not strictly fall within the philosophical literature, yet they serve as foundational pillars in the historical trajectory of environmental thought. They set the baseline for the problems of concern, drawing attention to previously disregarded issues like pollution, overpopulation, and the exploitation of natural resources, among others. The cultural backdrop that these works, in conjunction with a growing body of alarming scientific evidence highlighting the rapid changes of the long-stable environmental conditions of our planet, paved the way for innovative philosophical contributions to emerge.

1.2.2.1. Who and what has worth? Alternatives along a spectrum

Early works in environmental philosophy primarily tackled a fundamental question: whether to adopt an anthropocentric or non-anthropocentric approach.[153] Answering this question was central for determining which of the ethical issues raised by the environmental crisis were the most pressing and immediate to address. In this respect, between the 1970s and 1980s, environmental philosophers embraced various approaches that could be accommodated within a spectrum ranging from strong anthropocentrism to radical anti-anthropocentrism. It is worth noting, as a side point, that the majority of developments in environmental philosophy, at least during those initial years, originated from an American perspective and, to a lesser extent, from a European one. In this context, it is evident that one of the primary objectives of ethical thought was to challenge the deeply entrenched dualism within the Western worldview.

---

[151] P.R. Ehrlich, *The Population Bomb*, New York, 1968. For a glimpse on how the authors revised their own initial perspective, see P.R. Ehrlich and A.H. Ehrlich, 'The Population Bomb Revisited', *The Electronic Journal of Sustainable Development* 1, 3 (2009), 63–71.

[152] *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*, New York, 1972.

[153] Cf. E. Katz, 'Ethics and Philosophy of the Environment: A Brief Review of the Major Literature', *Environmental History Review* 15, 2 (1991), 79–86.

Among the early contributions to environmental ethics, John Passmore presented a significant concept: a form of 'weakened' anthropocentrism. In this perspective, the idea of domination over nature is replaced with one of stewardship towards it.[154] The essence of this approach is the shift from a strong utilitarian perspective, where nature is viewed merely as a resource for unlimited exploitation, to a less extreme form of the same utilitarian view. In this revised approach, nonhuman nature is still regarded as a resource, yet its exploitation is limited within certain boundaries. The issue, however, is that these boundaries are still established based exclusively on human needs, and the protection of nature is contingent on the risk that excessive exploitation poses to human wellbeing.[155] This ethical proposition has been the subject of substantial critique from its inception, and it raises numerous problematic aspects that will not be explored in depth here.

Within anthropocentric declinations of environmental ethics, a distinction can be drawn between physical exploitation of nature and other instrumental values attributed to it.[156] Eugene Hargrove, another prominent advocate of anthropocentric environmental ethics and founder of the journal *Environmental Ethics*, argued for the preservation of the natural world based on 'immaterial' values that humans assign to the non-human world, such as cultural or aesthetic interests. However, such views ultimately perpetuate the fundamental issues of dualism and 'human-centredness' which, as discussed previously, are utterly incompatible with preservation of the planet's ecological systems both from an ethical and scientific perspective.

In the same years, non-anthropocentric theories began to emerge, notably *biocentrism* and *ecocentrism*. These concepts encompass various lines of thought, differing slightly from each other. Their common foundation lies in the gradual extension of the moral subject (i.e., who or what is the centre of moral considerations). This movement implies transcending human-centric perspectives to include either certain species based on distinct traits – for

[154] As an additional point of interest, it is worth noting that this very approach was introduced as a response to the critique made by the historian Lynn White against the anthropocentric approach of the Christian tradition. The reinterpretation of the biblical text, shifting from the idea of 'domination' to 'stewardship' towards nature, remains prevalent in contemporary theological theories that prioritise environmental concerns, as evidenced by the papal encyclical "*Laudato si'*," published in 2015.

[155] For a comprehensive summary of the utilitarian views of nature that can be found in anthropocentric perspectives, cf. W. Fox, 'A Critical Overview of Environmental Ethics', *World Futures* 46, 1 (1996), 1–21.

[156] J. Kawall, 'A History of Environmental Ethics', in S.M. Gardiner and A. Thompson (eds.), *The Oxford Handbook of Environmental Ethics*, 2017.

instance, the capacity to feel and suffer, as in the case of sensiocentrism, or simply the fact of being alive, as in proper biocentric accounts[157] –, all living beings, or entire ecological communities. This conceptual framework has been consequently termed 'moral extensionism.' A significant turning point in this process is marked by a transition from an exclusive focus on humans – our interests, values, and our position with respect to (or within) nature – to a genuine focus on non-human entities, whether individual or collective, acknowledging their 'inherent' ethical worth, independent of any human judgements or valuations.

Building on the framework proposed by Kawall, a further distinction can be made between individualistic (extensionist) and holistic environmental ethics.[158] While the former theories, as mentioned earlier, can be characterised as endeavours to extend the moral community to include individual entities beyond the human, the latter takes a distinct starting point. Rooted in the scientific and ethical considerations articulated by American ecologist Aldo Leopold in the 1940s, this line of thought advocates for viewing not only individuals but entire communities as recipients and subjects of ethical value and consideration.

John Baird Callicott, often regarded as the main 'translator' of Leopold's thought to philosophy, emphasises that the focal point of this holistic environmental ethics lies in preserving the integrity of the 'land,' that is, the entire ecological community. Independently of interpretations by Callicott, which have undergone substantial critiques over the years, Leopold's land ethic retains several points of interest, prompting engagement from numerous environmental philosophers. One noteworthy aspect of Leopold's thought, that holds particular relevance to our discussion, is its radical grounding of any ethical reflection concerning the environment in a profound and comprehensive

[157] In his perhaps most renowned publication, "*Respect for Nature*" (1986), Paul Taylor contends that individual living organisms should be valued simply by virtue of their existence. Being alive, they have interests that should be adequately considered from an ethical point of view. Taylor explains: «We conceive of the organism as a teleological center of life, striving to preserve itself and realize its good in its own unique way. To say it is a teleological center of life is to say that its internal functioning as well as its external activities are all *goal-oriented*, having the constant tendency to maintain the organism's existence through time and to enable it successfully to perform those biological operations whereby it reproduces its kind and continually adapts to changing environmental events and conditions. […] Physically and chemically it is in the molecules of its cells that this activity occurs, but the organism as a whole is the unit that responds to its environment and so accomplishes (or tends to accomplish) the end of sustaining its life» (P.W. Taylor, *Respect for Nature: A Theory of Environmental Ethics*, *Respect for Nature*, 1986, 121–122).

[158] Kawall, 'A History of Environmental Ethics,' cit.

understanding of ecological systems. In his view, this stands as a fundamental prerequisite for grasping the impact of human activities and, consequently, formulating a normative theory for the contemporary era.

Leopold adopts an ecological perspective on nature, conceptualising it as a 'biotic pyramid' that encompasses all existing species, including humans, within a single comprehensive network of interdependent connections. Taking a further step, Leopold contends that adopting an ecological viewpoint on the history of life – and of human history as well – reveals that, in our species, ethical theories have always been the expression of a kind of 'community instinct' which has historically enabled complex societies to protect themselves and thrive. The underlying assumption is that no individual can survive outside the concentric circles of the various ecological communities it inhabits, upon which its very existence invariably depends.[159]

1.2.2.2. Environmental ethics and ecological sciences: A dynamic interplay?

In my view, one of the most intriguing topics that environmental ethics has introduced in the public debate is the constructive problematisation of the relationship between scientific knowledge concerning nature and the environment, on one hand, and philosophical concepts and tools, on the other. Environmental ethics has, in this context, delved into exploring the potential convergence between these typically isolated domains. Several scholars have pushed these boundaries even further, seeking to reconcile the traditional distinction between factual statements and value judgements, *is* and *ought* – a problem well-known in the philosophical discourse as 'Hume's law,' named after English philosopher David Hume, who first articulated it. The argument posits that trying to derive normative statements from descriptive ones implies incurring in a logical fallacy, since these two domains are incommensurable. A notable example of a statement seemingly contravening Hume's law can be drawn from Aldo Leopold's renowned work, "*A Sand County Almanac*":

> A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.[160]

In response to allegations of violating Hume's law, Callicott has defended Leopold's assertions by contending that environmental ethics indeed allows for

[159] Nash, *The Rights of Nature*, cit.; M. Andreozzi, *Etiche Dell'ambiente. Voci e Prospettive*, 2012; Kawall, 'A History of Environmental Ethics,' cit.

[160] A. Leopold, *A Sand County Almanac: And Sketches Here and There*, 1949, 224–225.

the movement from *is* to *ought*. He argued that this transition can and should be pursued because, following Hume, the basis for respecting our ecological community lies within us, being a direct implication of human moral sentiments. These sentiments, derived from evolutionary processes and guided by reason, evoke a sense of kinship, and therefore moral responsibility, towards nature.[161] Callicott's perspective implies that by getting acquainted with, and finally adopting the depiction of the natural world offered by ecology and evolutionary biology, people can develop an appreciation, fondness, and, consequently, a commitment to preserve the natural environment, assimilating it to their own community or society. This approach aligns with "our generally positive attitude"[162] towards our community, extending it to encompass the natural world around us.[163]

In my view, the aim of the argument put forward by Callicott is to mitigate the risk of succumbing to the logical fallacy by demonstrating that value judgements are inherently rational or factual arguments. Callicott posits that even moral 'passions', using Hume's terminology, have a 'natural,' even evolutionary, origin. Conversely, I believe that a more valuable approach to argue against the claim of violating Hume's law should involve recognising the overarching framework that underpins the entire discourse, that is, the complex relationship between science and ethics. This entails acknowledging that environmental and evolutionary sciences, despite their factual basis and empirical grounding, cannot be entirely objective, especially when formulating general descriptions of the world. As outlined earlier, it is essential to remember that the scientific endeavour is inherently *human* and consequently susceptible to biases and preconceptions. In particular, I argue that natural sciences are never purely descriptive; rather, their descriptions and definitions implicitly include a specific worldview and the values aligned with it.

[161] J.B. Callicott, 'Hume's Is/Ought Dichtomy and the Relation of Ecology to Leopold's Land Ethic', *Environmental Ethics* 4, 2 (1982), 163–174.

[162] Callicott, 'Hume's Is/Ought Dichtomy and the Relation of Ecology to Leopold's Land Ethic', cit., 172.

[163] A similar stance was taken by the renowned naturalist and science writer E.O. Wilson, who, albeit grounded in an alleged biological origin, namely that humans evolved an innate inclination towards the appreciation of life (biophilia), advocated the acknowledgement of other species as member of the same moral community. In the conclusion of his famous yet controversial book, "*Biophilia*", Wilson wrote: «But I suggest that as biological knowledge grows the ethic will shift fundamentally so that everywhere […] the fauna and flora of a country will be thought part of the national heritage as important as its art, its language, and that astonishing blend of achievement and farce that has always defined our species» (E.O. Wilson, *Biophilia. The Human Bond with Other Species*, Cambridge, MA, 1984, 145.

Environmental ethics openly relies on knowledge from the natural sciences, a feature widely recognised in the field as a specific trait of this discipline. Consequently, it encounters the challenge of addressing the intrinsically value-laden nature of the sciences on which it draws. This presents ethical implications, including, for example, the recognition that moral norms derived from value-laden factual statements inevitably lose some degree of universality, and are more easily justifiable as contextual. This position has much in common with the argument put forward by environmental ethicist Don Marietta, who argued that it is essentially impossible to disentangle facts and values, especially – I would add – when they refer to our understanding of the world around us.

> We seldom perceive value-free states of affairs, and we never perceive facts unmediated by human consciousness. When we make purely descriptive *is* statements, these are abstracted from the world as experienced, the world as we live and participate in it. Even to accept a statement as a factual statement is to give it a sort of value (to make it a bearer of truth value) within a larger system of thought. […] An ethic founded upon ecology, since it is not derived abstractly from entailment relations between statements, does not deduce *ought* from *is*. It is rather a matter of recognizing the values embedded in our observations of the world, observations in which factual cognition and value cognition are fused, only to be separated by reflection.[164]

1.2.3. The intertwining of (ecological) facts and (environmental) values

In a paper published in 1985, environmental philosopher Mark Sagoff suggested that ecological science encompasses two distinct tasks: 'providing products,' which involves ensuring that ecosystem services to meet human needs are in place, and 'protecting processes,' which entails preserving or restoring the functions of natural ecosystem.[165] This differentiation underscores that, in both cases, ecological sciences are not value-free. Indeed, by overlaying this distinction with the various environmental ethics approaches

[164] D.E. Marietta, Jr., 'The Interrelationship of Ecological Science and Environmental Ethics', *Environmental Ethics* 1, 3 (1979), 200.

[165] To my understanding, in the paper cited here, the term 'ecological science' is essentially synonymous with 'conservation science,' which is a specialised branch of ecology dedicated to the operational objective of managing and safeguarding natural ecosystems. This distinction sets it apart from the more theoretical branch of ecological science, primarily focused on the investigation and comprehension of the processes governing ecosystem function and the components that make up ecological systems.

we have previously examined,[166] a parallelism stands out between the contrapositions existing within the two fields: for instance, anthropocentric versus bio- or ecocentric theories on the one hand, and the 'utilitarian' versus 'deontological' approach to conservation on the other. Thus, it becomes evident that the domains of science and ethics, which may initially seem distant and independent from one another, are in fact closely intertwined.

Mark Sagoff's categorisation of the scope of ecological science serves as an illustrative example, revealing the often-hidden interplay between scientific facts and the values underlying them. In this case, for example, the 'providing products' approach seems to predominantly adopt an anthropocentric perspective. In contrast, the 'protecting processes' approach appears to be rooted, to some extent, in a non-anthropocentric stance. The values and underlying worldviews that subtly influence topics that may seem purely technical ultimately mould the outcomes of conservation efforts. In this particular case, the design of nature-based solutions is informed and motivated by anthropocentric values, such as the utilitarian goal of maximising ecosystem services for human societies, or considerations for cultural and aesthetic concerns. These values significantly shape the goals and outcomes of ecological management practices. This interconnection is also noticeable when considering how the concept of 'natural,' often conflated with 'untouched by humans,' as established by both historical and contemporary ecological narratives, has influenced societal perspectives and policymaking. Indeed, this rather limited (and ultimately flawed) perspective has significantly shaped the targets of environmental protection policies, often focused on the preservation of 'wilderness,' a concept that is indeed highly debatable and, as research has conclusively demonstrated, that refers to something that has not existed for millennia now. As economist Robert Nelson notes in an interesting historical analysis of the 'religious' narrative that, he argues, has been woven by ecological science throughout the 20th century:

> As [American ecologist] Botkin observes, many of his fellow ecologists advocated additional wilderness designations, even though it was no great mystery that "there is no longer any part of the Earth that is untouched by our actions in some way, either directly or indirectly." As a result, objectively speaking, "there are no wildernesses in the sense of places completely unaffected by people" (1990, 194), despite frequent assertions to the contrary in

[166] Cf. *infra*, §§ 1.1.2, 1.1.4.

> the rhetoric of environmental policymaking. Indeed, for many environmentalists, the idea of a genuine wilderness unaffected by human action – places on earth where the Creation still exists unaltered – is virtually a necessary benchmark of their own faith.[167]

It is, therefore, essential for both the scientific and policy levels to acknowledge the inherently non-neutral character of this kind of interventions. In fact, as proponents of post-normal science argue, scientific inquiry is never conducted in isolation, and scientists, including environmental scientists, inevitably view the natural world through the perspectives of the prevailing worldview.

Mark Sagoff revisits this distinction at the conclusion of his article, emphasising both the influence of values on shaping theories and practices in ecology, and the contribution of ecological science to ecosystem management and the development of societal attitudes towards the natural world. Once more, we witness the dynamic interaction of science, policy, society, and ethics.

> Ecology strives to offer society two kinds of knowledge and, therefore, two kinds of power. The first provides a scientific framework in which we may manage ecosystems to maximize the goods and services we may derive from them. The second provides a scientific framework in which society can appreciate the qualities of those systems and evaluate policies concerning them. The first kind of knowledge advances environmental management by enhancing our power over nature. The second promotes environmental protection by enhancing our respect for nature and therefore our power over ourselves.[168]

This also holds true when examining the same hypothesis from a historical standpoint. In the case under consideration, looking at how the interaction between ecological and evolutionary sciences and reflections in environmental ethics have coevolved in the modern and contemporary era can provide insights into both disciplines.

Throughout the 20th century, many biological advances, propelled by new data and the embrace of innovative scientific theories (e.g., the Darwinian theory of evolution by natural selection, or the theory of germs advanced by Louis Pasteur), had revolutionary effects on deeply ingrained philosophical

[167] R.H. Nelson, 'Ecological Science as a Creation Story', *The Independent Review* 14, 4 (2010), 531.

[168] M. Sagoff, 'Fact and Value in Ecological Science', *Environmental Ethics* 7, 2 (1985), 116.

paradigms. A compelling illustration of these transformative dynamics comes from palaeoanthropology. The strides made by this discipline in the late 19th and the 20th centuries gradually reshaped the way we humans depict ourselves, unveiling the intricate, non-linear evolutionary trajectory of our species. As we delved deeper into the complex journey that has led to our species current ecological dominance over other life forms, a substantial body of evidence conclusively showed the inconsistency of theories positing human separation from the broader natural world, or the narrative of evolution as a story of steady progress. This example vividly illustrates the complex interplay between empirical facts and underlying values, highlighting the potential for such interaction to serve as a catalyst for far-reaching societal transformations.

Along the same lines, the initial endeavours to challenge the anthropocentric worldview, as detailed in earlier sections,[169] had already commenced in the 19th century. During this period, a growing comprehension of the natural laws, mechanisms, and patterns operating across various scales, from the microscopic to the macroevolutionary, was fostered by scientific and technological advancements and marked by the emergence and substantial innovation of novel scientific disciplines like ecology, evolutionary biology, chemistry, and physics. These developments initiated the gradual erosion of anthropocentric narratives. These narratives, once the prevailing perspective in Western culture, found themselves increasingly at odds with the latest revelations stemming from scientific inquiry.

Today, this extensive knowledge base has given rise to a profoundly innovative understanding of the phenomenon of life and its various manifestations, in comparison to prior frameworks.[170] Life is now perceived as a complex web of interdependent and co-evolving living forms, engaged in both competition and cooperation at different levels. This contemporary understanding of the biosphere, acknowledging its complexity, implies, on the ethical level, that there exists no ontological distinction between the human species and other 'products' of the evolutionary trajectory of life on Earth. Undoubtedly, *Homo sapiens* holds a unique position within the realm of biology. Nevertheless, any supposed ontological separation (let alone claims of superiority) between our species and other living beings is fundamentally flawed both from an evolutionary and ecological standpoint. We are not

[169] Cf. *infra*, § 1.1.3.
[170] Cf. *infra*, § 1.2.1.

external to the natural community– we are an integral part of it and entirely reliant on it. Under no circumstances can we consider ourselves as independent from the surrounding environment.

Returning to the example of the objectives of ecological science as tentatively identified by Sagoff, mentioned at the outset of this section, it becomes evident that a dynamic interplay is in place between environmental ethics and the practice of ecological science. The consequences of such continued interaction can be discerned in the policy decisions arising from these debates. For instance, a dualistic perspective on the relationship between humans and the broader natural world often results, as Cowell highlights, in a form of 'ecological pessimism.'[171] This perspective arises from the belief that since every human intervention is considered 'unnatural' and potentially detrimental to 'natural' (i.e., untouched by humans) ecosystems, it is preferable to abstain from any action to mitigate the ongoing ecological degradation rather than intervening in any way. This type of reasoning, commonly observed in scientific and political discourses concerning environmental protection, can be overcome by adopting a more 'holistic' approach to the issue. Such an approach should consider the often-concealed interconnections between facts and values, cultural legacies, and scientific uncertainty. As Rozzi emphasises, there is a pressing demand for the integration of both the sciences and humanities, alongside the consideration of practical and ethical aspects.[172] This need is particularly evident when addressing overarching challenges like the interconnected crises of climate change, biodiversity loss, pollution, together with land degradation.[173]

> Critical thinking concerning the consonance between scientific theories and environmental ethics complement efforts to confront the global environmental crisis. By examining how particular ways of knowing about and living in the natural world are linked, scientific/ethical inter-analyses enable a discussion that goes beyond a mere "problem-solving" approach […]. An approach that integrates the interrelations between science and ethics enriches ecological reflection and creativity about the modes of human existence, avoiding the

[171] M. Cowell, 'Ecological Restoration and Environmental Ethics', *Environmental Ethics* 15, 1 (1993), 19–32.

[172] Rozzi, 'The Reciprocal Links between Evolutionary-Ecological Sciences and Environmental Ethics,' cit.; R. Rozzi, J.J. Armesto, R. Frodeman, 'Integrating Ecological Sciences and Environmental Ethics into Biocultural Conservation', *Environmental Ethics* 30, 3 (2008), 229–234.

[173] UNEP, 'Outcomes Document of the Scoping Meeting for the Seventh Edition of UNEP's Global Environment Outlook (GEO-7),' cit.

> frequently uncritical adherence to the dominant economic and instrumental paradigm.[174]

1.3. CAN WE IMAGINE A DIFFERENT HUMAN-NONHUMAN RELATIONSHIP?

The environmental crisis, as I mentioned at the beginning of this chapter, deeply impacts both the ecological and social dimensions, and is linked to what I call 'upstream' and 'downstream' injustices. The former are the injustices at the roots of the environmental crisis, stemming from colonialism, capitalism, and the unequal exploitation of resources between the global North and South. The latter denote the disproportionate burden faced by the world's vulnerable – present-day poorer populations, future generations, and nonhuman species – despite their minimal role, if any, in causing this crisis.

Throughout these pages, I have sought to highlight the substantial role played by worldviews and ideologies in shaping societal attitudes toward these issues. Indeed, the narratives we adopt significantly influence how we portray the natural world and how we perceive ourselves within it.

I have argued that addressing the crisis solely through a 'hands-on' approach, without concurrently tackling its theoretical and ethical underpinnings, is insufficient. The inadequacy of this strategy is evident, for example, in the recurring failure of international political efforts. Therefore, providing an alternative theoretical framework to reconceptualise our relationship with the natural world is crucial for navigating these turbulent times. This dissertation aims to confront this challenge through an analysis of the potential for a re-evaluation of the human-nonhuman relationship. In this initial chapter, I have introduced the philosophical and conceptual 'toolbox' that will guide my argument in subsequent sections. This toolbox comprises, but is not exclusively limited to, the concept of a 'long Anthropocene,' reliance on the latest evidence available from the life sciences, discussions in contemporary environmental ethics, and the contextualist approach of post-normal science.

A nuanced examination of disciplines like ecological sciences and environmental ethics reveals a fascinating aspect: the portrayal of the human-nature relationship as a monolithic entity, often assuming exploitation as the

[174] Rozzi, 'The Reciprocal Links between Evolutionary-Ecological Sciences and Environmental Ethics,' cit., 919.

only possible approach, is fundamentally flawed.[175] When examining, for example, how natural scientists have described the way the relationships between humans and the nonhuman world have changed throughout our evolutionary history, we discover that, even within the scientific community, there is a plurality of manifestations and values concerning nature, spanning from anthropocentrism to a profound sense of oneness with the living world.[176] Similar diversity is also discernible in philosophical contributions, as well as in cultural manifestations and traditions, as I will discuss in the following chapter. This suggests that such plurality may have emerged over the course of our species' history, manifesting in a diversity of worldviews within the multitude of cultures that have developed over time.

The answer to our question, 'is a different relationship between our own and other species possible?' may partially lie in humans' deep past. The variety of cultural complexes that human populations have developed over time is astounding. While in some cases humans have exhibited destructive behaviours towards their environments, it is indeed challenging to disregard the possibility that alternative explorations have taken place. Without indulging in the myth of a golden past of hunter-gatherer societies (a model that is clearly unfeasible to replicate in modern contexts), instances of non-exploitative interactions with the natural world are observable even in the recent evolutionary past (referring to the last 12-10,000 years, namely post the agricultural revolution) and, although becoming increasingly rare, in the present. Notably, the presence of such 'virtuous' examples is not solely confined to remote, often regarded as 'wild' territories, such as the rainforests of Papua New Guinea or South America. To the contrary, remnants of the exploration of alternative ways of interacting with the natural environment – essentially, alternative ways of

[175] Of course, my critical focus in this regard (and throughout this dissertation) centres on the modern Western cultural *milieu*, which has predominantly embraced an anthropocentric ideology. However, it is crucial to emphasise that even within a cultural context largely monopolised by this narrow approach, alternative worldviews have persisted. Exploring them is valuable as they may offer timely perspectives in our current situation.

[176] The latter is eloquently articulated by E.O. Wilson in numerous passages throughout his popular science book. One such example can be found in *Biophilia*, where the naturalist describes his feelings while working in the rainforest: «I savored the cathedral feeling expressed by Darwin in 1832 when he first encountered tropical forest near Rio de Janeiro ("wonder, astonishment & sublime devotion, fill & elevate the mind"). And once again I could hold still for long intervals to study a few centimeters of tree trunk or ground, finding some new organism at each shift of focus. The intervals of total silence, often prolonged, became evidence of the intensity of the enveloping life» (E.O. Wilson, *Biophilia. The Human Bond with Other Species*, Cambridge, MA, 1984, 27).

'being human' – also persist in historically industrialised countries, enduring within highly anthropized and contaminated environments.[177]

Investigating such diversity offers valuable insights on various fronts. Firstly, non-scientific traditional knowledge is increasingly recognised as a fundamental repository of knowledge concerning the natural environment. Engaging traditional and local communities in endeavours aimed at mitigation, adaptation, and restoration is thus increasingly recognised as essential for the success of such initiatives.[178] Secondly, listening to these alternative perspectives can unveil viable yet overlooked worldviews. Integrating them into our own offers the opportunity to gain a more pluralistic and broader understanding of the world around us, and potentially to advance ethical reflections. As I will argue more extensively in the final chapter, forging an 'intellectual alliance' among contemporary life sciences, environmental ethics, and traditional knowledges holds the potential to profoundly shift the Western-centric, economy-focused and human-centred mindset and facilitate the development of new narratives – potentially offering expedited solutions to address the current triple planetary crisis.

[177] This will be the focus of the third chapter, where the case study of this research project is presented and discussed. Cf. also *infra*, 2.4.

[178] S.M. Haq *et al.*, 'Integrating Traditional Ecological Knowledge into Habitat Restoration: Implications for Meeting Forest Restoration Challenges', *Journal of Ethnobiology and Ethnomedicine* 19, 1 (2023), 33; S. Ray, 'Weaving the Links: Traditional Knowledge into Modern Science', *Futures* 145 (2023), 103081.

2. BIOCULTURAL DIVERSITY: A COMPLEX INTERTWINING

In the Anthropocene, the anthropogenic biosphere is permanent, the legacy of our ancestors, and our actions as human systems a force of nature […]. The implication is clear; the current and future state of the terrestrial biosphere is up to us, and will be determined by human systems of one form or another.

(Ellis, E. C. (2011). Anthropogenic transformation of the terrestrial biosphere. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 369(1938), 1027)

2.1. INTRODUCTION

Reflecting on our position in the world prompts us to seek insights from cultures different from the one we are immersed in. Evidence drawn from both the past and the present strongly suggests that there is a bi-directional correlation between humans and the rest of the natural world. This evidence clashes with the prevalent Western narrative that emphasises separateness, as discussed earlier. When I initially encountered the concept of biocultural diversity, I sensed its significance might extend beyond practical implications, revealing the mutual connection between all living species, including humans, their material (cultural, especially in the case of humans) manifestations, and the natural environment. This concept also appeared to hold theoretical value, illuminating potential paths for exploring 'different ways of being human' in response to the ongoing crises.

Biocultural diversity is an interesting and rather new concept indicating the deep interconnection between biological and cultural manifestations of diversity across the world.[1] Several studies empirically show that the spatial distribution of these two types of diversity overlaps in many regions, and that the reduction (and in some cases extinction) of the two is also linked.

Yet, it is still debated whether cultural and biological diversity are two sides of the same coin ("the diversity of life in all its forms", as stated in the 1992 Convention of Biological Diversity) or two distinct and unrelated phenomena,

[1] Maffi, 'Biocultural Diversity,' cit.

each emerging from different and independent processes.[2] The biocultural diversity research framework argues for the existence of an evolutionary interdependence between the two realms, and stresses the similarities and convergence between them, rather than their differences.

However, in order to address this issue, a thorough understanding of both biodiversity and cultural diversity is required. The latter, in particular, is the most challenging: in fact, the concept of culture is broad and vague, and carries different meanings and values.

First, it seems useful to acknowledge the interconnectedness that binds humans and their diverse cultural manifestations to the rest of the natural world. From the appearance of the genus *Homo* on Earth, a prolonged and continuous process of co-evolution – that is, a sustained and reciprocal influence over each other's evolutionary paths – has been going on between human cultures on the one hand, and the local environments and their living inhabitants on the other. As stated by Cocks and Wiersum, «throughout human history societies have interacted with nature resulting in worldviews, cosmologies and narratives reflecting relations and relationships among plants, animals and people».[3] While modifying the local environment to meet their own needs through large-scale niche construction processes, peoples and their cultures have also been influenced by nature. Furthermore, over time, this continued relationship has resulted in location-specific, diversified cultural landscapes.

> Biocultural diversity therefore not only relates to cultural values, but also to the practices adopted by individuals and groups for shaping the nature and composition of biodiversity within the landscapes they live in.[4]

As numerous examples from around the world demonstrate, traditional cultures play a significant role in the conservation of biodiversity today. It is a common opinion that this stewardship role can only be fulfilled by Indigenous peoples and, more generally, local communities in developing countries, who carry the legacy of a long and often positive relationship with local

[2] L. Maffi, 'Linguistic, Cultural, and Biological Diversity', *Annual Review of Anthropology* 34, 1 (2005), 599–617; J. Pretty *et al.*, 'The Intersections of Biological Diversity and Cultural Diversity: Towards Integration', *Conservation and Society* 7, 2 (2009), 100; D. Rapport and L. Maffi, 'The Dual Erosion of Biological and Cultural Diversity: Implications for the Health of Ecocultural Systems', *Nature and Culture*, 2010; Bridgewater and Rotherham, 'A Critical Perspective on the Concept of Biocultural Diversity and Its Emerging Role in Nature and Heritage Conservation,' cit.

[3] M.L. Cocks and F. Wiersum, 'Reappraising the Concept of Biocultural Diversity: A Perspective from South Africa', *Human Ecology* 42, 5 (2014), 728.

[4] *Ivi*, 729.

ecosystems.[5] But this point of view is based on an unrealistic conception of culture, portrayed as static and unchanging.[6] In fact, growing evidence suggests that traditional and rural cultures are important for conservation even in industrialised countries, where they have been more often affected by processes of change and 'contamination.' Therefore, it is essential that, within the discourse on biocultural diversity, the dynamic character of culture is recognised, as well as its ability to modify and adapt under changing conditions: «Traditional ecological knowledge (TEK) should not be considered a static body of knowledge or as existing in isolation. Rather, it is in a process of constant change and adaptation to socioecological conditions».[7]

Since the notion of culture is vast and difficult to define, in the context of the present study I will focus on one particular aspect of human cultural expressions, namely, the intersection of the 'natural' and 'cultural' realms, and the values that arise from and pertain to this complex and multifaceted relationship.

2.1.1. Natural and Cultural: A Blurred Boundary

As emphasised by Pretty and colleagues, a clear definition of what is to be regarded as 'natural' and 'cultural' is not universally shared.[8] Among human societies, there is a 'gradient' of differing attitudes towards the natural environment, ranging from a complete sense of belonging to a sense of separation, even domination, towards the natural world.[9]

What is categorised as 'cultural' is influenced by worldviews, ideas, and practices that have been created locally. Here, I focus on those aspects that are directly related to the natural environment, being affected by it, or influencing its development. The aim is to draw attention to the long-term interactions between these two spheres, stressing their interdependence and mutual importance in shaping the history of humans and their environments.

The so-called 'biocultural environment,' also known as 'cultural landscape,' is a major element of this history. The concept refers to a specific biome that

[5] Garnett *et al.*, 'A Spatial Overview of the Global Importance of Indigenous Lands for Conservation,' cit.

[6] Elands *et al.*, 'Policy Interpretations and Manifestation of Biocultural Diversity in Urbanized Europe,' cit.

[7] M. von Glasenapp and T.F. Thornton, 'Traditional Ecological Knowledge of Swiss Alpine Farmers and Their Resilience to Socioecological Change', *Human Ecology* 39, 6 (2011), 770.

[8] Pretty *et al.*, 'The Intersections of Biological Diversity and Cultural Diversity,' cit.

[9] R.M. Pyle, *The Thunder Tree. Lessons from an Urban Wildland*, Corvallis, OR, 1993; M. Soga and K.J. Gaston, 'Extinction of Experience: The Loss of Human–Nature Interactions', *Frontiers in Ecology and the Environment* 14, 2 (2016), 94–101.

has evolved as a result of long-lasting, low-impact disturbance regimes brought on by human presence, to which the surrounding ecosystems have plastically adapted over time. As explained by Farina, cultural landscapes are

> […] geographic areas in which the relationships between human activity and the environment have created ecological, socioeconomic, and cultural patterns and feedback mechanisms that govern the presence, distribution, and abundance of species assemblages.[10]

Cultural landscapes are a fundamental element of most ecological systems of the world.[11] According to several studies, the co-existence among humans and non-human nature based on human alteration of the environment dates back to several millennia ago – at least 12,000 years before present.[12] Environments that are deemed to be 'pristine' are not untouched; in fact, they are often the result of a long-term co-evolutionary process involving ancient human populations and the local biodiversity. The scale and mode of exploitation of natural resources are the main differences between the practices that created and sustained historical cultural landscapes and current human activities. It has been shown that traditional practices developed over a timescale that allowed organisms and ecosystems to gradually adapt to human modifications;[13] this is not the case with current large-scale activities such as industrial agriculture and farming, which have instead expanded at a pace that evolutionary processes are unable to adapt to. Furthermore, despite the recent recognition of the ecological significance of human-made cultural landscapes, these are still in danger due to the current trajectory of economic expansion.

In fact, biocultural diversity has entered the institutional and academic debate only a few decades ago, being described for the first time in 1988 in an official document, the Declaration of the first congress of the International Society for Ethnobiology, as the expression of an "inextricable link" between cultural and biological manifestations of the world's diversity. The Convention on Biological Diversity (CBD), signed in Rio de Janeiro in 1992, describes

[10] A. Farina, 'The Cultural Landscape as a Model for the Integration of Ecology and Economics', *BioScience* 50, 4 (2000), 313.

[11] K. Taylor and J. Lennon, 'Cultural Landscapes: A Bridge between Culture and Nature?', *International Journal of Heritage Studies* 17, 6 (2011), 537–554.

[12] Stephens *et al.*, 'Archaeological Assessment Reveals Earth's Early Transformation through Land Use,' cit.; Ellis, 'Land Use and Ecological Change,' cit.

[13] J. Blondel, 'The "Design" of Mediterranean Landscapes: A Millennial Story of Humans and Ecological Systems during the Historic Period', *Human Ecology* 34, 5 (2006), 713–729; N.L. Boivin *et al.*, 'Ecological Consequences of Human Niche Construction: Examining Long-Term Anthropogenic Shaping of Global Species Distributions', *Proceedings of the National Academy of Sciences* 113, 23 (2016), 6388–6396.

biocultural diversity as «biological diversity and cultural diversity and the links between them», and acknowledges its importance.[14] Cultural landscapes are also recognised under the UNESCO World Heritage Convention, as "combined works of nature and of man."

It is worth noting that the notion of biocultural diversity carries with it several theoretical and even political implications. First, bringing together in one concept the natural and cultural domains is a step towards overcoming the classical Western dichotomy that describes the human and non-human worlds as completely separate. The epistemological description of reality that characterises contemporary scientific knowledge, economics, the humanities, and even certain ecological perspectives all exhibit this ontological shortcoming.[15] As Muraca rightly remarks, however, empirical evidence as well as a number of philosophical approaches emphasise that the alleged dualism between *res cogitans* and *res extensa*, subject and object, humans and nature, is not our primary mode of interaction with the external world, which is rather experienced as a complex reality from which we are not separate or superior, but of which we are a part.[16]

Therefore, if it is true that, as the most up-to-date knowledge developed by natural sciences demonstrates, a discrete separation between human and non-human living beings does not seem necessary to hypothesise, we might have to admit that the Western understanding of the world is not *the* only objective description of reality, but one of many possible narratives about the world we are entrenched in. In this respect, biocultural diversity allows us to confer new dignity to different worldviews, such as Indigenous and local communities' perspectives about human relationships with the natural environment, and even to "decolonise nature."[17] Therefore, employing the concept of biocultural diversity as a theoretical tool allows to re-frame the current environmental crisis in light of the long-term, multilevel interactions among our species and the other members of the global ecological community.

The main aim of this chapter is to outline our understanding of biological diversity and cultural diversity in order to provide a clear theoretical

[14] CBD, *The Convention on Biological Diversity*, 1992.

[15] Cf. *infra*, § 1.1.2.

[16] B. Muraca, 'Re-Appropriating the Ecosystem Services Concept for a Decolonization of "Nature"', 2016, 143–156.

[17] Muraca, 'Re-Appropriating the Ecosystem Services Concept for a Decolonization of "Nature",' cit.; see also B. Muraca, 'The Map of Moral Significance: A New Axiological Matrix for Environmental Ethics', *Environmental Values* 20, 3 (2011), 375–396.

framework against which the intersection between these two fields can be drawn.

2.2. BIOLOGICAL DIVERSITY

As for the present discussion, my primary goal is not to comprehensively quantify and describe biodiversity and cultural diversity; rather, I am interested in assessing what the linkages between these two dimensions are. Comparing these two dimensions, however, can be challenging given their inherent differences and the few proxies that can be applied to both the cultural and biological realms. Thus, it is necessary to first define the two components of this concept in order to better outline our research framework and evaluate the outcomes. In this section, after a brief general overview, I specifically address those aspects of biological diversity that directly relate to, or are influenced by, human activities and cultural processes.

2.2.1. General definition and quantitative measures of biodiversity

Biodiversity, in general, refers to the diversity of life forms that currently populate the Earth. As per the definition officially adopted by the Convention of Biological Diversity,

> *Biological diversity* means 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.[18]

Researchers in biology and ecology have developed different measuring methods, mainly based on quantitative assessments. These can be carried out by considering the number of species in a given area (*alfa* diversity), the changes in biodiversity within a community over time (*beta* diversity), or the total biological richness of a place (*gamma* diversity).[19] Additionally, there are several indexes which help measure biological diversity at different scales, such as the Simpson Index and the Shannon Index.

Given the difficulty of conducting a comprehensive survey of global biodiversity, scientists often select proxies that provide a statistical

[18] CBD, *The Convention on Biological Diversity*, cit.

[19] D.J. McGlinn *et al.*, 'Measurement of Biodiversity (MoB): A Method to Separate the Scale-Dependent Effects of Species Abundance Distribution, Density, and Aggregation on Diversity Change', *Methods in Ecology and Evolution* 10, 2 (2019), 258–269; A. Shmida and M.V. Wilson, 'Biological Determinants of Species Diversity', *Journal of Biogeography* 12, 1 (1985), 1–20.

approximation of the rates of biodiversity across the world. The biodiversity of vertebrates, notably mammals[20] and birds, is one of the most commonly utilised proxies there. Extinction rates projections also vary depending on which drivers are taken into consideration (deforestation, habitat fragmentation, alien species invasion, climate disruption, human population growth, among others). As a result of data incompleteness, particularly with regard to invertebrates and microorganisms (the vertebrate phylum includes the most researched and well-known species), comprehensive scientific estimates of the world's biodiversity are still lacking.

Studies on biodiversity are currently concentrated on mapping and eventually reversing the 'extinction spasm' that is impacting both the quality and quantity of Earth's biological variety on a global scale. But precisely this lack of knowledge on the true figures of global biodiversity is a significant barrier to a thorough understanding of the scope of this crisis. According to Norman Myers, as he argued in a book edited by E.O. Wilson in 1997, the fundamental extinction challenge may not be the loss of species in and of itself, but rather the decreasing abundance of genetic variation even among different populations of the same species. This, in turn, could have severe implications on their evolution:

> The loss of large numbers of species, let alone species subunits, will be far from the only outcome of the present biotic debacle, supposing it proceeds unchecked. The forces of natural selection and speciation can work only with the 'resource base' of species and subunits available – and, as we have seen, this crucial base is being grossly reduced. […] Given what we can discern from the geologic record, the recovery period, i.e., the interval until speciation capacities generate a stock of species to match today's in abundance and variety, will be protracted.[21]

As Wilson, the first proponent of the concept of 'biodiversity,' declared decades ago, the primary goal of biological research today must be conservation science.[22] And knowledge is crucial for preservation. Thus, systematics plays a critical role in quantifying the world's biodiversity and its rapid depletion. Nevertheless, a mere catalogue of biodiversity is insufficient because biological diversity also comprises an intricate web of ecological

[20] R. Dirzo *et al.*, 'Defaunation in the Anthropocene', *Science* 345, 6195 (2014), 401–406.

[21] N. Myers, 'The Rich Diversity of Biodiversity Issues', in M.L. Reaka-Kudla, D.E. Wilson, E.O. Wilson (eds.), *Biodiversity II. Understanding and Protecting Our Biological Resources*, Washington, DC, 1997, 132.

[22] E.O. Wilson, 'The Biological Diversity Crisis: A Challenge to Science', *Issues in Science and Technology* 2, 1 (1985), 20–29.

relationships that has yet to be fully acknowledged and thoroughly investigated. The wealth of human cultures that have co-evolved with nature over time are likewise enclosed within this web of relationships. To incorporate this often-overlooked aspect of biological diversity, an integrated strategy that takes into consideration the close co-evolutionary course followed by humans and non-humans for millennia should be implemented.

2.2.2. A new evolutionary actor: humans

The effects of human activity on biodiversity go back millions of years, to when our ancestors started competing for the same ecological niches as other great predators, which induced a rapid decline in those species.[23] Humans have driven several species to extinction throughout their multiple 'out of Africa' migrations,[24] forcing a state shift to new equilibria in recently colonised settings.

Overexploitation of natural resources, pollution, and habitat change are some of the biggest hurdles to biodiversity conservation and are setting the stage for a Sixth mass extinction.[25] Widespread impacts on biodiversity are still discernible today, and have particularly intensified since the start of the so-called 'Great Acceleration.'[26]

On the other hand, historical information, archaeological evidence, and ecological data suggest that humans have not always had a destructive impact on the ecosystems they inhabit. On the contrary, human populations have been shown to be a beneficial component within local ecosystems in several instances, given their ecological role as a 'hyper-keystone species'.[27] This

[23] C.N. Johnson *et al*., 'Biodiversity Losses and Conservation Responses in the Anthropocene', *Science* 356, 6335 (2017), 270–275.

[24] Examples abound; let us only mention the notable hypothesis suggesting that the extinction of Pleistocene megafauna may have been primarily driven by human over-hunting activities. See A.D. Barnosky *et al.*, 'Assessing the Causes of Late Pleistocene Extinctions on the Continents', *Science* 306, 5693 (2004), 70–75; J. Bergman *et al.*, 'Worldwide Late Pleistocene and Early Holocene Population Declines in Extant Megafauna Are Associated with Homo Sapiens Expansion Rather than Climate Change', *Nature Communications* 14, 1 (2023), 7679.

[25] N.E. Stork, 'Measuring Global Biodiversity and Its Decline', in M.L. Reaka-Kudla, D.E. Wilson, E.O. Wilson (eds.), *Biodiversity II*, cit., 41–68; A.D. Barnosky *et al.*, 'Approaching a State Shift in Earth's Biosphere', *Nature* 486, 7401 (2012), 52–58; G. Ceballos *et al.*, 'Accelerated Modern Human–Induced Species Losses: Entering the Sixth Mass Extinction', *Science Advances* 1, 5 (2015), e1400253; R.H. Cowie, P. Bouchet, B. Fontaine, 'The Sixth Mass Extinction: Fact, Fiction or Speculation?', *Biological Reviews* (2022).

[26] McNeill and Engelke, *The Great Acceleration*, cit.

[27] Based on the keystone species concept, which is applied to species that exert "disproportionate and often unexpected effects" on food-web dynamics, Worm and Paine propose to define humans as a 'hyper-keystone species' in light of the fact that human activities "affect multiple other keystone species in different habitats." This concepts

implies that removing *H. sapiens* from an ecosystem which has been shaped by its continued activity for centuries, or even millennia, may lead to a disequilibrium in the dynamic stability of the local ecological system, eventually resulting in a loss of biological diversity and overall complexity.

2.2.3. Importance of biological diversity

Biodiversity and eco-diversity preservation is essential both to the maintenance of a healthy biosphere and the functioning of human societies. These, in fact, have developed and still thrive largely thanks to the numerous and oft-neglected 'ecosystem services' provided by functional natural systems, whose complete disruption would have severe effects at local, regional and global scales. High levels of biological diversity protect the health of ecosystems and ensure their resilience, i.e., their ability to promptly respond and adapt to shocks.

Moreover, as we will see in greater detail later,[28] biodiversity is essential to many aspects of human cultures, including, among others, sacred sites, language, literature, music, food traditions, medicinal knowledge. The preservation of species diversity is not only important for maintaining a healthy and functioning biosphere, but it is also a necessary prerequisite for the development and maintenance of the astounding cultural variety that constitutes the main expression of diversity within the human species.

2.3. CULTURAL DIVERSITY

According to the first proponents of the concept of biocultural diversity, human cultures are to be recognised as part of the diversity of life on Earth.[29]

In scientific research, a general definition of culture – intended as a shared property of many different life forms – is provided among others by Danchin and colleagues, who define culture as «the part of phenotypic variation that is inherited socially (that is, learnt from others)».[30] Limiting the attention, for the purposes of this research, only to our own species, we can adopt a narrower definition of culture and its manifestations. Encompassing the many forms of expression, worldviews, beliefs, and practices that shape the identity of

---

emphasises the primary ecological role humans play in nearly all existing ecosystems.' Cf. Worm and Paine, 'Humans as a Hyperkeystone Species,' cit.

[28] The dynamic and mutual interactions among humans and the ecosystems they inhabit is explored in more detail in the following sections. Cf. *infra*, § 2.5.

[29] Maffi, 'Linguistic, Cultural, and Biological Diversity,' cit.; Maffi and Dilts, *Biocultural Diversity Toolkit*, cit.; Maffi, 'Biocultural Diversity,' cit.

[30] É. Danchin *et al.*, 'Beyond DNA: Integrating Inclusive Inheritance into an Extended Theory of Evolution', *Nature Reviews Genetics* 12, 7 (2011), 475–486.

different communities, the UNESCO Universal Declaration on Cultural Diversity defines the notion of 'cultural diversity' as follows:

> Culture takes diverse forms across time and space. This diversity is embodied in the uniqueness and plurality of the identities of the groups and societies making up humankind. As a source of exchange, innovation and creativity, cultural diversity is as necessary for humankind as biodiversity is for nature (art. 1).[31]

Just like biodiversity, cultural diversity also plays a central role in ensuring the resilience of social-ecological systems.[32] However, just like biodiversity, this 'utilitarian' value is not the only reason why both biological and cultural diversity require attention and deserve to be protected.

As outlined by Foley and Mirazón Lahr, diversification of cultures is an inherent feature of the history of our species. Following their proposal, we could also take into consideration the possibility of defining culture as,

> […] a species-specific trait, in which the human brain produces mental states which process, transmit and receive information "capable of affecting individuals' behaviour that they acquire from other members of their species through teaching, imitation, and other forms of social transmission". One of the primary outcomes of the capacity for culture is particular sets of behaviour, mostly homogeneous within populations, and different between them. Culture, therefore, produces 'cultures.'[33]

Looking back into the distant past, it is evident that a wide range of environmental factors clearly affected the process of cultural ramification among human populations. Following the historical trajectory of our species, we find that cultural differentiation occurs regionally as a result of the dispersal of populations. Then, at the beginning of the Pleistocene, cultural distinctions appear to gradually develop, mostly reflecting demographic and ecological processes. Finally, in historical times, various social processes have resulted in both the homogenisation and increased fragmentation of human societies, creating «human landscapes which are complex, with diverse communities existing in a patchwork of overlapping territories or cultural units».[34] The connection between the formation of culture and the underlying environmental

[31] UNESCO, *Universal Declaration on Cultural Diversity*, 2001, art. 1.

[32] Pretty *et al.*, 'The Intersections of Biological Diversity and Cultural Diversity,' cit.

[33] R.A. Foley and M. Mirazón Lahr, 'The Evolution of the Diversity of Cultures', *Philosophical Transactions of the Royal Society B: Biological Sciences* 366, 1567 (2011), 1080.

[34] *Ivi*, 1084.

conditions is emphasised by the pattern of distribution of cultural diversity around the world:

> Latitude, temperature, and rainfall are all good predictors of the ethnographically observed diversity of cultures. […] Human cultures, as communities of individuals, form when boundaries begin to occur within such communities, and when, through both adaptive and neutral mechanisms, the traits of each community – from language to decoration to technology – begin to diverge. […] In essence, the formation of boundaries, and so different cultures, is an outcome of the context; this may be the natural context, where there are real geographical barriers, or demographic ones, where there may be competition. In either case, diversity of cultures is basically being driven by resource availability and its social and economic context.[35]

2.3.1. Measuring cultural diversity

Due to the variety of its manifestations, it can be challenging to unambiguously define what is part of a cultural complex, and to quantify, for example, the corresponding increasing or decreasing trends. In order to achieve this goal, several disciplines employ proxies to evaluate the richness and distribution of cultural diversity. However, since cultural diversity is more transient and less determinable in quantitative terms than biological diversity, monitoring the distribution of this form of diversity on a global scale requires slightly different strategies than those used for biodiversity assessments. The most reliable indicators of cultural variety are both tangible and intangible, such as archaeological remains, technological innovations, culinary practices, dialects, and languages. Language, in particular, represents an important part of a community's culture because it is the way through which culture itself can be conceptualized and perpetuated over time; moreover, it is the primary vehicle through which the traditional knowledge which binds a community to its environment, accumulated over thousands of years, can be transmitted.[36]

2.3.2. Languages and dialects

Linguistic diversity is difficult to assess. Its main subject, language, is a concept characterized by blurred boundaries. When evaluating a mixed

[35] *Ivi*, 1085.

[36] K.P. Whyte, 'On the Role of Traditional Ecological Knowledge as a Collaborative Concept: A Philosophical Study', *Ecological Processes* 2, 1 (2013), 7; Maffi, 'Biocultural Diversity,' cit.

dialect,[37] for instance, what is the threshold to mark the exact point of transition between two different languages? Moreover, what perspective should the researcher adopt – that of scientific postulates and evidence, or that of the native speakers of the language considered?[38]

As noted by Maffi, language is essential to a culture not only for its obvious primary use as an essential communication tool; indeed,

> it serves many social and cultural functions: from signifying social identity to expressing and transmitting the worldview, cultural values, beliefs, feelings, knowledge, practices, and artistry of its speakers. As well, language reflects and conveys the historic adaptations of humans to their local environment, developed through long-term interactions between people and the natural world on which they depended for survival.[39]

Thus, maintaining even 'minority' languages alive is essential to ensure social and cultural identity of local communities, to foster social cohesion, to promote individual and collective wellbeing. Moreover, language is directly linked to the preservation of traditional knowledge, that is, the body of tangible and intangible culture in which the identity, history, and abilities of a community are embodied. Therefore, as Maffi states,

> every time any language, no matter how small, disappears, and with it go the cultural traditions and traditional knowledge that language conveys, it is a piece of the planet's living fabric that gets torn off, leaving all of the living world more fragile, more vulnerable, and with fewer options for the future.[40]

According to the most recent assessments, there are currently between 6,500 and 10,000 spoken (living) languages in the world.[41] Their distribution, however, is extremely unbalanced – and this is an interesting point for our research, as it reflects the distribution of patterns of cultural homogenisation in the world over time.[42] In fact, 4% of the world's languages is located in Europe and the Middle East; the Americas host around 1,000 languages (15% of the

[37] A mixed dialect is a dialect that might have evolved on the borders of two different regions, or that has been influenced by different ethnicities, which is why it is not always easy to discern its origins or its belonging to a specific ethnic, geographical or cultural group.

[38] Whyte, 'On the Role of Traditional Ecological Knowledge as a Collaborative Concept,' cit.

[39] L. Maffi, 'What Is Linguistic Diversity, And Why Does It Matter?', in L. Maffi and O. Dilts (eds.), *Biocultural Diversity Toolkit*, vol. Vol. 2-Assessing the State of The World's Languages, 2014, 7.

[40] *Ivi*, 11.

[41] T. Skutnabb-Kangas and D. Harmon, *Biological Diversity and Language Diversity*, 2017.

[42] There is an apparent difference, for example, between the rates of cultural (as well as biocultural) diversity in countries with low and high levels of industrialisation. Cf. *infra*, § 2.4.

world total); finally, the majority of this diversity is located in Asia (32.4%), Africa (30.2%), and the Pacific (18.5%).[43]

Estimating distribution rates is essential to map the proportion of linguistic diversity in different countries and regions. Moreover, linguistic diversity has several definitions: it may be defined based on the number of languages spoken natively in a country, thus assessing its diversity based on its relative linguistic richness. Another possible definition is based on the Greenberg Index, which assesses the frequency at which two randomly selected speakers in the same country have different native languages: the higher the probability, the higher the local linguistic diversity. [44] A third possible assessment tool is the Index of Linguistic Diversity presented by Loh and Harmon, which combines language richness and language evenness (i.e., the number of languages in a region and their distribution).[45]

2.3.3. Linguistic and biological diversity: parallel extinctions

One of the most evident features that linguistic and biological diversity have in common is that, in response to the current rapid state transition of the global social-ecological systems triggered by human actions, they are both declining at a pace that is faster than ever before in human and even Earth's history. Today, of the 6,500-10,000 existing oral languages, only 88 have more than 100 million speakers; on the other hand, about 88% of the world's languages are spoken by fewer than 1 million speakers, and 1,537 languages (21.6%) are spoken by communities of fewer than a thousand speakers – that is, are likely destined to extinction.[46]

In studies of biological and linguistic diversity, scientists and researchers have mostly concentrated on a quantitative assessment of their richness (i.e., linguistic and biological diversity are determined by the number of existing languages and species); nevertheless, this approach has overshadowed the qualitative dimension of both the biological and social domains, which are fundamentally dependent on an intricate web of qualitative interrelations. In fact,

[43] These data are available in M.P. Lewis, G.F. Simons, C.D. Fennig (eds.), Ethnologue: Languages of the World (Seventeenth edition), SIL International, Dallas, Texas, 2014, as cited in Skutnabb-Kangas and Harmon, *Biological Diversity and Language Diversity*, cit.

[44] J.H. Greenberg, 'The Measurement of Linguistic Diversity', *Language* 32, 1 (1956), 109–115.

[45] J. Loh and D. Harmon, 'A Global Index of Biocultural Diversity', *Ecological Indicators* 5, 3 (2005), 231–241; Skutnabb-Kangas and Harmon, *Biological Diversity and Language Diversity*, cit.

[46] Skutnabb-Kangas and Harmon, *Biological Diversity and Language Diversity*, cit.

> for conservation work (and in general too) species and their living conditions have to be seen not as isolated but as relational, just as mother tongue and ethnicity are not characteristics of individuals or groups, but are indexical of relations, including power relations, between them and other people.[47]

Adopting this relational perspective is also useful to explore the interlinkages between these two dimensions. As outlined above, the uneven geographical distribution of languages presents a pattern that can be largely superimposed on that of the distribution of biodiversity. Biodiversity hotspots, for instance, are often home to a high diversity of human languages, as well as diverse societal configurations and cultural practices.

These interrelations are leading to shared fates: the parallel extinction crises that are affecting biological and cultural diversity are partially caused by common economic, political, and social factors and, moreover, they might be driving each other on.[48] Many traditional and indigenous communities still directly rely on the natural environment both for their subsistence needs and for grounding their cultural and spiritual aims and values; thus, the impoverishment of the environment affects the preservation of both material and immaterial cultural manifestations, that can be collectively defined as Traditional Ecological Knowledge.[49] This traditional knowledge, which has also proved valuable from a scientific perspective, is mainly transmitted through oral language.

> When young people no longer learn the language of their forebears, or know it only partially, the special knowledge incorporated in their languages is often not transferred to the dominant language that replaces it. Commonly, this is because the dominant language does not have the vocabulary for this special knowledge, or even because the very situations in which this kind of knowledge and its relevance for survival are learned do not occur in the dominant culture whose language indigenous or minority people adopt.[50]

The gradual loss of living endemic languages and the decrease in the transmission and use of Traditional Ecological Knowledge, in turn, causes

[47] *Ivi*, 14.

[48] T. Skutnabb-Kangas, L. Maffi, D. Harmon, *Sharing A World of Difference. The Earth's Linguistic, Cultural, and Biological Diversity*, 2003.

[49] S. Zent and E. Zent, 'Processual Perspectives on Traditional Environmental Knowledge Continuity, Erosion, Transformation, Innovation', in R. Ellen, S.J. Lycett, S.E. Johns (eds.), *Understanding Cultural Transmission in Anthropology: A Critical Synthesis*, New York and Oxford, 2013; Whyte, 'On the Role of Traditional Ecological Knowledge as a Collaborative Concept,' cit.; Gómez-Baggethun, Corbera, Reyes-García, 'Traditional Ecological Knowledge and Global Environmental Change,' cit.

[50] Skutnabb-Kangas, Maffi, Harmon, *Sharing A World of Difference*, cit., 36.

cascading effects on both biodiversity conservation and the wellbeing of communities. Therefore, encouraging the transmission of this traditional body of knowledge from one generation to the next is a guarantee for the preservation of healthy social-ecological systems, as many of the traditional practices performed by local communities are inherently sustainable and essential for preserving the environment.

2.3.4. Intangible knowledge and its transmission

Tangible and intangible aspects of biocultural practices are deeply intertwined to one another. In many local communities, a vast body of ecological knowledge – information about wild plants, cultivation techniques, local flora and fauna, ecosystem functioning – is exclusively transmitted from one generation to the next through oral wisdom. In some cultural contexts, for example, a relevant part of this information is retained into linguistic structures that persist only in sung language, not in spoken discourse; consequently, in those cases knowledge preservation is 'inextricably linked' to the preservation of the associated musical genres.[51]

The same can be said of the connection between Traditional Ecological Knowledge and agricultural, hunting or harvesting practices, which help preserve and enhance the sustainability of the local environment. Here, religious and magical traditions and beliefs are the repository of a large set of environmental and biological notions accumulated over a long period of time.

> Over time, these communities have through such activities developed in-depth knowledge of local ecosystems. They have adapted to them while at the same time learning to use and manage them to fulfil their needs. These societies have also elaborated complex classification systems for the natural world, reflecting a deep understanding of local flora, fauna, ecological relations and ecosystem dynamics. [...] In many cases, indigenous and traditional knowledge has been found to be more sophisticated than Western science, and it precedes other sources of knowledge, such as scientists' findings.[52]

Losing these sung and spoken languages, religious customs, classification systems, and magical beliefs might result in the loss of insights that are fundamental to the sustainable management of the local area, leading to the subsequent erosion of ecological and cultural resilience. Moreover, this would have dramatic effects in terms of socio-economic impacts. According to a recent study, about 30% of people living in the tropical areas of the world (an

[51] Grant, 'Analogies and Links between Cultural and Biological Diversity,' cit.
[52] *Skutnabb-Kangas, Maffi, Harmon, Sharing A World of Difference*, cit., 35.

estimated 1.2 billion people) highly depend on local natural resources to meet their basic needs (e.g., water, housing, energy, occupation).[53] Reducing the traditional knowledge base that has long guaranteed the livelihood of local communities increases the risk of deep social and ecological transformations, with unpredictable consequences in terms of social and climatic security.

2.3.5. Food and culinary practices

The food and traditional meals that are consumed on a regular basis or on special occasions are of primary importance among the elements of a cultural complex that define the character of a community and its connection to the local environment. Indeed, «food and dishes do always reflect a 'vision of the world' and consequently people, ethnic groups and communities are proud of their special dishes and the plants gathered and used».[54]

Culinary use of wild plants is an outstanding example of the profound interconnection between biological and cultural diversity of a place, as the wild species chosen for collection vary from culture to culture and reflect the degree of knowledge and connection with the local ecosystems, as well as «the traditional management of natural resources and the spatial organization of the natural-cultural landscape».[55] 'Wild' plants are those that grow in a given environment without being cultivated by humans. In most cases, they are native or long-imported species growing in their natural habitat, and thus are part of the local biodiversity; moreover, many species that are now perceived as 'wild' have been in fact cultivated in the past, and then abandoned.[56]

A study conducted in the Mediterranean area, involving seven different countries which all have access to the Mediterranean sea, indicates that «even though some plants are distributed and used around the Mediterranean, some others are closely related to the traditions, environment and cultural heritage of each country».[57] In most cases, the choice is operated not only for 'biological' reasons (i.e., which edible species are available in the local area), but also following cultural preferences, which are themselves variable over time, thus

[53] Fedele *et al.*, 'Nature-Dependent People,' cit.

[54] A.CH. Hadjichambis *et al.*, 'Wild and Semi-Domesticated Food Plant Consumption in Seven Circum-Mediterranean Areas', *International Journal of Food Sciences and Nutrition* 59, 5 (2008), 409.

[55] Hadjichambis *et al.*, 'Wild and Semi-Domesticated Food Plant Consumption in Seven Circum-Mediterranean Areas,' cit., 410.

[56] L. Luczaj *et al.*, 'Wild Food Plant Use in 21st Century Europe, the Disapperance of Old Traditions and the Search for New Cuisines Involving Wild Edibles', *Acta Societatis Botanicorum Poloniae* 81, 4 (2012).

[57] Hadjichambis *et al.*, 'Wild and Semi-Domesticated Food Plant Consumption in Seven Circum-Mediterranean Areas,' cit., 387.

leading to a slow but steady evolution of the relationship between human communities and local biomes.

The practice of gathering wild food declined dramatically in the twenty-first century, particularly in industrialised countries, as living standards rose and most people no longer needed to compensate for a lack of appropriate food supply by gathering in the wild. The discontinuation of this kind of activities has resulted in the abrupt loss of knowledge regarding regional biological diversity and associated traditional cultural practices. As reported in a study by Luczaj and colleagues, the culinary use of wild species in Europe is very low today; «some rural communities in Mediterranean countries still practice the gathering of some wild vegetables, but this knowledge is becoming fragmented and the practice is restricted almost exclusively to older people».[58]

The same socioeconomic drivers (i.e., among others, the general change in lifestyle that occurred especially in industrialised countries roughly over the last 80 years, driven by urbanisation and a general increase in the quality of life) resulted in a gradual reduction in the exposure to the natural environment, coincident with the loss of direct interaction with nature.[59] Nonetheless, other factors are at play as well. For instance, in several reported cases, the abandonment of certain cultural practices concurred with changes in the availability of species at a local or regional level. However, in this case, the causal relationship is unclear: it is difficult to ascertain whether the cultural use or wild species disappeared first.

Focusing on the European context, a clear example of the bond between cultural and biological factors is provided by the Mediterranean diet, which is defined as «a set of skills, knowledge, practices and traditions ranging from the landscape to the table, including the crops, harvesting, fishing, conservation, processing, preparation and, particularly, consumption of food».[60] This social-ecological heritage includes not only biologically relevant information but also a variety of practices and skills that have long permeated the whole Mediterranean society. Through traditional activities of food cultivation and gathering, the Mediterranean diet-related lifestyle has promoted and bequeathed a set of practices that exemplify a sustainable relationship between

[58] Luczaj *et al.*, 'Wild Food Plant Use in 21 St Century Europe, the Disapperance of Old Traditions and the Search for New Cuisines Involving Wild Edibles,' cit., 362.

[59] Pyle, *The Thunder Tree. Lessons from an Urban Wildland*, cit.; Soga and Gaston, 'Extinction of Experience,' cit.

[60] P.L. Petrillo, 'Biocultural Diversity and the Mediterranean Diet', in B. Burlingame and S. Dernini (eds.), *Sustainable Diets and Biodiversity. Directions and Solutions for Policy, Research and Action*, Rome, 2012, 228.

humans, their environment, and local biodiversity. Thus, the Mediterranean diet and the related *corpus* of biocultural diversity show how biological elements are important not only in biological or nutritional terms, but also carry many other values, such as sense of place and profound social significance.[61]

2.3.6. Traditional crafts

A number of low-impact agricultural and husbandry methods as well as traditional crafts are other significant components of (bio)cultural diversity, that are closely tied to culinary traditions as well. As acknowledged by UNESCO, such traditional activities are based on a sustainable approach to the management of land and locally available resources, thus strongly contributing to shaping (via a process that has often begun in the distant past) and preserving (in the foreseeable future) the wealth of local biocultural manifestations.

Focusing on such activities is of crucial importance both for understanding the historical processes that led to the creation of complex mosaic landscapes and for appreciating the essential role they play in maintaining high levels of cultural and biological diversity within a given landscape, compared to contemporary intensive (fossil-based) agricultural and farming techniques.[62] This is especially true in industrialised, high-income societies, like European countries:

> European landscape is for the most part of cultural origin. Agricultural, forestry, and pastoral practices are inherent in it. The practices can be active or abandoned, but the type of environment they create is always shaped by cultural factors. Every culture moulds its surroundings just as the environment affects how cultures evolve. It is a bilateral feedback loop between culture and the environment.[63]

In the second half of the 20th century, the rapid process of industrialisation that spread over the rural landscapes that made up the Old World coincided with the depopulation of rural inland areas and a decline in traditional peasant occupations. As a result, the preservation of traditional cultural landscapes,

[61] For a more detailed contextualization of the Mediterranean diet as an outstanding example of biocultural diversity in industrialised countries, see *infra*, § 3.2.3.2.

[62] B. Prus, M. Uruszczak, J. Hernik, 'Arguments Based on Biocultural Diversity to Cease Abandonment of Traditional Agricultural Systems: Lessons from Poland', *Biodiversity and Conservation* 31, 10 (2022), 1–26.

[63] Prus, Uruszczak, Hernik, 'Arguments Based on Biocultural Diversity to Cease Abandonment of Traditional Agricultural Systems', cit., 2454

historically a crucial component of Europe's historical relationships between humans and environment, is seriously threatened by such processes.

Clearly, agriculture, pastoralism, and farming are not the sole activities that animate the economy of a rural society. The economic life of this type of societal organisation also incorporates a number of other activities, including manufacturing and handicraft work, which, when performed in accordance with traditional techniques, can entail a direct relationship with local biodiversity.

In a remarkable study, Nedelcheva and colleagues present the results of an extended set of interviews conducted with local inhabitants of Southeastern Europe, especially focusing on traditional handicrafts that helped establish a direct bond with the local biodiversity by using its elements as an integral part of such practices. The authors focused on plants that are used as materials for several manufactures, identifying a correlation between "abundant folk botanical knowledge" and the employment of plant parts in traditional crafts. Even though many of these skills are now vanishing and fewer and fewer members of the younger generations are interested in acquiring these kinds of crafts, many manufacturing activities are still active and relatively common in the region.[64]

Interestingly, the authors found a correlation between the plants' diffusion in the local ecological community and the frequency of their usage in traditional handicrafts:

> Most often cited are plants which are widespread in the study area, are well known to local people, and which have easily identifiable botanical characteristics […] Most of these objects are still being made and used today. This category also includes invasive species that are increasingly being used for traditional crafts as well as more contemporary articles.[65]

Such scenario provides insights about how cultural practices are tightly interlinked to biological processes (in this specific case, patterns of plant biological diversity). This survey, performed over a relatively large geographical area, suggests that there might have been a process of mutual change involving both cultural and natural elements. While a number of traditions and practices related to nature have been abandoned over time, others have evolved and changed, both in terms of their applications in daily life and

[64] A. Nedelcheva *et al.*, 'The Traditional Use of Plants for Handicrafts in Southeastern Europe', *Human Ecology* 39, 6 (2011), 813–828.

[65] *Ivi*, 826.

in terms of the natural elements employed. In the first case, the researchers report a shift from domestic uses of craft products to a modern rediscovery of their folkloric and symbolic values. As for the second case, the authors describe an increase in the importance of invasive plant species.

This example, along with many others from different regions of the world, provides evidence of the prolonged and ongoing relationship between humans and their local environment, showing that this is a two-way relation from which both parts can benefit. Furthermore, it indicates that the local natural environment influences the expressions and representations of human cultures, just as local cultural manifestations (from food to medicine, from languages to crafts) can shape the local ecological context, influencing its evolutionary path.

2.4. BIOCULTURAL DIVERSITY IN INDUSTRIALISED COUNTRIES

So far, scientific research on biocultural diversity has primarily focused on the link among indigenous cultures and biodiversity in tropical environments. As a matter of fact, the very notion of biocultural diversity was initially conceived in relation to indigenous peoples, who are known for their close connection to and stewardship of the ecosystems they inhabit.[66]

Indeed, an extensive literature search has revealed that a thorough investigation and reflection on the state of biocultural diversity is still lacking when it comes to industrialised countries, where anthropogenic processes have had profound and long-term impacts, leaving little room for the preservation of traditional ways of life and approaches to the non-human part of the living world.

Nevertheless, biocultural diversity is obviously present – albeit at lower levels than in tropical regions – also in historically industrialised countries, and traditional practices still hold a place in local cultures and identities. Moreover, there is still a connection between such rural dimension, the local environment, and the biological diversity that animates it.

Over the last two centuries, industrial countries have undergone a rapid transition from a predominantly agrarian social-ecological structure to an industrial economy; this paved the way for several socioeconomic processes with far-reaching consequences, which are still unfolding.

Beginning from the end of World War II, Western countries entered a period of overall social stability and increasing economic prosperity, which

[66] See, for example, Garnett *et al.*, 'A Spatial Overview of the Global Importance of Indigenous Lands for Conservation,' cit.

was based on an aggressive exploitive economy and on rapid technological innovation. The 'Great Acceleration' era had begun, with a strong propensity towards material and economic development, which promptly replaced the previous societal organisation, mostly agrarian and centred on subsistence rather than on marketing and selling. This also had direct consequences on the agricultural sector, where the shift from 'traditional' to 'modern' techniques was abrupt: «At the social level, those changes generated a developmentalist mindset, which focused on commercial agriculture, downplayed subsistence agriculture and undervalued traditional knowledge and practices as old and useless».[67]

In industrial countries, the loss of traditional knowledge systems was also exacerbated by other long-term processes initiated by this extensive cultural shift, such as urbanisation and the resulting gradual depopulation of inland rural areas. This, in turn, triggered a process of land abandonment and the loss of long-established social-ecological landscapes that were the outcome of a prolonged co-evolutionary trajectory between human communities and their local environments.

Nonetheless, as previously mentioned, traditional knowledge and practices related to biodiversity are still present in the eurozone (of which our selected study area is part) and, in general, in industrialised Western countries, albeit rapidly vanishing.[68] As Reyes-García and her colleagues point out,

> Barthel et al. (2010) call pockets of social-ecological memory those places that having captured, stored, and transmitted through time the knowledge and experience of managing a local ecosystem and its services, continue to maintain them alive despite drastic changes in the surrounding environments. For example, agricultural landscapes in Europe evolved through thousands of years of interactions between social and ecological systems, but changed drastically with the ubiquitous industrialization and mechanization of agriculture in the last century as well as with societal transformation more broadly. Despite this general change, some places still preserve locally evolved experiences of farming with historical continuity in management.[69]

In line with this perspective, authors focusing on different regions of the world argue that manifestations of biocultural diversity in non-traditional

[67] V. Reyes-García *et al.*, 'Resilience of Traditional Knowledge Systems: The Case of Agricultural Knowledge in Home Gardens of the Iberian Peninsula', *Global Environmental Change* 24 (2014), 224.

[68] S.E. Pilgrim *et al.*, 'Ecological Knowledge Is Lost in Wealthier Communities and Countries', *Environmental Science & Technology* 42, 4 (2008), 1004–1009.

[69] Reyes-García *et al.*, 'Resilience of Traditional Knowledge Systems,' cit., 224.

communities are just as interesting as the ones arising from communities commonly recognised as 'traditional,' suggesting that «the concept of biocultural diversity is thus not only of relevance to traditional indigenous people who remain in their traditional territories, but also to indigenous people who have experienced major upheavals»,[70] as it is the case in regions where the 'modern' fossil fuel-based way of life has become predominant. Indeed, the remoteness and isolation that characterise so-called traditional communities is not entirely representative of the condition of most human societies and, consequently, of their interactions with the local environment.[71]

While a unified framework of biocultural diversity in developed contexts is still lacking, numerous examples of biocultural diversity in industrialised countries are available in the scientific literature, helping us appreciate both the extent and diversity of traditional cultures that historically existed in the Old World, as well as their rapid decline.

2.4.1. Some European examples

The scientific literature on the connection that bounds traditional cultural heritage to the variety of life forms on a local level in industrialised countries is vast, though not exhaustive of the general phenomenon. Even within the European region, which is still poorly researched from this perspective, many local cases are described that highlight the interdependence and common fate of these – only apparently different – manifestations of life.

Alongside the previously reported case on the ethnobotanical knowledge of Southeastern Europe, there is another interesting study by Nedelcheva and colleagues, in which attention is drawn to the differences and similarities in broom-making crafts across four Southeastern European countries (Italy, Bulgaria, Macedonia, and Romania), and the links between such traditions and the climatic and ecological characteristics of the considered regions are highlighted.[72] Even the vernacular names given to the plants used for producing brooms reflect the interplay between the ecological, cultural, and geographical features of the surveyed areas. In many villages, the plants that are most commonly used as brooms are named after their traditional use:

> Local folk classifications (folk nomenclature) are the result of daily experience of people using brooms. They called them soft and hard brooms, big

[70] Cocks and Wiersum, 'Reappraising the Concept of Biocultural Diversity,' cit., 728.

[71] Cf. Cocks, 'Biocultural Diversity,' cit.

[72] A.M. Nedelcheva, Y. Dogan, P.M. Guarrera, 'Plants Traditionally Used to Make Brooms in Several European Countries', *Journal of Ethnobiology and Ethnomedicine* 3, 1 (2007), 20.

> and small brooms, depending on the type of plant they are made, their size and use. Names also are given according to their use (yard broom, home broom, threshing-floor broom, etc.).[73]

In summary, this study, although focusing on a slightly narrow manifestation of cultural diversity in an equally narrow geographical area, represents a valid example of the links between humans, their practices, and the context in which they operate:

> Collected data, no matter what the level of ethnobotanical knowledge in different parts of the study area, shows how ecological, geographical features and different cultures are related with the variety of plants traditionally used as brooms as well as details for their uses (p. 28).[74]

Similar conclusions emerge from another local study where the results of an ethnobotanical survey conducted in the Latium region, central Italy, involving the Tolfa, Cerite and Manziate areas are reported.[75] In this case, the authors performed surveys to gather qualitative data on traditional and modern uses of local plants. Among the results, they found 'new' (i.e., never reported in the literature) and traditional uses of plants, and at the same time recorded several losses of information and/or use.

Here too, the existence of a direct link between traditional agro-pastoral activities and the local biological diversity is clearly recognizable. Locally available plants – both endemic and invasive species – are (or were) widely employed for several purposes, among which the authors selected the following for investigation: medicinal, veterinary, handicraft, domestic, ritual uses, games, agro-pastoral, and anti-parasitic uses.[76] As suggested by other similar analyses, loss of knowledge about (or associated with) the local natural environment has been noted for each of these categories, and is especially apparent – although difficult to quantify – in relation to ancient crafts that are no longer practiced, or in cases where traditionally used species are no longer widespread in the local area due to rapid changes (often anthropogenic) in the ecological conditions. Counteracting this swift loss is essential both for cultural and ecological preservation, as the authors outline:

---

[73] *Ivi*, 27.

[74] *Ivi*, 28.

[75] P.M. Guarrera, V. Savo, G. Caneva, 'Traditional Uses of Plants in the Tolfa–Cerite–Manziate Area (Central Italy)', *Ethnobiology Letters* 6, 1 (2015), 119–161.

[76] *Ivi*, 121. See also P.M. Guarrera, *Usi e tradizioni della flora italiana. Medicina popolare ed etnobotanica*, 2007.

> Local knowledge (ethnobotanical or ecological) is part of the social memory of a socio-ecological system such as that of the Tolfa-Cerite-Manziate area. The preservation of this local knowledge (and social memory) is important for sustainable management of the environment and for dealing with future socio-ecological changes.[77]

Another example comes from Spain, where a sharp decline in agropastoral activities has been documented since the 20th century. In a work by Oteros-Rozas and colleagues, the authors attempted to identify some of the main causes of this decline: unsurprisingly, the findings indicate that a combination of socio-economic, cultural and ecological factors have been involved in this marked reduction of Traditional Ecological Knowledge (TEK) associated with traditional farming practices throughout the country.[78]

In particular, the Spanish researchers focused on transhumance, one of the main strategies implemented by traditional mobile pastoralists, which consists of «regular seasonal migration of livestock between summer and winter pastures, which allows adaptation to climate variability and matches grazing pressure with seasonal peaks in pasture availability».[79] This practice, albeit of great importance for tracking and adapting to the highly variable seasonal climate of the Mediterranean region, has been rapidly disappearing over the last century, thereby aligning with a global trend. According to the authors, a widespread loss of TEK poses a threat as this body of knowledge «is an essential part of the social-ecological memory of transhumance because it contains ecological and cultural information that enables practitioners to adapt to change».[80]

As for the Spanish case study, among the main factors involved in the gradual abandonment of transhumance were the loss of the Spanish monopoly on the Merino wool trade since the 19th century as well as, after World War II, the shift from foot trails to the transport of livestock by rail and then by truck. Recently, however, several economic factors have begun to push in the opposite direction, encouraging some of the remaining shepherds to resume transhumance on foot. Researchers note that it is this practice of mobile pastoralism that carries the largest part of TEK, as evidenced by the recognition of a direct causal link between elements such as «generational

[77] Guarrera, Savo, Caneva, 'Traditional Uses of Plants in the Tolfa–Cerite–Manziate Area (Central Italy),' cit., 158.

[78] E. Oteros-Rozas *et al.*, 'Traditional Ecological Knowledge among Transhumant Pastoralists in Mediterranean Spain', *Ecology and Society* 18, 3 (2013).

[79] *Ivi*, 33.

[80] *Ivi*, 34.

change, continuing to walk the drove road, full-time dedication to livestock raising, and gender»,[81] and the preservation of transhumance-related TEK, meaning that the latter is mainly maintained through continued use and the involvement of younger generations in learning the skills associated with such traditional practice.

As many other studies carried out in industrialised countries have shown, the rapid decline of nature-related traditions has had negative consequences both on human and non-human communities, eroding knowledge about the natural environment as well as the ability to adapt to rapidly changing environmental conditions. Indeed, the role of TEK within a community is not only related to preserving the history and 'social memory' of that group, but also represents a fundamental «reservoir of information, practices, and institutions to be drawn upon when a community confronts novel changes»,[82] as the ones we are witnessing today.

2.5. BIOCULTURAL DIVERSITY FROM AN EVOLUTIONARY PERSPECTIVE

The analysis of the case studies discussed above clearly shows how tight the connection between humans and non-human nature is. Indeed, this link has its roots in our species' evolutionary history, and it has profoundly shaped the evolutionary trajectory of the majority of the world's biomes through thousands of years, as demonstrated by several multidisciplinary investigations.[83] This theoretical framework emphasises the role of the long-standing interplay among humans – intended as a niche constructing and hyper-keystone species – and the different environments they inhabit. In this perspective, landscape modifications that are based on historical shifts in resource management practices «are understood as complex cultural traits coevolving together with the anthropogenic environments they produce» [84].

[81] *Ivi*, 42.

[82] *Ivi*, 44.

[83] E.C. Ellis, 'Anthropogenic Transformation of the Terrestrial Biosphere', *Philosophical Transactions of the Royal Society A* 369, 1938 (2011), 1010–1035; Ellis *et al.*, 'Used Planet,' cit.; Ellis, 'Ecology in an Anthropogenic Biosphere,' cit.; Boivin *et al.*, 'Ecological Consequences of Human Niche Construction,' cit.; Stephens *et al.*, 'Archaeological Assessment Reveals Earth's Early Transformation through Land Use,' cit.; F.M. Low, P.D. Gluckman, M.A. Hanson, 'Niche Modification, Human Cultural Evolution and the Anthropocene', *Trends in Ecology & Evolution* 34, 10 (2019), 883–885; E.C. Ellis *et al.*, 'People Have Shaped Most of Terrestrial Nature for at Least 12,000 Years', *Proceedings of the National Academy of Sciences* 118, 17 (2021); Ellis, 'Land Use and Ecological Change,' cit.

[84] Ellis, 'Land Use and Ecological Change,' cit., 3.

In this respect, there is an extensive case history of reciprocal interactions between human place-based populations and their local environments, both in the past and present. For instance, large patches of the Amazonian forest, frequently portrayed as a pristine environment, have been shown to be in fact a secondary forest, showing remnants of human cultivation practices dating back centuries before the European colonization of the Americas.[85] There are many other examples pertaining to different ecosystems, such as some Alaskan marine environments, where it has been demonstrated that native peoples, being at the top of the trophic chain, played a critical role in shaping the ecological community. Dunne and colleagues, authors of a study on the marine food webs in the western Alaskan Gulf, claim that «by treating humans as part of, not external to, ecosystems, we can better understand the historical and current context of human roles in ecological systems».[86] Most ecosystems that are today considered natural, then, are to be recognised as anthropogenic environments, or 'anthromes',[87] as archaeological and palaeoecological evidence has surprisingly revealed.

If we apply this narrative to the recent (evolutionarily speaking) history of life on Earth, we might have to admit that what differentiates the biosphere of the past – namely, the Holocene – from today's is not the abrupt expansion of human impacts on otherwise 'wild' lands and undisturbed ecosystems; rather, the multiple intertwined crises that we are witnessing today are the result of the intensification of those impacts in places that had already been shaped by human activities for millennia, albeit in a low-impact regime. As Ellis rightly remarks,

> The global history of human use of land is less a story of untouched wildlands recently destroyed, but more the deep history of a dynamic and used planet changing through processes of land use intensification and abandonment, and through the colonization, displacement, and appropriation of land from local peoples by larger-scale agricultural and industrial economies.[88]

[85] M.J. Heckenberger *et al.*, 'The Legacy of Cultural Landscapes in the Brazilian Amazon: Implications for Biodiversity', *Philosophical Transactions of the Royal Society of London. Series B* 362, 1478 (2007), 197–208; Lombardo *et al.*, 'Early Holocene Crop Cultivation and Landscape Modification in Amazonia,' cit.

[86] J.A. Dunne *et al.*, 'The Roles and Impacts of Human Hunter-Gatherers in North Pacific Marine Food Webs', *Scientific Reports* 6, 1 (2016), 6.

[87] E.C. Ellis and N. Ramankutty, 'Putting People in the Map: Anthropogenic Biomes of the World', *Frontiers in Ecology and the Environment* 6, 8 (2008), 439–447.

[88] Ellis, 'Land Use and Ecological Change,'cit., 20.

Accordingly, it is necessary to recognise that modest and steady quantitative changes – i.e., a gradual but continuous conversion of land from wildlands, to cultured anthromes, to intensive anthromes – finally produced a *qualitative* change, so that today the vast majority of the world's ecosystems should be considered anthropogenic.

This realisation has two major implications. First, recognising that the biosphere has long become human-dominated entails that it is not possible to understand natural processes without taking into account the role humans play in altering and moulding its evolutionary course. This evidence provides the basis for the Anthropocene concept in its broadest sense, which is now becoming theoretically independent from its official identification as a geological epoch (or event).[89]

Second, empirical evidence in support of the continued interaction between our own and other species, which has in many cases proved mutually beneficial, indicates that human influence on the environment is not always destructive, insofar as the final outcome of such influence is firmly dependent on how, to what extent and at what rate the anthropogenic alteration occurs.

2.5.1. Historical co-evolution

The emphasis placed here on the often-beneficial relationships between humans and other living beings does not mean disregarding the abundant evidence attesting to the detrimental outcomes that human dominance on the biosphere has produced over the past tens of thousands of years. Indeed, the profound ambivalence that marks the human species is indisputable. On the one hand, the relatively short evolutionary history of *Homo sapiens* is the result of natural events and contingencies, and the complex socio-economic systems that humans created are still today totally dependent on natural resources and ecosystem functions. Moreover, *Homo sapiens* has proven to be a crucial element for the different ecosystems it has shaped and to which it has adapted over time – in this respect, it can be defined as a 'hyper-keystone species,' as we have seen.[90] On the other hand, however, the peculiar evolutionary trajectory of *Homo sapiens*, which has become more and more reliant on cultural rather than biological drivers of change,[91] has led to the predominance

[89] Cf. *infra*, § 1.1.3.

[90] Worm and Paine, 'Humans as a Hyperkeystone Species,' cit.; A.P. Sullivan, D.W. Bird, G.H. Perry, 'Human Behaviour as a Long-Term Ecological Driver of Non-Human Evolution', *Nature Ecology & Evolution* 1, 3 (2017), 1–11.

[91] Low, Gluckman, Hanson, 'Niche Modification, Human Cultural Evolution and the Anthropocene,' cit.; A. Meneganzin, T. Pievani, S. Caserini, 'Anthropogenic Climate Change

of a single species over almost every ecosystem on Earth, probably an unprecedented event in the history of life.[92]

In the long run, cohabitation of human populations with other inhabitants (both native and introduced) of local environments has yielded mixed results, varying according to the scale taken into consideration. While on a global level human expansion has resulted in a reduction of biodiversity in the long run, both in terms of the overall number of species and the complexity of ecological communities, on a local scale human-led modification of the environment has frequently contributed to opening new ecological niches and establishing novel ecological equilibria. In several instances human populations have become, in all respects, a fundamental element of local ecosystems, so that their abrupt eradication – as it is the case in areas where, following social patterns of industrialisation and urbanisation, rapid depopulation has occurred – has been shown to result in biodiversity declines and the reduction of ecological functionality.[93] Yet, in some cases such interplay has become unbalanced. Several examples of mismanagement of environmental resources by human populations exist, which have invariably led to the disruption of the social fabric and sharp reductions in ecological functionality.

The process of industrialisation begun in the 19th century and, few decades later, the globalisation of this trend seems to be one of those cases of misallocation of the available natural resources, this time extended on a global scale in terms of the scope of both the alterations and the (largely unintended) consequences, namely the current climatic and ecological crisis. The low-impact and beneficial association that bounded together humans and non-humans has been set aside, as it does not fit into the dominant socio-economic paradigm. What has been magnified instead is a predatory approach to non-human nature, regarded as a 'sink' from where to extract resources and into which to dump waste.

Looking at the evolutionary history of our species, it appears that peaceful coexistence of *Homo sapiens* with other living beings within the biosphere is not impossible, but rather it is a path that has been already explored multiple

---

as a Monumental Niche Construction Process: Background and Philosophical Aspects', *Biology & Philosophy* 35, 4 (2020), 38.

[92] The theoretical implications of this radical ambivalence have been more extensively explored in S. Belardinelli and T. Pievani, 'The Ethics of Gaia: Geoethics From an Evolutionary Perspective,' cit.

[93] This is likely happening in the Italian Apennines, where the abandonment of historically managed agricultural lands is giving way to secondary forest encroachment, implying the loss of many rare species dependent on the previously existing social-ecological system. Cf. *infra*, § 3.2.

times by human populations during their gradual colonisation of Earth. The current maladaptive outcome of our actions is not proof of our insurmountable separateness from nature; instead, it confirms that this trajectory is historically dependent, highlighting how the destructiveness of our exploitative socio-economic model is a product of modern Western thinking and has become predominant around the world in recent times.[94]

2.5.2. Present cultural severance

In his seminal essay on *The Tragedy of the Commons*, the late biologist Garrett Hardin reasoned that «ruin is the destination to which all men rush», since in *every* human society that has ever existed, individuals pursue their own interests to the point of complete destruction of the environment which sustained each individual and the society as a whole.[95]

However, it is worth noting that this 'tragic' approach – which states that humans (all of them, no matter the spatial or historical context) have an inherently destructive attitude towards the natural systems – is more than 50 years old. Little did Garrett know that the life sciences would be able to demonstrate that different ways of 'being human' have been explored throughout the history of our species, and that many of them have developed into a respectful and mutually beneficial coexistence with non-human species.

The fact that today much of the Earth's surface bears the marks of anthropic activity is commonly interpreted as a negative fact. Yet, as research conducted in several scientific disciplines has extensively demonstrated, cultural interventions on natural systems have also had positive outcomes, sometimes even creating entirely new 'eco-cultural' environments:

> It is important at this stage to acknowledge and recognise that much communal use of ecological resources has not been benign. Indeed, many resources were overused to the point of extinction, and in others, the uses over time transformed landscapes dramatically. However, such overuse was generally a result of sheer human population pressure, and in the case of transformation, the resulting cultural landscapes were often created over centuries, and were sophisticated systems for producing sustainable outputs with minimal external subsidies. The cultural uses created the conservation landscapes we value today and many are or were species-rich and diverse systems. Furthermore, and presently neglected in many debates on conservation

[94] Cf. I.D. Rotherham, 'Cultural Severance and the End of Tradition', in I.D. Rotherham (ed.), *Cultural Severance and the Environment: The Ending of Traditional and Customary Practice on Commons and Landscapes Managed in Common*, Dordrecht, 2013, 11–30.

[95] G. Hardin, 'The Tragedy of the Commons', *Science* 162, 3859 (1968), 1243–1248.

> and the environment, a massive proportion of our most highly valued ecology and biodiversity depend for their existence on these traditional or customary uses.[96]

Conversely, several authors point to the increasing risks that abandonment of traditional land management practices pose to biodiversity conservation, ecosystem functions, and sustainability. This phenomenon is on the rise in many regions of the world and is directly related to the aforementioned widespread extinction crisis involving the diversity of human cultures and languages.[97] Processes like depopulation of rural areas and growing urbanisation are both cause and effect of the gradual detachment of people from the natural environments they historically inhabited, often co-evolving with them, as we have seen. This generates a series of positive feedbacks with both biological and cultural costs. On the biological side, there is the loss of ecosystem diversity and functionality, the reduction of local biodiversity rates, even the extinction of entire biomes; in this respect, Italy is an interesting case study, which will be discussed in more detail in the next chapter. On the cultural side, instead, the most evident effect is the increasing loss of contact with non-human nature, which is the first step in the disappearance of the majority of the varied cultural manifestations we explored in this chapter.[98]

The gradual loss of constructive human-nature interactions, especially evident in industrial countries due to the above-mentioned processes, leads to phenomena such as cognitive ignorance and emotional disaffection, that the entomologist Robert M. Pyle collectively named 'extinction of experience.'[99] This loss of continued interaction with non-human nature results not only in fewer benefits for human health and well-being, but also, as Soga and Gaston point out, in the overall reduction of the willingness to preserve natural features of the surrounding environment, ultimately leading to a vicious cycle.[100] While primarily regarding individual behaviour, this attitude is likely to spread across the community, influencing the attitude of other individuals (especially the younger population) towards the natural world and thus initiating a pathway of

[96] Rotherham, 'Cultural Severance and the End of Tradition,' cit., 17.

[97] Skutnabb-Kangas, Maffi, Harmon, *Sharing A World of Difference*, cit.; Rapport and Maffi, 'The Dual Erosion of Biological and Cultural Diversity,' cit.; Rotherham, 'Cultural Severance and the End of Tradition,' cit.

[98] Cf. infra, § 2.3.

[99] Pyle, *The Thunder Tree. Lessons from an Urban Wildland*, cit.

[100] Soga and Gaston, 'Extinction of Experience,' cit.

negative cultural inheritance.[101] The collective counterpart of the individual attitude termed 'extinction of experience' is a phenomenon known as 'cultural severance.'[102] This concept refers to «the breakdown of fundamental relations between human communities and their local environment as manifested in the landscape and its ecology as an eco-cultural resource».[103]

2.5.3. Biological and cultural dimensions: An evolutionary entanglement

Framing the debate on biocultural diversity in light of an evolutionary perspective proves useful in several respects. First, it enables us to historicise the relationship among humans and their environments, highlighting the evolutionary forces and remote causes which, over time, resulted in particular outcomes. Second, it helps disentangle the complexity of that relationship, exposing the unavoidable ambivalence inherent in human behaviours and activities.

An evolutionary perspective on how the human-nature relationship has developed provides a deeper comprehension of the long-term processes that shaped the current configuration of biological diversity on Earth, highlighting the mutual influence between natural processes and human cultures. Co-evolution, niche construction, and other ecological processes indicate the existence of the "inextricable link" that emerges when considering the concept of biocultural diversity and studying its indicators in local contexts.

The aforementioned ambivalence of our species shows that today humans can be as constructive for ecosystems as they are destructive for the biosphere. I argue that understanding such ambiguity from a more detached position – such as the one offered by an evolutionary approach – helps put in perspective the multiple crises we are experiencing today, and may thus help building a more informed ethical approach.

[101] This theme has been addressed more in-depth in S. Belardinelli and T. Pievani, 'From Biophilia to Geophilia: A Challenging but Necessary Expansion', in S. Peppoloni and G. Di Capua (eds.), *Geoethics for the Future: Facing Global Challenges*, 2024, forthcoming.

[102] I.D. Rotherham, 'The Implications of Cultural Severance in Managing Vegetation for Conservation', *Aspects of Applied Biology* 108 (2011), 95–104; Rotherham, 'Cultural Severance and the End of Tradition,' cit.; Bridgewater and Upadhaya, 'What is biocultural diversity, and why does it matter?,' cit.

[103] Rotherham, 'The Implications of Cultural Severance in Managing Vegetation for Conservation,' cit., 97.

3. BIOCULTURAL DIVERSITY IN ITALY: A CASE STUDY

[…] it is critical to remember that like biological evolution, sociocultural evolution is a process, not a destiny, and that the future remains fully open to surprise.

(Ellis, E. C. (2015). Ecology in an anthropogenic biosphere. Ecological Monographs, 85(3), 287–331, p. 321)

3.1. ITALY AS A HOTSPOT OF BIOCULTURAL DIVERSITY

In the previous chapter, I delineated the recent shift towards a revised interpretation of the concept of 'natural' environment. The long-prevailing notion of 'natural' as something entirely devoid of human influence has recently been dispelled by a growing awareness of the enduring and profound interconnections that have linked humans to their environments for millennia. Thus, authors like Erle Ellis have shown that 'pristine nature' does not really exist, considering that human activities have significantly shaped most of the Earth's ice-free land surface as we know it today.

Italy serves as an exemplary illustration of this prolonged interaction between our species and ecological contexts. Due to a variety of geographical and historical reasons, the country has been inhabited by several peoples throughout its history, each contributing to landscape modification in some way, resulting in a complex, highly stratified heritage. As outlined by Agnoletti,

> What distinguishes the complexity of the historical character of the Italian peninsula's landscape – even compared to other European landscapes that were anthropized in ancient times – is the multiplicity and stratification of the footprints left by so many distinct civilization on our countryside. We only have to think of the changes determined by land reclaiming works carried out by Greek settlers, Etruscans, Romans and Arabs. In the course of time, these same civilizations provided such an incomparably vast contribution to our agriculture, in the form of new plants species, cultivation techniques, plantation and land delimitation methods, water collection and use, and buildings and land works

> that the historical character of our landscape acquired a special value compared to that of other European countries.[1]

Over the centuries, the landscapes of Italy were shaped by the activities of predominantly agrarian societies – a type of organization which persisted for millennia, despite the succession of colonisers. This historical continuum crafted a diverse landscape mosaic composed of 'horizontal' and 'vertical' cultivations (i.e., in the plains and on hills and slopes), orchards, pastures and meadows, and woods. This trend has more or less consistently increased over time, ensuring high rates of biological diversity and, in parallel, high rates of cultural diversity. These two dimensions are, in fact, directly linked, as highlighted in the previous chapter.[2]

However, this largely traditional configuration of the Italian landscape changed abruptly starting from the mid-20th century. Demographic expansion played a pivotal role in this transformation, prompting significant rural-to-urban migration from the countryside to the burgeoning plains and from Southern to Northern regions. As a consequence, this shift led to «a gradual simplification and homogenization of the rural landscape», as noted by Agnoletti,[3] with cascading effects that impacted both biological diversity and ecological complexity.

3.1.1. A brief summary of the history of Italian landscape

The complexity and diversity of the Italian landscape stem primarily from two historical factors, each unfolding across different timescales: geological and ecological influences. First, a comprehensive understanding of the current conformation of the evolution of Italian landscapes requires consideration of the geological transformations that have occurred in this territory over millions of years. The geological evolution of Italy, from its formation resulting from the collision between the Eurasian and African plates during the Cenozoic era, has left evident imprints in its current topographic structure, characterised by two main mountain chains and a highly varied landscape. Notably, the orogeny of the Alps and Apennines is relatively recent, as it is testified by their continuing elevation.[4] These mountain chains stand as distinctive

[1] M. Agnoletti, 'Italian Historical Rural Landscapes: Dynamics, Data Analysis and Research Findings', in ed. M. Agnoletti, *Italian Historical Rural Landscapes: Cultural Values for the Environment and Rural Development*, Environmental History (Dordrecht, 2013), 7.

[2] Cf. *infra*, Chapter 2.

[3] Agnoletti, 'Italian Historical Rural Landscapes', 2013, 12.

[4] A. Bosellini, *Storia Geologica d'Italia: Gli Ultimi 200 Milioni Di Anni*, Bologna, 2005.

morphological features of the peninsula, substantially shaping its landscape diversity by moulding the morphology of the territory and altering the wind circulation, [5] thus establishing diverse climatic habitats.[6]

Throughout its history, the Italian peninsula experienced various climatic fluctuations that significantly influenced its ecological and geographic configuration. Notably, as Marchetti and colleagues emphasise, these climatic variations have substantially altered the coastal regions of the peninsula several times.[7] Over the past 2.5 million years, the coastlines underwent significant alterations due to cyclic shifts between glacial phases and sea-level variations. These profound changes have left a lasting imprint on the current morphology and distribution of ecological niches in the peninsula. In this regard, the modifications that occurred during the last 25,000 years BP (before present) were particularly significant: the melting of glaciers and the gradual establishment of a temperate climate niche played a pivotal role in shaping the peninsula's present-day landscape variety and ecological distribution.

The geographical positioning of the Italian peninsula can be considered an additional factor influencing its climatic and ecological variability. Spanning multiple latitudes and situated as a relatively narrow strip of land at the centre of the Mediterranean sea, the peninsula displays significant climatic variability from its northern to southern regions; moreover, with its high mountain chains, towering peaks – such as the Mount Blanc, the highest peak in the European continent – and approximately 7,500 kilometres of coasts, it encompasses a vast array of ecosystems. This concentration of diverse landscapes is particularly noteworthy given the country's relatively small territorial extent, as highlighted by Fredi and Lupia Palmieri:

---

[5] Fratianni and Acquaotta explain the role of the mountainous chains of Italy in shaping the peculiar climatic niches of the peninsula as follows: «The Alps and the Apennines in fact have a barrier effect: the former protect the Po Plain and the Venetian Plain from the cold northerly currents, while the latter, developing along the entire peninsula, limit the influence of the moist westerly air to the Tyrrhenian side, which is in turn protected from the cold easterly winds that hit the Adriatic side during the winter season. Winter is in fact colder on the Adriatic coast than on the Tyrrhenian coast at the same latitude» (S. Fratianni and F. Acquaotta, 'The Climate of Italy', in M. Soldati and M. Marchetti (eds.), *Landscapes and Landforms of Italy*, World Geomorphological Landscapes, Cham, 2017, 29).

[6] For a more detailed discussion of the physical and geological characteristics of the Italian territory, Fratianni and Acquaotta, 'The Climate of Italy,' cit.; P. Fredi and E. Lupia Palmieri, 'Morphological Regions of Italy', in M. Soldati and M. Marchetti (eds.), *Landscapes and Landforms of Italy*, cit., 39–74.

[7] M. Marchetti, M. Soldati, V. Vandelli, 'The Great Diversity of Italian Landscapes and Landforms: Their Origin and Human Imprint', in M. Soldati and M. Marchetti (eds.), *Landscapes and Landforms of Italy*, 7.

> The physical landscapes of Italy have a great variety of landforms, hardly found in other countries with a similar small size of about 301,000 km^2. […] Furthermore, everything is framed into a territory that is geologically young and very active, […] and with climatic conditions that change in time and in the different geographical zones. Italy, in fact, is not only one of the regions of the world characterized by the typical Mediterranean climate, […] but it is also affected by other climatic types and each of them comprehends different varieties, like, for example, the Mediterranean sub-arid climate of the southernmost areas of Sicily or the cold climate of the Alps.[8]

Such geological, topographic, and climatic variety likely contributed to the concurrent biological diversity that characterises the region today. Palaeontological records suggest that such biological richness has historically been a salient feature of this territory.[9] Scientific studies and reconstructions have shed light on the occurrence of multiple biological turnovers that took place in the Italian peninsula over time. This area also served as a refuge for biological species[10] during climatic changes across the European region.[11] Moreover, successive waves of immigration have significantly influenced the current biogeographic patterns of the country,[12] further influenced by the relative geographical isolation of species due to the physical barrier of the Alps, separating the peninsula from continental Europe. Today, due to the cumulative impact of these historical ecological processes, Italy, despite its limited geographical extent, harbours the highest levels of biodiversity in

[8] Fredi and Lupia Palmieri, 'Morphological Regions of Italy,' cit., 71.

[9] Recent research by Thomas Schmitt and colleagues has shown that there is a correlation between the biogeographic structures and the geological, orographic and environmental history of Italy: «[…] the complex and diverse geological history of Italy, including strong tectonic activity, shifting (micro)plates, the submergence of major parts of the current peninsula, the subsequent formation of numerous islands, as well as the Pleistocene climatic cycles have fostered the evolution of the highly complex biogeographic patterns observed today and an unexpected richness in biodiversity» (T. Schmitt *et al.*, 'Biogeography of Italy Revisited: Genetic Lineages Confirm Major Phylogeographic Patterns and a Pre-Pleistocene Origin of Its Biota', *Frontiers in Zoology* 18, 34 (2021), 11).

[10] On this point, Taberlet and colleagues remark: «First, Italy has many endemic lineages. Second, the southern regions [of Europe] in general, where refugia are localized, are of particular interest: they support most of the current genetic variation, and for long-term conservation the preservation of genetic diversity in these areas seems desirable» (P. Taberlet *et al.*, 'Comparative Phylogeography and Postglacial Colonization Routes in Europe', *Molecular Ecology* 7, 4 (1998), 462). Therefore, the complexity of biological diversity witnessed in Italy today may also stem from the presence of 'micro-refuges' within the classical refugia centres, as highlighted by Schmitt et al. (Schmitt *et al.*, 'Biogeography of Italy Revisited,' cit.).

[11] Taberlet *et al.*, 'Comparative Phylogeography and Postglacial Colonization Routes in Europe,' cit.

[12] Schmitt *et al.*, 'Biogeography of Italy Revisited,' cit.

Europe,[13] and is recognised as an integral component of the biodiversity hotspot of the Mediterranean Basin.[14]

Another important element to consider in order to thoroughly understand environmental changes in Italy is the enduring impact of human activities on the local landscapes. Situated as a harbour in the midst of the Mediterranean sea, Italy has historically been a crossroads for species, resulting in remarkable biological diversity and turnover. This characteristic applies not only to wild populations but also to human migrations and settlements. Indeed, archaeological evidence supports human presence in the region dating back nearly 1 million years, with the earliest hominin traces dating back approximately 850,000 years BP.

Of particular relevance to our discussion are the last few millennia of human-environmental coevolution in this territory, especially since the advent and progression of agricultural practices in Southern Europe. Numerous studies, including notable works by ecologist Erle Ellis, have highlighted that the vast majority of the Earth bears very early signs of the impact of human activities, whose imprints are far more ancient than previously thought. As already emphasised earlier, there is no such thing as 'pristine nature,' as nearly the entire Earth's ice-free land surface has been significantly moulded by our species' niche construction activities. Italy is no exception, carrying the legacy of particularly extensive and continued landscape modifications since the first evidence of human settlements. This transformation intensified in recent millennia with the establishment of agricultural practices.

[13] According to the country's profile published by the Convention of Biological Diversity (of which Italy is a member), Italy is the country with the highest faunal and floral biodiversity in Europe: «Italy is estimated to include over 58,000 faunal species, with 1,268 (2%) species of vertebrates, 1,812 (3%) species of protozoans, with the remaining 95% comprised of invertebrates. Recent studies on certain groups of insects suggest that the number of animal species, that are a part of the Italian fauna, should be increased by at least 15%, bringing the number of species reported in Italy to more than 65,000. There are over 6,700 vascular plant species, 1,156 recorded species of bryophytes, and around 20,000 known fungi species, including 2,328 taxa of lichen. Notably, at least 20 new species are published in Italy every year. The country has a high incidence of endemic species, with around 30% of animal species and 15% of vascular plants species being endemic. Sicily and Sardinia are particularly important in this respect (their indigenous flora accounts for 11% of all Italian flora, of which 15.26% are endemic)» (CBD: Italy – Main Details, https://www.cbd.int/countries/profile/?country=it). Cf. also Ministry for the Environment, Land and Sea, *Italy's Fifth National Report to the Convention on Biological Diversity (2009-2013)*, Rome, 2014; G. Domina and M. Zapparoli, 'Biodiversity in Italy', *Global Biodiversity*, 2018.

[14] J. Blondel and J. Aronson, *Biology and Wildlife of the Mediterranean Region*, Oxford University Press, Oxford, 1999; N. Myers *et al.*, 'Biodiversity Hotspots for Conservation Priorities', *Nature* 403, 6772 (2000), 853–858.

Crucially, even before the establishment of a predominantly agricultural mode of land exploitation and (even if embryonic) economic development, human activities had already modified the local environment. In this regard, Italy stands as an intriguing case in point, given the early human presence. Cevasco and Moreno emphasise that pre-agricultural environments in Italy can already be considered as 'cultural landscapes,' «shaped by productive systems in the context of Palaeolithic and Mesolithic foraging economies with a more or less continuous history».[15] Over time, agricultural and forestry practices emerged as primary drivers of land-use change, igniting the process of anthropization of the Italian landscapes:

> Except in a few limited areas in the country, the history of Italian agriculture had been one of continuous and laborious adaptation to a difficult natural environment, mostly made of mountains and high hills, originally covered with impenetrable forests and extensive marshes, to create favourable conditions for agriculture. The result was an extraordinary landscape whose value has been recognised by Western culture at least since the sixteenth century.[16]

3.1.2. Anthropization of Mediterranean and Italian landscapes

Although it is not uncommon for scientific literature to portray human interactions with the environment as diminishing the value of former 'wild' environments once 'contaminated' by human activities, an alternative paradigm exists for assessing and understanding the outcomes of such complex processes. It is true, in fact, that wherever humans settle, they profoundly redesign the landscape, often leaving indelible marks; however, it is crucial to recognise that this transformation is not inherently detrimental. The diversity observed in the Mediterranean region, as well as other biocultural diversity hotspots over the world, attest the positive effects of human-environment interactions.[17]

By analysing the outcomes of historical human-environment interactions in the Mediterranean region and in Italy, it is not our intention to assert that

[15] R. Cevasco and D. Moreno, 'Rural Landscapes: The Historical Roots of Biodiversity', in M. Agnoletti (ed.), *Italian Historical Rural Landscapes*, cit., 142.

[16] Agnoletti, 'Italian Historical Rural Landscapes,' cit., 12.

[17] R. Bliege Bird and D. Nimmo, 'Restore the Lost Ecological Functions of People', *Nature Ecology & Evolution* 2, 7 (2018), 1050–1052; Garnett *et al.*, 'A Spatial Overview of the Global Importance of Indigenous Lands for Conservation,' cit.; J. Ojeda *et al.*, 'Reciprocal Contributions between People and Nature: A Conceptual Intervention', *BioScience* 72, 10 (2022), 952–962; Sze *et al.*, 'Reduced Deforestation and Degradation in Indigenous Lands Pan-Tropically,' cit.

human impacts have been consistently positive for ecosystems. This stance would be untenable, as ample evidence documents the dramatic waves of extinction and ecological transformations brought about by processes of early and modern human colonisation of the world. However, we aim to counter the opposing viewpoint that exclusively categorises human influence as destructive, invariably resulting in ecosystem degradation, a stance that is as extreme as the one which fails to recognise the detrimental consequences of human niche constructing activities at local and regional scales. Nevertheless, human populations, with their technologies, social structures, and cultural practices, can be framed as a selective force in the local environment, eventually leading to the reduction of previously existing species complexes and favouring the emergence of new ecosystem assemblages and patterns of biological diversity.[18]

Sustained human activities have made a profound and long-lasting impact on the landscape of the Mediterranean region, comparable in influence to the effects of ecological and biological drivers of change. As the current human-induced environmental crisis demonstrates on a global scale, human activities have always exerted significant alterations on ecological and biological patterns, usually observable mainly at the local level. As articulated by French biologist Jacques Blondel,

> […] there is hardly a square meter of the Mediterranean Basin that has not been repeatedly manipulated or 'redesigned' by man over the last 300-plus generations of human occupation. […] Changes in the distribution of species and local extinction events were partly compensated for by intraspecific and interspecific adaptive differentiation in response to man-induced habitat changes.[19]

Over time, anthropogenic disturbances gradually intensified, eventually becoming the primary driver of change in Mediterranean landscapes and, indeed, across the majority of planetary ecosystems.[20] This enduring interaction with the local environment has bequeathed a distinctive legacy of what has been termed as 'socio-natural' or 'bio-cultural' landscapes, which

[18] Ellis, 'Ecology in an Anthropogenic Biosphere,' cit.; N.L. Boivin *et al.*, 'Ecological Consequences of Human Niche Construction: Examining Long-Term Anthropogenic Shaping of Global Species Distributions', *Proceedings of the National Academy of Sciences* 113, 23 (2016), 6388–6396.

[19] Blondel, 'The "Design" of Mediterranean Landscapes,' cit. 715

[20] Blondel, 'The "Design" of Mediterranean Landscapes,' cit.; Ellis, 'Anthropogenic Transformation of the Terrestrial Biosphere,' cit.; Ellis *et al.*, 'Used Planet,' cit.

make up the diversity and beauty of the Mediterranean region in general, and of Italy in particular.[21]

It is worth noting that the Mediterranean Basin, specifically the Eastern Mediterranean region known as the 'Fertile Crescent,' is recognised as the primary place of origin of domestication and early agriculture globally. While there still is uncertainty about whether agriculture had a single or multiple places of origin, it is generally acknowledged that the initial attempts at plant and animal domestication began in Southwest Asia and then expanded into the Eastern Mediterranean Basin approximately between 12,000-10,000 years BP.[22] Evidence suggests that in the subsequent millennia this new agricultural cultural complex rapidly spread westward, and several independent domestication events may have occurred in Mediterranean Europe, such as the multiple occurrences of wild boar domestication in Europe.[23] As highlighted by Zohary and coauthors, indications of early domestication quickly proliferated from Southwest Asia to Europe, central Asia, and the Mediterranean Basin.[24]

In this respect, Italy serves, once again, as an interesting example because, as previously mentioned, it has historically been a crossroads for both wildlife and human populations. This sustained flux has gradually engendered a stratification of biological and cultural heritages, jointly influencing and shaping a distinct social-ecological *milieu*. As discussed by Blondel in his works,[25] the imprint of human influence on Mediterranean ecosystems dates back at least 50,000 years, and it significantly intensified from approximately

[21] Regarding this relationship, Barbera and Cullotta argue that «[Italy] is very representative of the entire Mediterranean area's geography, environmental variability and history» (Barbera and Cullotta, 'The Traditional Mediterranean Polycultural Landscape as Cultural Heritage,' cit. 25).

[22] On this point, Colledge and coauthors have noted that, «The fragile consensus is that a complex mixture of demic expansion and cultural diffusion was responsible for the origin and spread of the Neolithic into Europe from its first appearance in southwestern Asia, although debate continues over which of these processes was dominant in different regions of the continent» (S. Colledge, J. Conolly, S. Shennan, 'Archaeobotanical Evidence for the Spread of Farming in the Eastern Mediterranean', *Current Anthropology* 45, S4 (2004), S35).

[23] As Zeder summarises, «Indigenous domestication of European boar also apparently happened several times, with two major European clades indicative of two separate domestication events, and an additional clade, currently restricted to Italy and Sardinia, representing another» (M.A. Zeder, 'Domestication and Early Agriculture in the Mediterranean Basin: Origins, Diffusion, and Impact', *Proceedings of the National Academy of Sciences* 105, 33 (2008), 11601).

[24] D. Zohary, M. Hopf, E. Weiss, *Domestication of Plants in the Old World: The Origin and Spread of Domesticated Plants in Southwest Asia, Europe, and the Mediterranean Basin*, 2012.

[25] Blondel and Aronson, *Biology and Wildlife of the Mediterranean Region*, cit.; Blondel, 'The "Design" of Mediterranean Landscapes,' cit. See also S. Mazzoleni *et al.* (eds.), *Recent Dynamics of the Mediterranean Vegetation and Landscapes*, Chichester, 2004.

10,000 years ago, coinciding with the diffusion of the 'agricultural revolution' spreading from the Middle East westward. Over time, the continuous remodelling of Italian landscapes by human populations has led to a distinctive phenomenon, characterised by the «superimposition of a series of land use practices on landscapes, traces of which are still visible today».[26]

In his seminal work on biocultural diversity in Italy,[27] landscape ecologist Mauro Agnoletti, advocate of the establishment of the first Register of Historical Rural Landscapes in Italy,[28] presents a historical overview of landscape coevolution in the country, emphasising the long-standing patterns of change witnessed in these landscapes from ancient times to the present day. One of the most salient and constant effects of human actions on Mediterranean natural habitats has been deforestation. As Blondel reports, signs of early reduction of forest ecosystems trace back to the Neolithic era, and it has been estimated that «no more than 15% of the 'potential' Mediterranean forest vegetation remains today, the rest being in more or less advanced stages of deforestation and soil degradation».[29] Ecological succession following the decline of forest ecosystems has resulted in a highly diverse 'mosaic' landscape. Indeed, a distinctive characteristic of Mediterranean and Italian panoramas is the complex mosaic pattern of cultural landscapes, comprising an alternation of agricultural patches, pastures, orchards, wooded grasslands, and semi-cultivated woodlands, among other elements. The disturbance regimes established during or shortly after the Neolithic revolution persisted with little change for centuries, and in some instances, even endured for millennia. These consistent alteration 'inputs' enabled a sustained coevolutionary process between human populations engaged in biocultural activities and the local biological and ecological diversity. This interaction resulted in the development of a distinct set of intertwined biological and cultural features, many of which have been preserved until recent times or continue to persist today. According to Barbera and Cullotta, this mosaic of natural and managed landscapes, shaped by millennia of medium disturbance regimes,[30]

[26] Blondel, 'The "Design" of Mediterranean Landscapes,' cit., 715.
[27] Agnoletti, *Italian Historical Rural Landscapes*, cit., 2013.
[28] M. Agnoletti, *Paesaggi rurali storici: per un catalogo nazionale*, Bari, 2010.
[29] Blondel and Aronson, *Biology and Wildlife of the Mediterranean Region*, cit., 716.
[30] Ecologist Erle Ellis introduced the concept of 'anthromes' (or anthropogenic biomes) as a means to refine and update the conventional ecological notion of 'biomes' by accounting for human interactions with ecosystems. This concept categorizes anthromes based on varying

> […] had a great species and interspecies diversity as a consequence of the cyclical disturbances introduced by rotational grazing, cutting and coppice regimes, fire management, as well as of cultivation and other human land use practices (Naveh 1995). Thus, these rural activities have played a major role in shaping the traditional Mediterranean landscape composition.[31]

This slow landscape evolution has resulted in a unique legacy of high biological, cultural, and historical value, which materializes in what is today called 'traditional' or 'rural landscapes.' These can be defined as follows:

> Traditional landscapes […] refer to landscapes with a long history, which evolved slowly and where it took centuries to form a characteristic structure reflecting a harmonious integration of abiotic, biotic and cultural elements. […] The process to create them was the slow development with few periods of change and long periods of consolidation.[32]

Such traditional landscapes, which represent a large part of rural landscapes in Europe, are of particular interest not only for the historical legacy they carry but also for the biocultural diversity they hold. First of all, the high spatial diversity found in these mosaic landscapes, moulded by human low-intensity management practices, is an essential condition for the preservation of high levels of biodiversity, broadly measured.[33] Thus, traditional landscapes, also known as 'historical rural landscapes,' hold significant environmental value as they contribute to preserving the integrity and functionality of ecosystems.

---

levels of population density, land use intensity, and land cover. In a seminal paper on the issue, Ellis and Ramankutty argue: «Anthropogenic biomes clearly show the inextricable intermingling of human and natural systems almost everywhere on Earth's terrestrial surface, demonstrating that interactions between these systems can no longer be avoided in any substantial way. […] Most importantly, though still at an early stage of development, anthropogenic biomes offer a framework for incorporating humans directly into global ecosystem models, a capability that is both urgently needed and as yet unavailable» (Ellis and Ramankutty, 'Putting People in the Map,' cit., 446). Cf. also Ellis, 'Land Use and Ecological Change,' cit.

[31] Barbera and Cullotta, 'The Traditional Mediterranean Polycultural Landscape as Cultural Heritage,' cit., 22.

[32] M. Antrop, 'The Concept of Traditional Landscapes as a Base for Landscape Evaluation and Planning. The Example of Flanders Region', *Landscape and Urban Planning* 38, 1–2 (1997), 109.

[33] As highlighted in the previous chapter, there are various conceptual tools for measuring biodiversity, including α-, β-, and γ-diversity. As Agnoletti and Emanueli (2016) point out, «When high species richness is kept at landscape level thanks to land cover heterogeneity, the decrease of biological diversity typical of large monocultures can be counterbalanced. This way, a disturbance-complexity interplay leads to divergent and compensatory trends followed by α-diversity at plot scale (within-patch or within each community), β-diversity at landscape level (between-patch or between-communities) and γ-diversity of the species pool hosted at regional scale» (Agnoletti and Emanueli, 'Biocultural Diversity and Landscape in Europe: Framing the Issue,' cit., 10). See also *infra*, § 2.2.1.

Additionally, the preservation of these social-ecological systems is of crucial importance in preventing the loss of the cultural practices and ecological knowledge associated with them. This significance persists even in heavily 'contaminated' regions such as Italy, which, similar to the rest of Europe, has undergone profound social, economic, and environmental transformations over the past 150-200 years.

3.1.3. Industrialisation, land use intensification, and landscape homogenisation

The recent evolution of land use patterns in Italy aligns with the global trend towards agricultural intensification and industrialization that emerged from the 19th century onwards.[34] According to Mauro Agnoletti, as outlined in the introduction of the book "*Italian Historical Rural Landscapes*," alterations in the morphology and exploitation patterns of Italian rural landscapes began accumulating at an accelerating pace during the latter half of the 19th century, particularly after the unification of the country. However, the pace of such modifications shows a dramatic acceleration following the end of World War II:

> Due to demographic growth and the expansion of agriculture into mountain areas, the rural landscape attained the peak of its development in the decades between the late nineteenth and early twentieth century. The resulting landscape was one of great complexity, enhanced by the stratification of the prints left by so many civilizations on the land, and the country's complex orography and climatic variability. In the second postwar period, however, we observe a gradual simplification and homogenization of the rural landscape […].[35]

Before the mass-scale process of industrialization took hold, Italy's rural landscape was characterised, as previously described, by considerable complexity and diversity. Such variety encompassed high rates of biodiversity and a wide array of traditional cultures and practices intricately linked to the local natural diversity. With the widespread adoption of new technologies, large-scale agricultural intensification,[36] and the shift from subsistence- to market-driven agricultural practices, the previously existing patterns were

[34] McNeill and Engelke, *The Great Acceleration*, cit.; Ellis, 'Anthropogenic Transformation of the Terrestrial Biosphere,' cit.; Ellis, *Anthropocene*, cit.; Ellis, 'Land Use and Ecological Change,' cit.

[35] Agnoletti, 'Italian Historical Rural Landscapes,' cit., 12.

[36] Ellis and Ramankutty, 'Putting People in the Map,' cit.; Ellis, 'Anthropogenic Transformation of the Terrestrial Biosphere,' cit.

disrupted. In few decades, only scattered remnants of the once complex landscape persisted, with significant implications for the preservation of both biological and cultural diversity, as highlighted by Antrop:

> […] these modern impacts became really devastating only after World War II with the economic boom that followed the general reconstruction period. These changes deform the traditional structures of the existing landscapes and thus their functioning. Consequently, only parts or remnants of the traditional landscapes can be recognised in the actual landscapes where they form isolated and disconnected elements in a large-scale uniformed space.[37]

In addition to agricultural intensification and the shift from land-use mosaic patterns to extensive monocultures, Italy has witnessed another central land-use transition in recent decades: the abandonment of land and subsequent reforestation, particularly in the inland mountainous regions of the country. Aligned with observations in other industrialised countries, here as well there has been a noticeable decline in agricultural activity, indicated by a reduction in agricultural surfaces. At the same time, however, agricultural production has increased, suggesting a major intensification of land exploitation rates. Simultaneously, urban and forested areas have expanded, reflective of the depopulation of inland areas in contrast to the rise of densely populated urban zones in the plains and along the coasts.[38]

[37] Antrop, 'The Concept of Traditional Landscapes as a Base for Landscape Evaluation and Planning. The Example of Flanders Region,' cit., 109–110.

[38] Farina, 'The Cultural Landscape as a Model for the Integration of Ecology and Economics,' cit.; Blondel, 'The "Design" of Mediterranean Landscapes,' cit.; A. Falcucci, L. Maiorano, L. Boitani, 'Changes in Land-Use/Land-Cover Patterns in Italy and Their Implications for Biodiversity Conservation', *Landscape Ecology* 22, 4 (2007), 617–631; Agnoletti, 'Italian Historical Rural Landscapes,' cit.; Agnoletti and Emanueli, 'Biocultural Diversity and Landscape in Europe: Framing the Issue,' cit.; Barbera and Cullotta, 'The Traditional Mediterranean Polycultural Landscape as Cultural Heritage,' cit.; D. Fulgione and C. Troiano, 'Clima, Abbandono Ed Evoluzione Del Paesaggio Mediterraneo', *Ambiente Rischio Comunicazione* 16 (2019), 65–69.

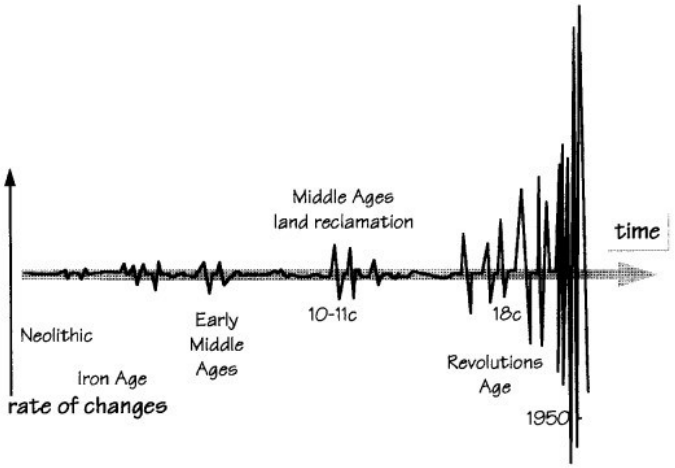

Fig. 4. Conceptual graph of the frequency and magnitude of landscape evolution in Europe.

Figure 2. Graphic reproduced from Antrop, M. (1997). The concept of traditional landscapes as a base for landscape evaluation and planning. The example of Flanders Region. Landscape and Urban Planning, 38(1–2), 109.

Furthermore, while showing distinct trends of modification in terms of spatial layout, both agricultural and forested surfaces in Italy have also undergone substantial qualitative changes in the recent past. As Agnoletti notes, «like its agricultural landscape, the wooded landscape of Italy today appears simpler and more homogeneous than in the past».[39] While the resurgence of forests might initially seem a positive development for biodiversity conservation, this perception, though commonly held, is inaccurate for at least two reasons.

Firstly, this perspective does not consider that Italian forests, like agricultural landscapes and meadows, are not 'wild' (in the sense of 'untouched by humans') but are instead the result of a long process of coevolution with human populations. Even those appearing pristine are typically secondary forests, having already undergone cycles of surface expansion and reduction as a result of past management practices.[40]

> Forestation is advancing in Italy at a rate of ca. 70,000 ha per year, including the loss due to fires, which is also indicative of the rate at which agricultural surfaces are being abandoned. The advance of woods contributes to reducing the landscape biodiversity of complex rural landscape mosaics, at such a rate that in Tuscany about 45% of biodiversity has been lost since the nineteenth

[39] Agnoletti, 'Italian Historical Rural Landscapes,' cit., 19.

[40] Falcucci, Maiorano, Boitani, 'Changes in Land-Use/Land-Cover Patterns in Italy and Their Implications for Biodiversity Conservation,' cit.; F. Malandra *et al.*, '70 Years of Land Use/Land Cover Changes in the Apennines (Italy): A Meta-Analysis', *Forests* 9, 9 (2018), 551; Mensing *et al.*, 'Historical Ecology Reveals Landscape Transformation Coincident with Cultural Development in Central Italy since the Roman Period,' cit.

> century, especially in the mountain areas. This biodiversity […] arose from a great variety of land uses that have given way to a homogenization and banalization of the landscape. It is true, although not always, that the expansion of woods can increase biodiversity as a result of the increase of the number of tree species. Concomitantly, however, there is a decrease in herbaceous species associated with meadows and pastures, and in animal species populating cultivated habitats, as well as a reduction of diversity at the landscape scale.[41]

Secondly, scientific studies consistently show that 'natural' landscapes do not always harbour more biodiversity than 'cultural' ones. On the contrary, as Almo Farina remarked, «biodiversity is often higher in cultural landscapes than in remnants of natural landscapes».[42] This observation aligns with the findings reported by Marco Marchetti and colleagues.[43] However, conservation priorities have often favoured the protection of natural landscapes, albeit fragmented and heavily degraded, neglecting the fact that cultural landscapes have actually constituted the majority of terrestrial ecosystems for at least 7,000 years, as quantitative studies have shown.[44] Studies conducted in the Apennines have consistently confirmed that the widespread reforestation occurred over the past 70-80 years, driven by both postwar reforestation programmes to counteract slope erosion and human abandonment of inland regions, has led to a widespread decline in local biodiversity due to the reduction of anthropogenic pressures.[45]

As highlighted in a meta-analysis by Queiroz and colleagues, the abandonment of rural areas and the subsequent erosion of traditional practices and cultures leads to different consequences across different regions

[41] Agnoletti, 'Italian Historical Rural Landscapes,' cit., 21.

[42] Farina, 'The Cultural Landscape as a Model for the Integration of Ecology and Economics,' cit., 315.

[43] M. Marchetti *et al.*, 'Behind Forest Cover Changes: Is Natural Regrowth Supporting Landscape Restoration? Findings from Central Italy', *Plant Biosystems - An International Journal Dealing with All Aspects of Plant Biology* 152, 3 (2018), 524–535.

[44] Cf. Ellis and Ramankutty, 'Putting People in the Map,' cit.

[45] Malandra *et al.*, '70 Years of Land Use/Land Cover Changes in the Apennines (Italy),' cit. But cf. also C. Palombo *et al*., 'Is Land Abandonment Affecting Forest Dynamics at High Elevation in Mediterranean Mountains More than Climate Change?', *Plant Biosystems - An International Journal Dealing with All Aspects of Plant Biology* 147, 1 (2013), 1–11; M. Gartzia, C.L. Alados, F. Pérez-Cabello, 'Assessment of the Effects of Biophysical and Anthropogenic Factors on Woody Plant Encroachment in Dense and Sparse Mountain Grasslands Based on Remote Sensing Data', *Progress in Physical Geography: Earth and Environment* 38, 2 (2014), 201–217; G. Vacchiano *et al.*, 'Forest Dynamics and Disturbance Regimes in the Italian Apennines', *Forest Ecology and Management* 388, (2017), 57–66.

worldwide.[46] Therefore, by focusing – as we will in the following sections of this chapter[47] – on the remnants of biocultural diversity within Europe, particularly in Italy, I do not intend to assert that, in all cases, the preservation of low-impact anthropogenic pressures is better than conserving natural landscapes and supporting rewilding or renaturalisation efforts. Rather, through an in-depth analysis of the following case studies, my goal is to exemplify alternative approaches in addressing the multifaceted issue outlined earlier.

Traces of biocultural diversity, especially those found in industrialised regions such as Europe and the Mediterranean, where landscapes have been subject to substantial restructuring processes in the last two centuries, offer valuable insights into reframing the relationship between humans and the rest of the natural world. These remaining 'pockets' of non-industrial cultures, strongly reliant on local ecosystems and, in several cases, inherently sustainable, stand as a testament to a different way of being humans – a way where 'horizontal' relationships between humans and other species have been actively explored. In addition, shedding light on traditional ecological knowledge and empowering local communities in their efforts to protect their natural heritage and resources has proven to be a successful strategy. From a strictly practical perspective, incorporating biocultural diversity as both a goal and a tool in conservation efforts has yielded positive results for the preservation of biological diversity and ecological integrity in both anthropized and protected areas.[48]

3.2. Biocultural Case Studies in Central and Southern Apennines

As a part of the Mediterranean diversity hotspot, Italy harbours a distinct richness in terms of the diversity of living forms. This characteristic is attributed to the confluence of geological, ecological, and historical factors

[46] C. Queiroz *et al.*, 'Farmland Abandonment: Threat or Opportunity for Biodiversity Conservation? A Global Review', *Frontiers in Ecology and the Environment* 12, 5 (2014), 288–296.

[47] Cf. *infra*, § 3.2.

[48] R. Mearns and A. Norton (eds.), *Social Dimensions of Climate Change. Equity and Vulnerability in a Warming World*, New Frontiers of Social Policy, Washington, DC, 2010; Garnett *et al.*, 'A Spatial Overview of the Global Importance of Indigenous Lands for Conservation,' cit.; C. Kremen and A.M. Merenlender, 'Landscapes That Work for Biodiversity and People', *Science* 362, 6412 (2018), eaau6020; B. Trewin, D. Morgan-Bulled, S. Cooper, *Australia State of the Environment 2021*, Canberra, 2021; Sze *et al.*, 'Reduced Deforestation and Degradation in Indigenous Lands Pan-Tropically,' cit.

explored earlier. Their cumulative influence on this territory has also led to a pronounced cultural stratification, which is apparent, for instance, in the variety of dialects, including several officially recognised minority languages within the Italian republic – twelve in total – still spoken in various areas of the country. This diversity also manifests in religious practices, culinary traditions, local foods and craftsmanship, healing customs and agricultural practices.

Cultural diversity is expressed in a variety of forms, which are both material and immaterial and, though not in all cases, may express strong connections to the local natural environment. In particular, Italy's varied cultural heritage associated to biodiversity includes not only the material culture of a community, such as foods, products, tools, and crafts, but also its intangible aspects. For instance, the country hosts numerous traditional festivities with stark differences observable even within relatively small geographic areas. These festivities often weave together a plurality of different traditions accumulated over time. This is the case of many Catholic holidays, which are oftentimes intertwined to ancient pagan rituals, frequently connected to agricultural cycles and elements of the natural world. Similarly, dialects encapsulate extensive knowledge about the territory and its inhabitants, encompassing not only humans but also the broader ecosystem.

Documenting these ancient traditions, which are expression of a strongly codified rural societal structure and indicate a deep, albeit not always peaceful, connection with the 'more-than-human' world, can help preserve the memory of our cultural heritage as well as the diversity of historical pathways that have shaped Italian social and ecological history over the past centuries and millennia. Furthermore, collecting and analysing such evidence offers the opportunity to reflect on the present. Indeed, the ways of life in which these practices, customs, and popular knowledge that characterised rural life are rooted were markedly distinct from the dynamics of accumulation and consumption prevalent in contemporary capitalist societies.[49] For most part of their history, these communities were based on a subsistence economy,[50] and their low-impact landscape modification activities often had positive effects on the local environment. As Agnoletti emphasised, it is not by chance that some of these traditional practices have endured to the present day:

[49] For a discussion on the ethical and socio-economic consequences of this worldview, see *infra*, § 1.1.4.2.

[50] Agnoletti, 'Italian Historical Rural Landscapes,' cit.; Barbera and Cullotta, 'The Traditional Mediterranean Polycultural Landscape as Cultural Heritage,' cit.

> The fact that in the Italian agricultural landscape some mixed cultivations still survive, in spite of the industrialization of the sector, is not an indicator of backwardness or an inability to innovate; rather, it bears witness to the set of values expressed by these practices, which have held up against attempts to replace them with technical and productive models that have not stood the test of history as well. Due to their long persistence, they play a fundamental role in landscape conservation and valorisation projects. […] It is also important to consider the environmental significance of these cultivation systems as an expression of traditional knowledge intimately connected to the local features of the areas where they occur .[51]

3.2.1. Methods

Our field studies have primarily focused on gathering direct evidence of these fading traditions, with particular attention to those that show a direct connection with elements of the natural world. This heritage holds immense value, representing a fundamental pillar of our traditional culture. Yet, parallel to the ongoing biotic crisis, it is at risk of being irretrievably lost. Moving forward, this study aims to construct a map – albeit inevitably incomplete – depicting Italy's biocultural diversity.[52]

3.2.1.1. Preliminary steps

To create an adequate experimental basis, several steps have been implemented. Firstly, I conducted a preliminary extensive review of existing literature on biocultural diversity in Italy to pinpoint areas of greatest interest to the research. Subsequently, I selected the type of social-ecological system that would be the focus of the empirical part of the investigation. The inland areas of the central-southern Apennines emerged as particularly intriguing for biocultural diversity research for various reasons, including:

(i) their recent socioeconomic history marked, on one hand, by a substantial process of depopulation, resulting in insufficient generational turnover and thereby limited cultural transmission, and on the other, by limited urbanisation, which enabled the preservation and continuity of traditional lifestyles and cultural practices;

(ii) the rich local biodiversity due, in part, to the rugged territory that facilitated the formation of numerous distinct ecological niches,

[51] Agnoletti, 'Italian Historical Rural Landscapes,' cit., 46.

[52] An initial step in progressing this long-term research project has led to the following review publication: V. Nazari et al., 'Biocultural Diversity in Italy', *Human Ecology* 51 (2023), 1263-1275.

largely isolated from each other by geographical and ecological barriers.

The final preliminary phase of the research work involved the selection of villages and communities for an in-depth exploration of their history, connection to the territory, and biocultural heritage. Each of the selected case study locations was chosen based on information sourced from the National Register of Historical Rural Landscapes, which, to our knowledge, represents the most comprehensive collection of historical rural landscapes in Italy available to date. Within the chosen region (Central and Southern Italy) and social-ecological system (inland hilly and mountainous Apennine areas), I identified five municipalities or rural areas located in four different administrative regions. Here, I conducted one or more surveys to comprehensively gather information on the biological, socio-economic, historical, and cultural aspects of the territory. The study sample comprises the following sites, many of which are registered in the National Register of Historical Rural Landscapes:

- Casette e prati di Cottanello (small households and meadows), Cottanello (Rieti province), Lazio;
- Abandoned village, Roscigno (Salerno province), Campania;
- Slopes of Mount Cervati (mixed cultivation and traditional farming), Sanza (Salerno province), Campania;
- Aliano (Matera province), Basilicata;
- Castagneti del Reventino (traditionally managed chestnut groves), San Pietro Apostolo (Catanzaro province), Calabria.

3.2.1.2. Field surveys and data collection

To gather specific information on the selected sites, I extensively relied on a wide range of existing literature, encompassing scientific and non-scientific sources, both historical and contemporary, as well as on data collected on field. Fieldwork was conducted between April 2021 and May 2022, involving surveys carried out across the selected locations. The field data collection involved two primary methods: the author's direct observations of the biological, ecological, and (bio)cultural aspects of the territory, and, where possible, interviews with local residents knowledgeable about the history and cultural heritage of the study area. It is noteworthy that most interviewees (except in one case, namely Cottanello) were born between the 1940s and 1960s. The knowledge they had access to and shared was predominantly

'second-hand', passed down either through their predecessors or dating back to their childhood memories, suggesting that a process of cultural loss was already taking place.

To attempt to perform a scientifically sound comparison between biological aspects and cultural practices – the two 'ingredients' that constitute biocultural diversity – I identified a number of proxies for measuring biocultural diversity. These are representative elements of local cultural practices essential to quantifying the cultural dimension. Specifically, I focused on linguistic (dialectal) aspects, exploring words and proverbs hinting to the presence of ecological knowledge concerning local biodiversity; culinary aspects, particularly focusing on typical products and traditional recipes, with equal attention to both cultivated and wild species for which traditional uses have been recorded; ancient crafts, many of which have already disappeared, that significantly contributed to the economy – often subsistence-based – of rural areas and small villages around which the investigation revolved.

The research approach adopted is twofold, mirroring the duality of elements we aimed to analyse – specifically, the biological and cultural elements constituting the biocultural heritage of the area. During the on-site surveys, my focus was primarily on collecting data related to the cultural dimension. For this purpose, I opted for a qualitative analysis, conducted through semi-structured interviews with local residents – mainly elderly individuals recognised as possessors of extensive knowledge of the territory and the (often endangered) traditions defining the local communities. Throughout these interviews, the aim was to highlight elements of the local culture that could best signify the connections between the community and the local ecosystem in which it is embedded. Therefore, special attention was given to aspects of the collected testimonies that could be attributed to one or more of the previously identified proxies of cultural diversity.

The interviews with members of the local populations were not the sole source of information that contributed to the research. Significant attention was also dedicated to various available manifestations of the area's material culture. This involved examining objects used in daily rural life, mostly in the past, from tools utilised in food production to those employed in agricultural and livestock activities. This exploration focused particularly on the materials used, construction techniques, and preservation of the skills to produce these items. On several occasions, I also had the opportunity to gather information from the

"museums of rural civilization" established in many of the visited villages[53] and collected bibliographic material concerning the culture, traditions, and local historical memory.

3.2.1.3. Data elaboration

Finally, I processed the collected data by signalling, for each analysed case study, the identified proxies of cultural diversity. In parallel, I created individual records – reported in the subsequent sections – for each of the surveyed villages, summarising the main information relative to each of the villages and natural areas involved. These details have then been compared to the available data concerning local biodiversity to attempt identifying a correlation (albeit not claiming a direct causal relationship) between any observed trends of variation in both domains.

Site/Proxy	Cottanello	Mount Cervati	Roscigno	Mount Reventino	Aliano
Dialects		✓	✓	✓	
Traditional foods	✓	✓		✓	✓
Crafts		✓		✓	
Agricultural practices	✓	✓	✓	✓	✓
Farming practices	✓	✓	✓		✓
Music		✓			

Table 1 Scheme of the cultural elements related to biodiversity found in the surveyed sites.

3.2.2. Cottanello

The village of Cottanello, situated in the administrative province of Rieti within the Latium region, hosts a small municipality comprising 526 inhabitants.[54] The village encompasses a historical city centre, currently housing approximately 30-50 residents, a more recently developed borough and several '*contrade*' (smaller groups of houses) located in the nearby countryside.

[53] These institutions where available, in particular, for the case studies of Roscigno, Sanza, and San Pietro Apostolo.

[54] The data were retrieved from "*Bilancio demografico mensile 2022*", released by ISTAT (https://demo.istat.it/app/?a=2022&i=D7B). Last accessed on December 17, 2023.

Of particular significance for the present research is the area known as '*Prati di Cottanello*', spanning 740 hectares within the municipality of Cottanello. This area is included in the National Register of Historical Rural Landscapes. It is a biocultural landscape characterised by the preservation of a patchwork of mixed broadleaf woods, pastures, and cultivated areas. This distinctive landscape is the result of centuries of semi-nomadic pastoralism practiced in the local area, a tradition that, albeit considerably reduced, still persists to this day.

3.2.2.1. Prati di Cottanello

Figure 3 A view of the historical town centre of Cottanello.

The most prominent remnants of the ancient pastoral activities are the small stone constructions found in the '*Prati*', which, until a few decades ago, were used as 'summer residences' for shepherds and their livestock. There are approximately fifteen housing units, referred to as '*casette*' in the local dialect. These units consist of two floors, each comprising a single room measuring about 3x5 square metres, usually equipped with a fireplace. All the fireplaces share a similar structure, not very deep, likely indicative of their multifunctional use, which probably included cheese-making, an activity still practiced today, in some cases using traditional methods. The doors are predominantly made of local wood – in fact, we mainly found specimens of

oak (particularly holm oak), along with beech, chestnut, oak, and turkey oak trees in the surrounding environment.

Constructed entirely from a local stone type, the houses have roofs covered with terracotta tiles. As reported by Monica Volpi, the municipal Councillor for Culture of Cottanello and one of the primary sources for the surveys conducted in the area, these small houses trace back to the early 19th century.

The building materials were obtained, at least in part, from the demolition of the ancient '*Rocca di Monte Calvo*', an erstwhile fortress that overlooked the plain where the houses were built. Despite its current state as a ruin, the fortress had great strategic importance, since it enabled the inhabitants of Cottanello to oversee the surrounding valleys on the border between Latium and Umbria and to guard the road that crossed the '*Prati*' area – a vital connection linking Cottanello and neighbouring villages to the city of Rieti.

Some of the houses display signs of recent renovation, suggesting that some of them are still in use. In fact, while no longer inhabited year-round, these houses serve as a practical base for the remaining pastoral activities, especially during the warmer seasons.

Figure 4 Prati and Casette of Cottanello.

3.2.2.2. Herding

In the past, herding and agriculture, alongside the red marble quarry in Cottanello, were the primary local economic activities. Almost every family owned its own livestock and cultivated land, which were primarily managed for self-sufficiency. Annually, during spring, the transhumance took place. The inhabitants journeyed from the village to the '*Prati*' and settled in the houses there, where they remained throughout the warm season until the following winter. Both men and women, along with children, actively engaged in the transhumance and participated in the farming activities. In periods where the population increased beyond the usual levels, some pastures were temporarily used for crops, the main products being wheat and hay.

As already mentioned, many of the '*casette*' are still used today as toolsheds or shelters for animals, providing support to farmers during the mountain grazing season. While various herds including cows, donkeys, goats and feral

pigs roam free in the area, they are fed by the farmers daily. The local presence of wolves in the area has been observed, and their local population is on the rise, echoing a trend seen across much of the Italian peninsula. For this reason, sheep and lambs are kept in enclosed fences, in barns adjacent to the houses, and are let out twice a day, in the morning and evening.

At present, the pastoral economy in Cottanello is in decline. Whereas farming and agriculture were once the main activities to ensure subsistence, today most of the population is employed elsewhere. In the past, nearly every '*Cottanellese*' family owned a few animals and small plots of land. However, today, only a handful of farmers own significant cattle and land.

The few farmers still engaged in local traditional activities have, to some extent, upheld traditional practices. For instance, in a fairly large area of the '*Prati*', comprising pastures of '*Prati di Sotto*' and '*Prati di Sopra*', animals are allowed to roam free. In fact, it is well established that animal grazing greatly contributes to the preservation of ancient patched landscapes. Yet, we have observed only a low grazing pressure. The pastures mainly consist of karst depressions surrounded by mixed woodland, whose foothills tend to occupy the margins of pastures. This too appears to be a recent phenomenon, as there are young shrubs and propagules of several tree species. It was probably the low-impact human presence and associated productive activities that controlled forest encroachment, along with the higher grazing pressure that was probably present in earlier times.

(a)

(b)

Figure 5 (a) The inside of an abandoned household ('casetta'), with a fireplace in the corner; (b) Lambs are kept in fences to protect them from wolves.

3.2.2.3. Typical products and local culture

Typical local foods – none of which is officially recognised the 'D.O.C.' or 'I.G.P.' labels[55] – include olive oil, honey, and cheese. Cheese, in particular, is still crafted today using traditional methods, directly on the pastures. The milk, hand-milked either in the morning or evening, is heated in a large pan known as "*callaro*" in the local dialect. Traditionally, it was cooked on the hearth, but today gas stoves are primarily used. The milk is then thickened by adding rennet, with only a few cheesemakers still using natural rennet, obtained from lambs' stomachs. This cheese is not sold but reserved for personal consumption. Some of it is eaten as fresh cheese, some as 'hard cheese', after a varying period of ageing. The locally produced meat also remains primarily for local consumption. Cottanello houses a municipal slaughterhouse, and local butchers are the ones who process the meat, selling it to the village inhabitants.

In the 1950s and 1960s, economic decline and depopulation struck the village. At that time, many '*Cottanellesi*' (local residents) migrated to cities like Turin, Rome, or Frosinone, seeking better-paying jobs in Italy's booming Fiat automobile industry. Over time, this migration led to the widespread loss of local ecological knowledge, traditional skills, and crafts, no longer practiced and hence not passed down to younger generations.

Present-day farmers, among which there is Donatella De Paola, municipal councillor, acknowledge that this heritage of practical skills and ecological knowledge has largely been lost. Even those striving to keep some traditions alive face the challenge posed by the lack of the old empirical knowledge about the local environment and biodiversity.

3.2.3. Mount Cervati and Diano Valley

Sanza, a small municipality comprising about 2000 residents, is located in the southeastern part of the Diano Valley, nestled on the foothills of Mount Cervati, within the Cilento, Diano Valley and Alburni National Park. This area holds immense natural relevance: officially designated as a protected area since 1991, the Natural Park extends from the coastal environment to Mount Cervati, the area's highest peak. It encompasses a diverse array of ecological niches and holds great biological diversity, including several endemic, endangered, and

[55] D.O.P. and I.G.P. are quality and authenticity labels, officially recognised by the European Union. They stand, respectively, for *Denominazione di Origine Controllata* (Protected Designation of Origin), and *Indicazione Geografica Protetta* (Protected Geographical Indication). Cf. https://dopigp.politicheagricole.it/. Last accessed on December 17, 2023.

threatened species. Furthermore, the site has been recognised as a 'Man and Biosphere' (MAB) reserve by UNESCO since 1998.[56] This designation underscores the considerable biocultural value of the region, which is among the earliest human-inhabited areas in the entire Italian peninsula. Evidence of human presence dates back approximately 500,000 years BP and has persisted uninterrupted to the present day.

Despite this enduring human presence, the area has not historically experienced intense human exploitation. In fact, the distinctive geo-morphological features of the region have facilitated a dynamic of low-impact anthropic alteration of the natural environment, fostering a relationship of mutual dependence between the local populations and the ecosystems. Numerous traces of this diverse biological and cultural heritage exist. Among them, for the purpose of this dissertation it is worth mentioning the Mediterranean Diet, deeply interwoven with the region's biodiversity and cultural wealth, which was inscribed on the Representative List of the Intangible Cultural Heritage of Humanity by UNESCO in 2013.[57]

Similar to various other villages in this region, Sanza has been affected by a swift and substantial depopulation wave in recent decades. Thus, like in many other areas of the Italian Apennines, numerous rural traditions and knowledge – in some cases, even the memory of their existence – have been lost.

The life of the residents of the Mount Cervati area has always been closely entwined with the mountain that presides over it. In this setting, the '*Sanzesi*' (inhabitants of Sanza) have developed their customs and traditions, forging a profound and mutual interdependence with the mountain natural environment.

> Living in a pastoral and agricultural society, our ancestors practiced subsistence agriculture, using cultivation practices that relied on manual labour, respecting nature and constantly interacting with the local environment to obtain from it the necessary goods. They grazed sheep, goats, and cattle, and farmed pigs. From these grazing and reared animals, they obtained milk and meat; from poultry, they gathered meat and eggs. In fields and gardens, they cultivated legumes, cereals, vegetables, potatoes, olives; they collected edible wild plants, abundant in our territory. From the orchards, they harvested fruits such as apples, pears, figs, grapes, nuts, chestnuts, cherries, plums, mulberries,

[56] UNESCO, World Network of Biosphere Reserves. See: Cilento and Vallo di Diano. https://www.unesco.org/en/mab/cilento-and-vallo-di-diano. Retrieved on December 17, 2023.

[57] UNESCO, 2013 Representative List of the Intangible Cultural Heritage of Humanity. See: Mediterranean Diet. https://ich.unesco.org/en/RL/mediterranean-diet-00884. Retrieved on December 17, 2023.

wild strawberries, and '*sorbe*' (*Sorbus* sp.). All these foods, products of the land, indicated the close relationship our ancestors had with nature.[58]

3.2.3.1. Agricultural and herding activities

The '*Sanzesi*' ingeniously benefitted from the natural abundance of their territory. In the past, they practiced agriculture and animal husbandry across various altitudes on Mount Cervati, adapting their activities and movements to the seasonal changes. Testimonies from elderly citizens revealed that nearly every Sanza citizen owned small plots of land, primarily to sustain their families' food requirements. These plots existed both 'in the plain,' near the city centre, and 'in the mountains,' situated farther up, a few hundred metres along the slopes of Mount Cervati.

(a) (b)

Figure 6 (a) Abandoned dry-stone terraces on the slopes of Mount Cervati; (b) a handmade collar for sheep, carved out of ashwood.

According to the memories of those who were children during that time, these higher lands were predominantly cultivated with potatoes, tomatoes, and '*chiurmano*,' a term that interviewees could not distinctly translate into Italian. From these interviews and further research, it appears to be a staple crop, possibly similar to wheat, as it is suggested by its reported usage in bread making. It was typically men who cultivated these lands, which were located in challenging-to-reach areas, and which were simultaneously cultivated while livestock grazed at higher latitudes during the warm seasons.

Sheep and goats were the most prevalent livestock, although cattle were also present. The milk from these animals was widely employed in producing a variety of fresh and aged cheeses. These traditional cheese-making practices are still somewhat active today, albeit considerably reduced, especially among

[58] R. Giordano Eboli *et al.*, *A l'Usu re Sanza*, Quaderni, Sanza, 2009, 2. My translation.

the younger generation, and continue to employ mostly traditional methods and tools.

Reportedly, agriculture persisted on the mountain slopes until approximately 50 years ago. The abandonment of this practice seems to be closely associated with increasing depopulation of the area. Evidence of the ancient agricultural activities in the mountains remains visible in numerous abandoned dry-stone constructed terraces, now slowly succumbing to the expansion of the forest vegetation cover.

In contrast, herding is still practiced today, albeit on a much smaller scale compared to the past. Unlike in other regions, several families here perpetuate traditions across generations, and younger members inherit their fathers' crafts and the associated traditions.

3.2.3.2. Culinary traditions

It is worth mentioning that the famous study by American researchers Ancel and Margaret Keys, investigating the health benefits associated with the Mediterranean Diet, was based on the culinary traditions of Pioppi and the surrounding area. This small village of fishermen, situated along the Cilento coast, was where Ancel Keys resided with his family for around forty years while conducting his research. By closely examining the dietary habits of middle- and low-class residents in Southern Italy and comparing their diets with their overall health, the two American physicians proposed a revolutionary hypothesis – now a cornerstone in modern epidemiology – that many non-communicable diseases are tightly connected to lifelong dietary patterns. In their seminal work on the subject, Keys and Keys (1975) pointed out the remarkable diversity of plants constituting the daily diet across all seasons.

(a)

(b)

Figure 7 (a) The 'ruocciolu', a tool used to stir the milk, handmade out of fig and ashwood; (b) locally produced goat-milk cheeses ('ricotta' and 'caciocavallo', respectively.

Like in many other Italian villages, culinary traditions in the '*Sanzese*' culture are rich and distinctive. These traditions are deeply entrenched in the local biological variety and are a focal element in community life, whose events and rituals it underlines.[59]

Within peasant culture, life was organised around the agricultural calendar, dictating activities to be undertaken and common festivities, and on which, of course, food depended as well. This 'natural' calendar was complemented by the liturgical calendar, including and often overlapping with common holydays (Lent, Easter, Christmas) and with community-specific festivals such as the winter feast of Sant'Antonio Abate in Sanza. The most sumptuous dishes were reserved for these religious and secular occasions, including hams, meats, roasts, cheeses, and desserts.

On ordinary days, on the contrary, a predominantly plant-based diet was prevalent, relying on typical local products. Notably, it was quite common to combine garden produce with a plethora of wild – i.e., non-cultivated – plants, often renowned for both their edibility and medicinal properties.

Wild chicory, for example, often accompanied beans or pork rinds in a tasty, high-energy one-pot meal. Fennel seeds were employed to enhance the taste of salami, while its tender leaves were used to delicately flavour vegetable soups. Asparagus, vitalba and borage, on the other hand, formed the basis for omelettes and side dishes. Unbeknownst to many, these dishes provided the body with numerous beneficial ingredients as is now widely recognised.[60]

3.2.4. Roscigno

Located at an altitude of 570 metres above sea level, within the UNESCO site of the Cilento, Diano Valley and Alburni Mountains National Park, Roscigno is a small village with a unique history directly intertwined to the geomorphological features of its surrounding territory. With a declining population of 1100 inhabitants, this village shares a similar history trajectory with other small towns in the area. Originally founded in the Middle Ages, according to the available documents, Roscigno was primarily characterised by

[59] P. Giordano Bonomo, *L'archivio della memoria*, Sanza, 1992; Giordano Eboli *et al.*, *A l'Usu re Sanza*, cit.

[60] Giordano Eboli *et al.*, *A l'Usu re Sanza*, cit.

an agricultural-pastoral economic structure throughout much of its history. In the last century, it has faced a depopulation trend that still persists today.[61]

What sets this village apart from others in the region is the legacy of forced migrations that affected its residents until very recently. In fact, the initial settlement was constructed on unstable terrain, necessitating multiple uphill migrations. The most recent relocation occurred in the first decade of the 20th century. Remarkably, however, the anticipated landslide threat that posed a danger to the community did not occur, thus sparing the old structures that still stand today.

Figure 8 A view of the central square of the old village of Roscigno.

As a result, Roscigno has now two distinct urban areas: the 'new' one, built in the last century with a modern appearance, and the 'old' one, which, despite the passage of time, has retained its original 17th-century form, thus serving as a unique testament to the past rural community life (cf. Coletta 2006).

3.2.4.1. Daily life of a rural community

Information about the rural life of this village in the past is scarce. Unlike our experience in other study areas, we encountered challenges in finding reliable literature sources or knowledgeable informants who could shed light on the daily life and the aspects of material or immaterial culture linked to the local biodiversity in order to trace a comprehensive portrait of the community's traditions and customs. Nonetheless, we had the opportunity to explore the local Museum of Rural Life (*Museo della Civiltà Contadina*), which houses an extensive collection of objects and documentation showcasing the historical

[61] V. Russo, 'Historical "Ghost" Towns: Sustainable Conservation Issues in Southern Italy', in Mileto *et al.* (eds.), *Vernacular Architecture: Towards a Sustainable Future*, London, 2015, 655–660.

activities of the community. Here, in the past, the daily life mainly revolved around primary occupations such as agriculture and herding, mirroring the practices of many other small Southern Italian towns until recent times.

During our visit, Franco Palmieri, the president of the *Pro Loco* association of Roscigno Vecchia, provided us with a guided tour of the museum's exhibits, which hint to the agricultural activities that filled the daily life of the '*Roscignoli*' (inhabitants of Roscigno) roughly until the 1950-1960s. The displayed wooden ploughs, millstones, and various items, according to Palmieri, "remained nearly unchanged for thousands of years before the advent of mechanisation." Additionally, photographs depicted the continuation of traditional ways of life in Roscigno Vecchia, persisting at least until the 1980s – an unusual circumstance likely attributable the old village's unique 'frozen-in-time' essence. The last residents of the village passed away in the early 2000s, leaving Giuseppe Spagnuolo as the sole remaining '*Roscignolo*'.

(a) (b)

Figure 9 (a) Baskets used to transport produce; (b) tools made from canes to protect fingers while harvesting.

3.2.5. Chestnut groves of Mount Reventino: San Pietro Apostolo

The Reventino Massif, nestled in the central area of the Calabria region, is a mountain range with its peak, Mount Reventino, rising to 1,417 metres above sea level. It is located on the slopes of Sila Piccola within the province of Catanzaro, forming an integral part of the Sila Massif. Hosting numerous villages, this area has been reportedly inhabited since Prehistory and has continuously witnessed human presence until today. Despite experiencing

various waves of immigration during the XVI century [62], these mountainous regions seemed to bear a relatively low population pressure during the Middle Ages and much of modern times. However, this did not hinder the exploitation of the natural resources within the area by the '*Calabresi*.' Indeed, since ancient times, the Reventino mountains served as pastureland, a timber source, and a site for the cultivation of various plants, notably chestnuts.[63]

Figure 10 View of the Reventino range from the village of San Pietro Apostolo.

The area hosts an extensive wooded area of about 1465 ha, characterised by the predominance of chestnut forests. As Barbera underlines, «the area owes its significance to the historical importance of the cultivation of chestnut tree, one of the forest species with the highest cultural importance in the Italian rural landscape».[64] For this reason, this area has been recognised as a biocultural landscape and included in the National Register of Rural Historical Landscapes.

Historical records suggest that chestnut tree cultivation in this area for both its fruits and wood traces back to the 4th century BCE, when the territory was inhabited by the Brutii people. Many centuries-old chestnut trees still stand within the Reventino's chestnut groves. Arcidiaco and colleagues (2006) point out that,

> In Calabria, chestnut groves cover a large area both as coppice and fruit trees. In the past, chestnut groves were an important part of the economy of the

[62] G. Maruca *et al.*, 'Ethnobotanical Notes about Medicinal and Useful Plants of the Reventino Massif Tradition (Calabria Region, Southern Italy)', *Genetic Resources and Crop Evolution* 66, 5 (2019), 1027–1040.

[63] G. Barbera, 'Calabria', in M. Agnoletti (ed.), *Italian Historical Rural Landscapes*, cit., 489–508.

[64] *Ivi*, 497.

> mountain population, and some of them were transformed into coppices for a combination of economic and social reasons (p. 491).[65]

As a consequence of the gradual abandonment of inland areas starting from the 1960s, numerous chestnut groves were either abandoned, transformed into coppice, or later improperly reforested with non-native species (cf. Barbera 2013; Spampinato et al. 2022). The drastic decline in human management led to a significant drop in chestnut production for several decades. Nevertheless, recent years have seen a recovery in production, partly attributed to various projects aimed at preserving both the land and local rural traditions. Presently, the total area of chestnut woods in the Reventino, Mancuso, Tiriolo and Castellazzo mountains spans 8,054 hectares, predominantly managed as coppice [66]. However, chestnut groves are still in decline, gradually giving way to mixed forests.

(a) (b)

Figure 11 (a) Local chestnuts in a typical measuring basket; (b) Handmade baskets in different shapes, sizes, and materials, each dedicated to a different use for everyday agricultural activities.

3.2.5.1. Rural traditions and local culture

In the municipality of San Pietro Apostolo, one of the settlements surrounding the rural historical landscape of the chestnut grove, a Museum of Rural Life and Craftmanship (*Museo della Civiltà Contadina e Artigiana*) has been established. This museum houses an assortment of everyday items from the past and recreates scenes depicting everyday moments of rural life. A large part of the museum is dedicated to agricultural activities, including chestnut cultivation. Similar to other selected study areas, the transmission of traditional activities and ecological knowledge across generations is declining, and such

[65] *Ivi*, 491.

[66] L. Arcidiaco *et al.*, 'Area Di Vegetazione e Campo Di Idoneità Ecologica Del Castagno in Calabria', *L'italia Forestale E Montana* (2006), 489–506.

knowledge is thus rapidly fading. One of these traditional activities was the production and processing of chestnuts, which were the basic ingredients for several typical preparations. Each of them is provided with a vernacular name in the local dialect, often denoting their shape or preparation methods. For instance, '*pastigghi*' refers to chestnuts dried for an extended period of time, sometimes followed by boiling; they were used both as pig feed, a widely used farm animal, and as a reliable year-round food source. '*Turduni*,' on the other hand, were dried chestnuts strung together to form a chain-like structure and then cooked until soft, resembling a 'necklace' in appearance.

(a)

(b)

Figure 12 (a) Reproduction of a household scene in the Museum of Rural Life in San Pietro Apostolo; (b) Chestnut Groves in the Reventino area.

The products harvested from chestnut groves, historically divided into small private plots in this region, have been a cornerstone of the local economy, and to some extent, they continue to be so. However, our local guide at the Museum expressed concern over the vanishing knowledge of the different chestnut processing techniques. This unique knowledge is disappearing along with the elders who once held it, failing to pass down to the newer generations.

This gradual loss of cultural heritage coincides with a simultaneous erosion of genetic diversity. Quantitative studies conducted in the inland hilly and mountainous areas of Calabria have demonstrated a rapid reduction in crop genetic diversity [67]. This decline suggests a potential correlation between the

[67] G. Maruca *et al.*, 'Historical and Traditional Notes on Collecting Crop Genetic Resources in Central Part of Calabria Region', *Journal of Environmental Science and Engineering B* 2 (2013), 117–126.

abandonment of traditional activities, demographic shifts, and the preservation of local agrobiodiversity.

3.2.6. Aliano

In the classical book "*Cristo si è fermato a Eboli*," writer and artist Carlo Levi recounted his two-years political exile in Aliano (known as *Gagliano* at that time), Basilicata, between 1935 and 1936.[68] Coming from a bourgeois, intellectual family in the city of Turin, Northern Italy, Levi experienced something akin to a cultural shock upon first encountering the distinctive rural culture of the Italian South. At that time, this part of Italy was profoundly underdeveloped in economic terms and still primarily relied on subsistence agriculture and farming, in a relatively inhospitable land.

Figure 13 A view of the Sauro valley from Aliano.

Aliano is a very small and remote hilltop municipality in the Sauro Valley, in Basilicata. This area presents a landscape different from the lush vegetation covers found only a few kilometres towards the coast, such as the Agri and Sele valleys. On the contrary, here the scenery is rather barren, confirming that little has changed from Levi's time, as the writer's vivid descriptions attest. In his own words , the landscape surrounding Aliano is depicted as,

> […] un seguirsi digradante di monticelli, di buche, di coni di erosione rigati dall'acqua, di grotte naturali, di piagge, fossi e collinette di argilla uniformemente bianca, come se la terra intera fosse morta, e ne fosse rimasto al sole il solo scheletro imbiancato e lavato dalle acque.[69]

[68] C. Levi, *Cristo si è fermato a Eboli*, Mondadori, Milano, 1945.

[69] «[…] a sloping succession of mounds, holes, erosion cones marked by water, natural caves, plateaus, ditches, and small hills of uniformly white clay, as if the entire earth were dead, and only its bleached skeleton remained under the sun, washed by the waters» (our translation). Levi, *Cristo si è fermato a Eboli*, cit., 69. My translation.

Immersed in a rich Mediterranean scrub, Aliano has been historically influenced by the geological and morphological characteristics of the surrounding area. Levi, in his autobiographical account, recalled how the harsh badland environment could not yield sufficient produce to meet the needs of a relatively large population. At that time, the author noted, the primary means of sustenance were wheat cultivation, although unproductive due to the infertile land, and farm animals, notably goats because of their minimal maintenance requirements. According to an archive and field research conducted by King and Killingbeck in the late 1980s, the number of agricultural workers decreased during the latter half of the 20th century, along with the general population.[70] At the same time, with reduced population pressures, there was an increase in cultivation diversity, marked by the expansion of orchards and gardens, fruit trees, olives, and various polyculture patterns. Alongside this diversification, large patches of abandoned land have slowly been covered by the typical Mediterranean scrub that thrives even on the slopes of the *calanchi*. Nonetheless, the general cultivation pattern – a mosaic of staple crops (mainly wheat) interspersed with orchards and gardens – has remained relatively unchanged since Levi's time, albeit with a shift in balance among the elements composing it.

Similar to the other surveyed villages, Aliano also suffers from depopulation, which is now reduced to slightly over 900 inhabitants, with very few young residents and almost no generational turnover.[71] Despite this challenging situation, some activities and traditional crafts still endure in the community. For instance, two or three families still specialise in sheep herding, and three butcheries personally process the meat, exclusively used for consumption within the village community.

[70] R. King and J. Killingbeck, 'Carlo Levi, the Mezzogiorno and Emigration: Fifty Years of Demographic Change at Aliano', *Geography* 74, 2 (1989), 128–143; R. King and J. Killingbeck, 'Agricultural and Land Use Change in Central Basilicata', *Land Use Policy* 7, 1 (1990), 7–26.

[71] King and Killingbeck, 'Carlo Levi, the Mezzogiorno and Emigration,' cit.

(a) (b)

Figure 14 (a) A view of the 'calanchi'*; (b) The village of Aliano.*

Compared to not-so-distant areas where economic development has permanently altered the shape of the local landscapes and ecosystem, Aliano stands out due to its unique characteristic—a seemingly unaltered 'balance' between its sparse human community and the surrounding natural environment.[72] Time seems to stand still here, preserving elements of landscape, ecological and biological diversity, as well as material and immaterial aspects of the traditional rural culture, better than elsewhere. However, albeit more slowly than other areas, this cultural heritage connected to the land is vanishing, with many implications both at the social and the environmental level, as King and Killingbeck already observed in the late 1980s:

> The eventual collapse of peasant farming *sensu strictu* will inevitably threaten other practices which, for the time being, not only form highlights of the seasonal round of peasant household life, but also afford opportunities: for interfamily social contact and therefore reinforce the meaning of community. We are referring here to events such as weekly bread-making, the annual olive harvest and the subsequent milling of the oil, and the annual ritual of slaughtering the family pig in early spring.[73]

[72] According to King and Killingbeck, «The real problems of southern Italy, in terms of rural development and land use planning, lie in these uplands where hundreds of thousands of people live huddled in remote, hill-perched villages, attempting to wrest a living from an unyielding and hazard-ridden physical environment» (King and Killingbeck, 'Agricultural and Land Use Change in Central Basilicata,' cit., 7).

[73] *Ivi*, 18.

3.3. RESULTS

As anticipated in previous sections of this chapter,[74] the fieldwork presented here yielded the expected results, aligning with evidence sourced from the available literature on biocultural diversity in Europe.[75]

It is noteworthy that the traditional knowledge and practices associated with the rural way of life prevalent in Italy, particularly in its inland hilly and mountainous regions, throughout much of its history, are still preserved and practiced to a certain extent, albeit in seemingly nearly 'unconscious' forms. In fact, there appears to be little active reflection within the communities regarding the rapid decline of these practices and the evident disparity with alternative 'modern' lifestyle that have already spread within these communities.[76]

Moreover, despite the geographical, ecological and historical peculiarities of each selected study area, we found consistent features and trends in both the natural and cultural domains across all the surveyed municipalities and landscapes. Concerning the natural dimension, on-site observations confirmed the impact of rural depopulation and land abandonment on the natural environment. This impact is particularly noticeable in regions continuously exposed to human low-intensity disturbances for millennia, as exemplified by the case of Italy. This environmental change is testified by the expansion of shrublands and forests along the central and southern Apennines and the parallel trend of rapid homogenisation of the landscape (reduction of β- and γ-diversity), transitioning from a landscape with a high rate of patch diversity (mosaic landscape) to a more homogenous forest cover.[77]

> The effects of abandonment on biodiversity vary. Direct, positive effects are more likely to occur when intensively managed and biodiversity-poor croplands

[74] Cf. *infra*, § 3.1.3.

[75] Cf. Agnoletti and Emanueli, *Biocultural Diversity in Europe*, cit.

[76] Fischer and colleagues clearly explain this point by arguing that, «Urbanization and increasing integration into global markets furthermore mean that people are less reliant on local ecosystem services, because locally oriented agriculture is being replaced by a culture where goods are purchased in shops. Globalization thus breaks apart the historical links between the social and ecological subsystems in traditional farming landscapes» (J. Fischer, T. Hartel, T. Kuemmerle, 'Conservation Policy in Traditional Farming Landscapes', *Conservation Letters* 5, 3 (2012), 168).

[77] Vacchiano *et al.*, 'Forest Dynamics and Disturbance Regimes in the Italian Apennines,' cit.; Malandra *et al.*, '70 Years of Land Use/Land Cover Changes in the Apennines (Italy) ,' cit.; Marchetti *et al.*, 'Behind Forest Cover Changes,' cit.; A. Ferrara *et al.*, 'Land-Use Modifications and Ecological Implications over the Past 160 Years in the Central Apennine Mountains', *Landscape Research* 46, 7 (2021), 932–944.

> are abandoned. Abandonment benefits forest and mixed- or closed-habitat birds and invertebrates. Coupled rural depopulation and abandonment can lead to passive rewilding, particularly for large herbivores and carnivores. [...] Negative or mixed effects of abandonment on biodiversity prevail in cultural landscapes and close-knit socioecological systems that are characterized by low-intensity, often subsistence farming. The long coevolutionary history of these landscapes and their people, found in, for example, Eastern Europe, Japan, and parts of the tropics, has created high habitat heterogeneity that can disappear after abandonment and lead to the loss of locally rare species and to biodiversity homogenization.[78]

In all case studies, I consistently witnessed the almost complete erosion of mechanisms for intergenerational transmission of Traditional Ecological Knowledge. This decline can be attributed, among other factors, to the lack of interest, and in several cases, physical absence of younger generations. As correctly summarised by Kelly and coauthors, the stopping of this information flow has several implications involving the local social-ecological system:

> This leads to 'greying' of communities which changes social dynamics, interrupts intergenerational communication, and disrupts social memory through the loss of knowledge and experience accumulated over several generations. Once social memory is lost, it can no longer be drawn upon to tackle land degradation.[79]

As noted before, the last custodians of traditional (ecological) knowledge were often born between the 1940s and 1960s, and typically possess secondary information, as the process of erosion had already started by the time they were born. Indeed, with the onset of mechanisation and due to ongoing emigration and land abandonment, several traditional agricultural or farming activities were gradually disused, resulting in the loss of daily contact with natural elements and the slow disappearance of associated knowledge from social memory. The same fate has been reserved for numerous empirical notions about the local environment rooted in folk wisdom, pertaining to seasonal changes and the ecological relationships between the various components of ecosystems. Notably, however, despite lacking formal support or validation by scientific studies and solely relying on the experience accumulated over

[78] G.N. Daskalova and J. Kamp, 'Abandoning Land Transforms Biodiversity', *Science* 380, 6645 (2023), 582.

[79] C. Kelly *et al.*, 'Community Resilience and Land Degradation in Forest and Shrubland Socio-Ecological Systems: Evidence from Gorgoglione, Basilicata, Italy', *Land Use Policy* 46 (2015), 13.

generations, this folk knowledge is not only compatible but also comparable to findings from modern scientific studies. This underscores the significance of this traditional knowledge for a comprehensive understanding of the local biological and ecological diversity. The extinction of this Traditional Ecological Knowledge poses a risk of losing invaluable insights into local biology and ecology, particularly crucial for conservation efforts in light of the current environmental crisis.

As previously stated, our intention is to avoid taking an ideological stance either for or against human presence in natural or seminatural environments. Issues like the coexistence of humans and nonhumans, coupled with biodiversity conservation, present intricate challenges. Often, debates around these topics are driven more by ideological positions than by scientific evidence. As highlighted by Daskalova and Kamp, it is important to acknowledge that human abandonment can lead to both negative and positive implications for local seminatural ecosystems, representing "both a threat and an opportunity" for ongoing and future conservation efforts.[80]

It is also essential to acknowledge that there remains a significant gap in comprehensive studies examining the collective effects of land abandonment on biodiversity at regional and global scales. Therefore, further investigation is necessary to understand the impacts of biocultural diversity loss alongside changing demographic trends, such as rural-to-urban migration and abandonment of inland areas. Valuing traditional rural cultures as stewards of complex socioecological systems may represent a successful strategy in «designing landscapes that improve both human quality of life and biodiversity conservation».[81] This approach may suggest a conservation strategy that extends beyond merely salvaging so-called 'Nature's Contributions to People,' such as ecosystem services or agrobiodiversity, but also emphasises the importance of preserving and enhancing 'People's Contributions to Nature.' This notion refers to the ways in which our species can positively impact the local natural environment and its inhabitants.

A new consideration of the interactions between humans and their ecosystems may prove beneficial on both a practical and theoretical level. It has the potential to support conservation practices, bolster the resilience of

[80] Daskalova and Kamp, 'Abandoning Land Transforms Biodiversity,' cit.
[81] *Ivi*, 583.

communities, and foster a reimagined way of seeing ourselves in the world at the same time.

4. A MOULDED PLANET: MANY WAYS OF BEING HUMAN

I envision a time when the intellectual monoculture of science will be replaced with a polyculture of complementary knowledges. And so all may be fed.
(Robin Wall Kimmerer (2013) *Braiding Sweetgrass*. Minneapolis: Milkweed Editions, p. 139)

4.1. CO-BELONGING

As emphasised throughout the pages of this dissertation, the reason behind this research is a profound sense of urgency and what might be termed as 'generational fear' in response to the interconnected climatic and ecological crises defining our time.

These crises are poised to significantly impact not just my generation, but also those that will follow. I firmly contend, as repeated throughout this work,[1] that these intertwined crises originate from a fundamental theoretical fallacy before being the result of technical, social, or economic issues. Hence, calling into question and identifying viable alternatives to the predominant mindset toward the natural world is an initial step for devising technical and practical solutions to the 'triple planetary crisis.' Therefore, my interest in environmental ethics transcends mere theoretical concern; rather, it is grounded in the pressing need for practical solutions to navigate the current circumstances.

For this reason, through the lens of biocultural diversity, I have attempted to demonstrate that the current theoretical underpinnings of the dominant socioeconomic structure are not static and unchangeable, nor are they inherent to human nature. Instead, I aimed to illustrate that alternatives exist, and one need not look solely at the distant past or indigenous cultures to track them down. Instead, the basis for deploying an alternative worldview can be found in our own recent past. While these instances of a different worldview have largely been overshadowed by the current globalised development model, characterised by strong anthropocentrism and a utilitarian perception of

[1] Cf. *infra*, § 1.1.

nonhuman nature, remnants of these alternative perspectives still linger even in the complex social framework of industrial societies.

The liaison between philosophical and scientific reasoning in the modern era resulted in the crystallization of a hierarchical relationship between humans and nonhumans in terms of ontological value, positioning humans at the apex and relegating other entities to varying levels below this self-proclaimed pinnacle. Consequently, this hierarchy has enabled and justified the relentless exploitation of not only the nonhuman world but also of other humans. Indeed, Western culture, by attributing inherent value solely to its own members, has implicitly disregarded the ontological value not just of other species or ecological collectives but also of any other human group.[2] The most evident outcome of such exploitation is the widespread disruption of the biosphere's dynamic equilibria on a global scale.

The remedy to the imminent future looming on the horizon, I believe, can only be distilled by recognising and challenging the shortcomings that this extractivist, anthropocentric mindset holds. One such flaw lies in the idea that the natural world is either something to be protected or overly exploited, a viewpoint that reveals a perception of nature as the *other*, an external entity merely subjected to our actions and valuations. Humans, despite performing as the directors and main actors in this film, exclude themselves from the overall picture, failing to acknowledge their integral connection to the natural world they supposedly ought to preserve or exploit.

Throughout history, each era has tackled the issue of defining humanity's place in the world in a unique way; consequently, also the current period, which is markedly different from anything in the past, demands a specific response.

Perhaps for the first time in human history, our ability to foresee the future based on past knowledge is uncertain. Legal scholar Michele Carducci underscores this radical uncertainty, highlighting the possibility of a future 'non-analogous' to the past.[3] This term encapsulates the unpredictability caused by the epochal changes that have disrupted the long-standing foreseeable variability that had characterised the Earth's systems for nearly all human history and played a pivotal role in shaping the evolutionary trajectory of societies from the Agricultural Revolution to the present day.

[2] Cf. *infra*, § 1.1.2.

[3] M. Carducci, 'Cambiamento Climatico (Diritto Costituzionale)', in R. Sacco *et al.* (eds.), *Digesto Delle Discipline Pubblicistiche*, UTET, Milano, 2021.

Solutions forged in the past may be unsuitable for preparing for an unforeseeable future. Therefore, new solutions and, most importantly, novel theoretical and ethical foundations to underpin these solutions are required. Various tools can be employed to achieve this objective, as outlined in previous chapters. Among these, a scientifically informed philosophical reflection is undoubtedly valuable in accurately framing the key elements of this discourse, namely the human and nonhuman realms, and discerning their similarities, differences, and relationship.

Scientific knowledge, especially that gathered from life sciences, is useful in providing a contextual framework for understanding the long-standing relationship between humans and the natural environment. Evolutionary biology clearly displays this connection, highlighting the inherent ambivalence of the human species, whose evolutionary trajectory has exposed its potential to either disrupt ecosystems and biodiversity or play an essential role in their thriving and preservation. Notably, delving into the deep time of evolution helps unveil that, since their emergence, behaviourally modern humans have moulded the planet through an ongoing process of niche construction that had eventually reached a global scale far before the Industrial Revolution and then the Great Acceleration started. Therefore, the notion of humans as separate from the rest of the natural world contradicts abundant scientific evidence that underscores their close and mutual connections. The natural world has set the constraints to and enabled the evolution of our species and the richness of our cultures; simultaneously, through extensive niche construction activities, humans have profoundly shaped and modified ecosystems worldwide, thereby transforming the Earth into a 'moulded planet.'

4.2. Above and Beyond: Overcoming Dualism in Environmental Ethics

4.2.1. An ecological planet: relations in nature

In the field of ecological sciences, an ecosystem is defined as «[…] an integrated system composed of a biotic community, its abiotic environment, and their *dynamic interactions*».[4] The study of the evolution of life on this planet has highlighted how the continued interactions between organisms and their environments has been fundamental in shaping life as we know it today.

[4] A.K. Salomon, 'Ecosystems', in S.E. Jørgensen and B.D. Fath (eds.), *Encyclopedia of Ecology*, Oxford, 2008, 1155. Emphasis added.

Remarkably, living beings have not just adapted to Earth's physical and chemical conditions; they have actively contributed to shaping our planet, from atmospheric composition to the generation of fossil fuel reserves. Across nearly four billion years, the Earth and its life forms have co-evolved in a mutually transformative relationship.

Similar to this 'ecological turn' in the life sciences, which highlights the paramount importance of relationships among living beings, as well as between them and the surrounding abiotic environment, there has been a growing interest in the notion of relationships even within philosophical studies, in some cases with the aim to overcome the traditional Western dualism between humans and nonhumans, as well as between culture and nature.

As we have seen, the classical dichotomic approach falls short of comprehensively capturing the centrality of relations to understand how the natural world functions. On the contrary, the idea of relationship offers a more productive approach to understanding that the world is not segregated into separate compartments of 'natural' and 'human,' but instead comprises an ever-evolving flow of natural-cultural interconnections. Indeed, as observed by Muraca, all of us exist within an interconnected continuum of changes since our inception as living entities. These interconnections form the bedrock of the natural world and, as indicated by evolutionary and developmental biology, play a vital role in shaping both individual development (ontogeny) and the broader history of life (phylogeny).

The philosophical approach that mirrors this account of ecological science and condenses this 'ecological awareness' is a specific ontological outlook known as 'relational ontology,' associated with the broader school of thought known as 'process ontology.' As elucidated by Mancilla García and colleagues,[5]

> A process-relational perspective focuses attention on processes, as opposed to objects, as the primary constituents of reality. Processes can be understood as patterns and their properties and functions are defined by the set of relations that constitute them. These relations span over different realms, such as the social

[5] But see also M. Mancilla García *et al.*, 'Adopting Process-Relational Perspectives To Tackle The Challenges of Social-Ecological Systems Research', SSRN Scholarly Paper, Rochester, NY, 2020; Walsh, Böhme, Wamsler, 'Towards a Relational Paradigm in Sustainability Research, Practice, and Education,' cit.

> and the ecological, which is why a process-relational perspective is particularly useful for reflecting on the ontology of social-ecological systems.[6]

Related to this philosophical approach is the so-called 'relational turn' in sociology, rooted in the strong antecedent of A.N. Whitehead's philosophy,[7] also recalled by Muraca in her proposal of a relational value approach for environmental ethics.[8] This Whiteheadian perspective, referred to by Muraca as 'radical relationalism,'[9] views subjects and objects – i.e., the entities engaging in relationships – as 'becomings' rather than 'beings.' This applies not only to humans, which are, of course, the primary actors of ecological relationships in today's social-ecological biosphere, but also to other components of our 'humanly moulded' planet.

> From relational perspectives, the enduring objects that we generally perceive as substances or entities – bodies, trees, rocks – are reconceived as temporary convergences, stabilizations or 'events' within flows of dynamic relationships that already encompass what we tend to think of as 'human' and 'natural' aspects.[10]

4.2.2. Two levels of ethical discourse in a relational view of the natural world

In an insightful essay published in 2011, philosopher Barbara Muraca advocated in favour of transcending what I referred to as 'ontological' and 'ethical anthropocentrism,'[11] which entails the opposition between subject and object, as well as between intrinsic and instrumental values. Muraca proposed a relational approach as 'conceptual key' to overcome this "atomistic ontology and atomistic logic."

---

[6] M. Mancilla Garcia, T. Hertz, M. Schlüter, 'Towards a Process Epistemology for the Analysis of Social-Ecological System', *Environmental Values* 29, 2 (2020), 29.

[7] C.R. Mesle, *Process-Relational Philosophy: An Introduction to Alfred North Whitehead*, Templeton Foundation Press, 2008; E. Kohn, 'Anthropology of Ontologies', *Annual Review of Anthropology* 44, 1 (2015), 311–327; M. Arias-Maldonado, *Environment and Society: Socionatural Relations in the Anthropocene*, SpringerBriefs in Political Science, Cham, 2015; I. Darnhofer *et al.*, 'The Resilience of Family Farms: Towards a Relational Approach', *Journal of Rural Studies* 44 (2016), 111–122; Saxena *et al.*, 'From Moral Ecology to Diverse Ontologies,' cit.; Mancilla García, Hertz, Schlüter, 'Towards a Process Epistemology for the Analysis of Social-Ecological System,' cit.; Mancilla García *et al.*, 'Adopting Process-Relational Perspectives To Tackle The Challenges of Social-Ecological Systems Research,' cit.

[8] Muraca, 'The Map of Moral Significance,' cit.; B. Muraca, 'Relational Values: A Whiteheadian Alternative for Environmental Philosophy and Global Environmental Justice', *Balkan Journal of Philosophy* 8, 1 (2016), 19–38.

[9] Muraca, 'Relational Values,' cit., 19.

[10] West *et al.*, 'A Relational Turn for Sustainability Science? ,' cit., 305.

[11] Cf. *infra*, § 1.1.2.

> Most non-western and many western worldviews intuitively reject the attribution of sheer instrumentality to several natural beings and processes, to spiritually relevant places, and to aesthetic experiences. If left with no third option beside intrinsic or instrumental values we might understandably want to subsume all entities which we consider more than mere means to the ends of individual (human) subjects under the category of inherent moral value. Yet, by doing this we implicitly accept such a dichotomy and still leave the field outside the moral community to a mere instrumental consideration. Against this, I argue for a greater variety of axiological categories that take into account different moral intuitions about the relations between humans and the non-human world.[12]

In the quest for an alternative to the dichotomy of anthropocentric versus bio- or ecocentric theories of environmental ethics, a relational approach has proven valuable in that it emphasises the dimension in which entities establish relations rather than solely focusing on the entities themselves (whether subjects or objects).

Indeed, as highlighted by Muraca, following Rolston,[13] every living entity comes into existence as an integral part of a relationship, and there exists no moment when an individual entity is detached from the intricate web of interactions of which the world is made, in a literal sense. Therefore, the relevance of relationships should be acknowledged both on an ethical (i.e., relational *values*, as we will see shortly) and a theoretical or ontological level, because it is relationships that constitute the natural world and enable its functioning across all scales.

In my view, in addressing the global challenges posed by the ongoing planetary crises, two separate levels of environmental ethics discourse need to be considered. The first revolves around the criteria employed to value different entities such as humans, living beings, and ecosystems. In this regard, it is impossible to neglect the fact that scientific evidence has conclusively demonstrated the fallacy of any alleged ontological and ecological separation between humans (the most prominent niche constructors of Earth) and the broader natural world, rendering the classical Western anthropocentric perspective untenable.

---

[12] Muraca, 'The Map of Moral Significance,' cit., 378.

[13] Muraca, 'The Map of Moral Significance,' cit.; H. Rolston III, 'Value in Nature and the Nature of Value', in R. Attfield and R. Belsey (eds.), *Philosophy and the Natural Environment*, Cambridge, 1994, 13–30.

The second level of discourse involves more practical considerations, particularly regarding how we ought to act and what principles should guide our behaviour in an era marked by rapid and potentially unprecedented transformations – in other words, a 'non-analogous future.' I believe that, within this more 'practical' level of discourse, it might still be acceptable to retain a minimal degree of anthropocentrism (referred to by Thompson as 'conceptual anthropocentrism'[14]), since it is impossible for a human subject to see the world other than from a human-centred standpoint, thus establishing a hierarchy of priorities for ethical consideration of human and nonhuman entities. However, this concession does not absolve humans from the responsibility of acknowledging the equal value and 'right to integrity' of every other-than-human member of the natural community. This acknowledgement emphasises that humans do not have the right to destroy, but instead bear the duty to protect the natural world and its nonhuman inhabitants.

Returning to the first level of ethical discourse, the theoretical one – one of the most useful effects of adopting a relational approach is the possibility of overcoming the debate around anthropocentrism, biocentrism, ecocentrism, and related concepts. All these notions, regardless of the philosophical school of thought, propose a singular 'centre' of ethical consideration – be it the '*anthropos*,' sentient beings, all living beings, or even collective entities, such as ecosystems. However, all these approaches fall short in acknowledging the inherent interconnections that exist among these diverse entities (whether material or abstract, i.e., individual specimens, biodiversity, or ecosystems).

Contrary to viewing the Earth as a sum of separate entities, considering it as a network of connections renders the distinction between various 'centres' of ethical consideration scientifically and philosophically obsolete. Humans, other living beings, and ecosystems cannot be understood in isolation, as autonomous entities, because they are all shaped by their interactions with one another. These interdependencies occur across various levels and are fundamental conditions of existence for life on Earth. Consequently, deflecting the attention of ethical inquiry from natural entities themselves to the relationships they partake in allows for an easier deconstruction of the notion of human separateness. This reorientation puts focus on the bidirectional connection and interdependence that binds humanity to the broader spectrum of the living world.

[14] Thompson, 'Anthropocentrism. Humanity as Peril and Promise,' cit. See *infra*, § 1.1.2.

Moreover, recognising primacy in the connections between entities rather than solely in the entities involved in the relationship represents a substantial departure from the prevailing framework in modern Western culture outlined earlier. While accepting that a relational approach might encompass, within its diversity, also anthropocentric stances, its strength lies precisely in its capacity to go beyond all types of '*-centrisms*' by prioritising the value of relationships over the subjects/objects involved in these relationships.[15] Therefore, an environmental ethics account based on the notion of relationship might be described as 'non-centric.'

Such relational approach is far from a novel concept. As briefly outlined earlier, it has some notable precursors in philosophical thinking and strong scientific validation in ecological science. Furthermore, it is the norm in numerous cultures worldwide and persists, albeit in limited 'pockets,' even within Western societies. As highlighted by Chan (2016), individuals from diverse social and cultural backgrounds report a sense of connectedness, stewardship, even belonging towards the environment and natural diversity, suggesting that the notion of being 'different' or 'separate' from nature is not an inherent feature of our species but rather the (by)product of a specific cultural background. However, despite recognising the relativity and one-sidedness of the human-centred perspective, it remains crucial to acknowledge that the current extent and pace of planetary ecosystem alterations due to the activities of a singular species is likely an unprecedented occurrence in the history of life. This situation creates a fundamental imbalance in the human-nonhuman relationship, a disequilibrium that strongly calls for being accountable (for past actions) and taking responsibility (for the future).

As rightly asserted by Peppoloni and Di Capua, the first proponents of 'geoethics,'[16] «The anthroposphere has now come to coincide with the physical limits of the planet. Consequently, the human ethical space has also expanded to a planetary dimension».[17] For this reason, environmental ethics must engage

[15] Hourdequin and Wong, 'A Relational Approach to Environmental Ethics,' cit.; Himes and Muraca, 'Relational Values,' cit.; Saxena *et al.*, 'From Moral Ecology to Diverse Ontologies,' cit.; A. Deplazes-Zemp, 'Beyond Intrinsic and Instrumental: Third-Category Value in Environmental Ethics and Environmental Policy', *Ethics, Policy & Environment* 0, 0 (2023), 1–23.

[16] On the concept of geoethics, cf. also S. Peppoloni and G. Di Capua, *Geoethics: Manifesto for an Ethics of Responsibility Towards the Earth*, Cham, 2022; Belardinelli and Pievani, 'The Ethics of Gaia,' cit.

[17] S. Peppoloni and G. Di Capua, 'Geoethics for Redefining Human-Earth System Nexus', in G. Di Capua and L. Oosterbeek (eds.), *Bridges to Global Ethics*, cit., 11.

not in theoretical reasoning alone but should attempt to provide guidance on practical issues as well. This guidance is crucial for individuals and decision-makers in dealing with radical transformative changes in social and environmental dimensions. This calls for the identification of a set of common goals and, first and foremost, common guiding principles.

To this effect, the relational perspective reveals its 'practical' strength through the notion of relational values, a concept that closely mirrors the attitudes of both lay-people and decision-makers towards the natural world better than intrinsic or instrumental value frameworks are capable of capturing. According to Chan and co-authors, relational values can be defined as «preferences, principles, and virtues associated with relationships, both interpersonal and as articulated by policies and social norms».[18] In the same vein, Pascual et al. describe relational values as «values that do not directly emanate from nature but are derivative of our relationships with it and our responsibilities towards it»,[19] and continue by arguing that these values pertain «to the meaningfulness of relationships, including the relationships between individuals or societies and other animals and aspects of the lifeworld (all of whom may be understood as conscious persons), as well as those among individuals and articulated by formal and informal institutions».[20]

The fruitfulness of the relational value category has recently gained increasing recognition, even at the institutional level. The "*Values Assessment Report*," issued by IPBES in 2022,[21] places the 'third category' of relational values as a central theme of its inquiry, underscoring their critical role in both the theory and practice of nature conservation, as well as in ensuring long-term human wellbeing. As emphasised in the above-mentioned influential paper coauthored by Pascual and colleagues,

> This kaleidoscopic view on values – intrinsic, instrumental and relational – permeates the ways we understand our relationship with nature. This makes it necessary to expand the way society recognizes the diversity of values and to embrace pluralistic valuation approaches.[22]

[18] Chan *et al.*, 'Why Protect Nature? ,' cit., 1462.

[19] U. Pascual *et al.*, 'Valuing Nature's Contributions to People: The IPBES Approach', *Current Opinion in Environmental Sustainability* 26–27 (2017), 11.

[20] *Ivi*, 15.

[21] But see also IPBES, *Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*, cit., where the concept of relational values had already been introduced.

[22] Pascual *et al.*, 'Valuing Nature's Contributions to People,' cit., 12.

Incorporating the concept of relationships as a relevant element of the discourse on environmental ethics offers a means to acknowledge the multitude of existing approaches towards nature. Moreover, it enables us to recognise the complex web of values and interests that are at stake when it comes to reconciling the human and nonhuman dimensions, with the ultimate goal of fostering an equitable coexistence between members of both. By integrating relational values alongside intrinsic and instrumental ones, which are reflective of bio- or ecocentric and anthropocentric approaches, respectively, this viewpoint also departs from the conventional value dichotomy, legitimising diverse worldviews on nature.

The acknowledgement of the validity of relational values is also closely tied to recognising human belonging to the natural world. In fact, relational values include anthropocentric stances by representing human perspectives, interests, and needs in relation to nature. Yet, in this specific context, the anthropocentric aspects do not conflict with the 'interests' (i.e., the preservation and health) of ecological systems, because assessments and judgements based on relational values programmatically allow for the pursuit of equilibria and trade-offs that equally value the needs of both parties involved in the relationships considered. Most importantly, this method shifts the focus from either one of the sides involved to the relationship itself, prioritizing the mutual well-being of both humans and the natural environment.

4.3. BIOCULTURAL EARTH

The relational environmental ethics account closely resembles the bidirectionality of the human-nonhuman relationship, a feature that also emerges from biocultural diversity studies. Both contemporary and historical evidence consistently indicate a mutual interdependence: humans rely on nature, and simultaneously nature needs humans.[23]

Highlighting the relevance of the interdependence and the variety of relational values attributed to the natural world also sheds light on the fact that the pathway followed until now, leading to the ongoing intertwined planetary crises, was not an inevitable or predetermined outcome of the social and

[23] Nevertheless, it is worth reminding that this claim ("nature needs humans") needs to be contextualised: I refer to the fact that, today, most of Earth's land is to some extent anthropized, and in several instances – where industrialisation has not yet prevailed – the ecosystem is a social-ecological one, owing its current configuration to human presence, and therefore incorporating the human species as key element of the local ecosystem. In this sense, it is also possible to refer to 'people's contributions to nature.'

cultural environment that shaped it. On the contrary, by giving dignity to worldviews beyond the confines of the anthropocentric and market-driven Western understanding of nature, it becomes apparent that the current situation is not an inescapable destiny. The study of the diverse existing forms of biocultural diversity, especially their manifestations in industrialised regions such as Europe, suggests that representations of human-nature relations that are alternative to the conventional Western way of framing this discourse are viable and worth exploring.

By prioritizing relationships, we embrace a view of nature that *includes* humans – a conception that still recognises nature as such, even if 'contaminated' by human activities. This viewpoint moves away from the 'wilderness' versus 'anthropic environment' dichotomy, which directly derives from the notion of humans as separate from, or opposed to, the 'natural' environment. To the contrary, adopting a relational approach prompts a reassessment of the narrative concerning the deep-time historical interactions between our species and the natural environment, viewing the present configuration of the biosphere as the result of a long-standing process of coexistence and coevolution.

In addition, this approach allows for the recognition, and even valorisation, of what I would term the ontological ambivalence of the human species in relation to nature. The concept of 'hyper-keystone species' effectively encapsulates this point.[24] Arguing that we are a hyper-keystone species, Worm and Paine attach a negative connotation to this term, as destructive outcomes arising from an overly pervasive niche construction activity are currently prevalent. However, throughout history, humans have acted as a hyper-keystone species in various environments, and not in all instances have they triggered extensive ecological degradation or mass extinctions, as is most likely happening today; in fact, they have often succeeded in achieving a degree of equilibrium, as traditionally managed agricultural landscapes all over the world exemplify.[25]

A paradigm that recognises the natural world as fundamentally structured by relationships permeating it across every level of complexity, from the microscopic to the macroevolutionary, engenders a substantial shift in the way the materialisation of the Anthropocene, the age of humans, is understood. The

[24] Worm and Paine, 'Humans as a Hyperkeystone Species,' cit.
[25] Cf. *infra*, §§2.4. and 3.2.

proposition of a 'recent Anthropocene' points to a sudden qualitative transformation as the signal of the planet's transition into a new geological epoch, with its inception traced back to just under a century ago. While the physico-chemical evidence required from a technical standpoint to formally designate a geological epoch aligns with this hypothesis, numerous scholars have emphasised its limitations on a theoretical level.

Indeed, the assertion that the Anthropocene commenced in 1950, coinciding with the occurrence of the Great Acceleration – an event that denotes, as the term itself suggests, a *quantitative* rather than qualitative change in the human impact on the planet – implicitly presumes that during the previous geologic epoch, the Holocene, the Earth remained essentially unaffected by human influence. However, this assumption disregards the reality that our species has historically acted as a hyper-keystone species within ecosystems, even in earlier phases of its evolutionary trajectory. In fact, contrary to this theory, a wealth of multidisciplinary pieces of evidence indicate that the biosphere has not existed in a 'wild' state but has undergone radical functional modifications due to human land use activities for a span of at least 10,000 years.[26]

By putting emphasis on this extended transformative interaction between humans and the biosphere, it is possible to reaffirm that humans are not (solely) a destructive force detached from natural systems. Our species possesses the capacity to significantly modify the dynamic balance of ecosystems, either by depleting their resources or by directing them towards new states of equilibrium. In several instances, humans perform crucial regulatory functions for the sustenance of the ecosystems they cohabit. Acknowledging this nuanced interplay on the one hand allows for the recognition of humanity's belonging to the natural world, affirming that, like all other living beings, humans too are subject to natural laws and ecological dynamics; on the other hand, it stresses the contemporary 'biocultural' nature of the Earth as a result of an extensive and prolonged modification process driven by ever-evolving human cultural practices.

[26] Erle Ellis, one of the most prominent advocates of the 'long Anthropocene' proposal, has stressed this point in many of his works. In an influential review paper issued in 2021, he argues: «Land use is at least as old as humans are. An expanding base of archaeological and palaeoecological evidence confirms that humans societies have inhabited and shaped ecosystems for millennia across every continent except Antarctica by means of an increasingly diverse and transformative array of land use practices ranging from hunting and landscape burning to agriculture and urbanization that have left a permanent record across the terrestrial biosphere» (Ellis, 'Land Use and Ecological Change,' cit., 2).

Hence, in light of this standpoint, it becomes evident that the beginning of the Anthropocene long predates the attributed date of 1950, possibly extending back to the Neolithic Revolution or even before, as argued by some scholars. This epochal event entailed the substantial reconfiguration of vast regions of the planet, leading to the conversion of entire wild ecosystems into mosaic-like agricultural landscapes.

This shift in perspective also carries significant ethical implications. The assertion of a recent onset of the Anthropocene implicitly suggests that human impact on the planet was minimal before this period. Justifying this assertion would require either substantially downplaying humanity's actual influence in moulding global ecosystems or claiming that humans exist outside the realm of the natural world. This narrative also implies that when humans finally gained the ability to 'tame' and 'dominate' nature, it led to destructive outcomes. Moreover, this approach perpetuates a dualistic model that establishes a complete severance between our species, which is not considered a natural entity, and the rest of the biosphere. Consequently, this viewpoint significantly diminishes our responsibility towards the natural world, only attributing ethical relevance to nature in relation to the benefits or harms humanity may suffer due to the degradation of the natural world.

Conversely, the concept of the 'long Anthropocene' harmonises more coherently with the relational ethical framework outlined above, as it recognises and attaches importance to the prolonged, and often beneficial, interactions between our species and other members of ecosystems. Recognising ourselves as an integral part of the natural community and valuing our non-invasive and non-destructive historical interactions with non-human natural beings, we are compelled to accept the responsibility derived from the freedom to choose between equally possible divergent paths.

4.4. A Way Forward

The pivotal question now lies in whether, with a thorough understanding of our coevolutionary past, which is tightly intertwined with the 'biocultural nature' of this planet, and recognising the regrettable path that a small fraction of humanity has chosen to follow at a particular (recent) juncture in our history – will we be able to cherish this hard-earned awareness and effectively utilise it. As emphasised by Ellis, «Now, the fate of all life on this planet, including

ours, depends on whether human societies can shape these cultural landscapes to better sustain both people and the rest of life on Earth».[27]

The decision to centre the case study of this work around the notion of biocultural diversity is motivated by the potential richness of this concept in encapsulating the inherent ambivalence of the human species, which is at the same time natural and cultural, destructive and fundamental to ecosystems. If, as consistently demonstrated by theories such as ecosystem engineering, niche construction (both ecological and cultural[28]), and biocultural diversity, human use of natural environments can trigger large-scale ecological transitions despite being driven by cultural evolution and change, then the same cultural processes that, through the gradual intensification of the human impact on socio-natural systems, have come to pose a threat to the stability of the biosphere's complex systems might potentially become an ally in safeguarding it.

By harnessing the understanding that alternative modes of engaging with planetary systems are viable, it becomes feasible to initiate a cultural paradigm shift towards valuing and preserving non-human nature by acknowledging not only our reliance on it but also our kinship with it. Achieving this long-term goal could potentially occur within a relatively short period of time by integrating both theoretical and practical changes and solutions.

Ellis[29] advocates for a paradigm shift in ecology that goes beyond the romanticised perception of the environmental crisis depicted solely as a consequence of recent human-induced alterations to natural ecosystems and instead recognises the "sociocultural nature" of both human societies and the "used planet" in which they develop.[30] Complementary to this proposal, I contend that this called-for paradigm shift should extend beyond ecology,

[27] Ellis, 'Land Use and Ecological Change,' cit., 24.

[28] Odling-Smee and Laland, 'Ecological Inheritance and Cultural Inheritance,' cit.; J. Kendal, J.J. Tehrani, J. Odling-Smee, 'Human Niche Construction in Interdisciplinary Focus', *Philosophical Transactions of the Royal Society B* 366, 1566 (2011), 785–792; Ellis, 'Ecology in an Anthropogenic Biosphere,' cit.; Boivin *et al.*, 'Ecological Consequences of Human Niche Construction,' cit.

[29] Ellis, 'Ecology in an Anthropogenic Biosphere,' cit.

[30] On a similar note, Kimmerer remarks that this same romanticized idea of an inherent dualism between the 'good' nature and the 'bad' human beings is found in some environmentalist positions: «We are deluged by information regarding our destruction of the world and hear almost nothing about how to nurture it. It is no surprise then that environmentalism becomes synonymous with dire predictions and powerless feelings. Our natural inclination to do right by the world is stifled, breeding despair when it should be inspiring action. The participatory role of people in the wellbeing of the land has been lost, our reciprocal relations reduced to a KEEP OUT sign» (Kimmerer, *Braiding Sweetgrass*, cit., 327).

catalysing a fundamental transformation in worldviews by pinpointing the radical intertwining of nature and culture not as an ontological, universal norm, but as an accurate portrayal of the current condition of the Earth system.

Moving away from a narrative that portrays humans solely as destroyers of nature towards one that positions humans as an integral part as well as sustainers of nature is imperative. This transition requires sustained efforts and must be realised through collaboration between the scientific community and humanities. As elucidated in the first chapter of this dissertation, these disciplines have porous borders and are inevitably intertwined. Embracing this interdisciplinary alliance is crucial for fostering a new understanding of humanity's relationship with nature and for advancing this transformative paradigm shift.

The role of cultural processes in achieving this shift in worldviews is emphasised by Robin Wall Kimmerer, ecological scientist and writer, who also advocates for the rediscovery of a non-utilitarian, reciprocal relationship with the nonhuman world. Kimmerer draws upon indigenous knowledge rooted in the traditions of Native American peoples, who, like many other indigenous communities globally, exemplify non-exploitative and non-destructive interactions between humans and the nonhuman realm. Upon closer examination, similar principles of non-extractive, non-utilitarian, and inherently sustainable approaches toward the environment can be discerned, albeit increasingly contaminated and rapidly diminishing, within the lifestyles of traditional communities in Western countries as well. For instance, such practices are observable among communities residing in the inland regions of the Apennine mountains in Italy.

In her work "*Braiding sweetgrass*," Kimmerer narratively argues that it is the way we *choose* to perceive the world that shapes our attitude towards it. This notion emphasises the profound impact that our perspectives and worldviews have on our relationships with the environment:

> It is human perception that makes the world a gift. […] A species and a culture that treat the natural world with respect and reciprocity will surely pass on genes to ensuing generations with a higher frequency than the people who destroy it. The stories we choose to shape our behaviours have adaptive consequences.[31]

[31] *Ivi*, 30.

Just as the perception of the natural world as a gift, the dualistic, economy-driven worldview is not a universal truth but a social construct, with its axioms and dogmas. As soon as their inadequacy becomes apparent – as it is evidently the case today – they can and should be challenged and opposed with alternative paradigms. Viewing the world as a gift – in other words, recognising and valuing our kinship with it and reliance on it – calls for a sense of responsibility, as engaging in relationships and sustaining them requires commitment from all involved parties. Therefore, 'using' the biosphere for our needs entail that we take responsibility for it.

> Cultures of gratitude must also be cultures of reciprocity. Each person, human or no, is bound to every other in a reciprocal relationship. Just as all beings have a duty to me, I have a duty to them. […] What is the duty of humans? If gifts and responsibilities are one, then asking "What is our responsibility?" is the same as asking "What is our gift?" It is said that only humans have the capacity for gratitude. This is among our gifts.[32]

In the face of the substantial challenges posed by our construction of a global anthropogenic niche, one for which we are proving ultimately unsuited, the alliance and integration of environmental ethics with life sciences stands as a powerful tool for nurturing cultural change.

Environmental ethics can experience considerable progress from reflecting on insights derived from life sciences. Embracing the hypothesis of a 'long Anthropocene' and recognising the deep evolutionary history of our species enables a mindful exploration of the ways in which our relationship with the broader natural community has unfolded over time, intertwining with cultural evolution. This exploration facilitates the acknowledgement of the inherent fallacy within anthropocentric assertions, challenging claims of ontological uniqueness and ethical superiority.

This heightened awareness can foster the cultivation of a sentiment of humility, fuelled by a movement of de-centralisation of human's place in the biosphere. This shift acknowledges the radical contingency of the evolutionary path that led to our species' emergence and emphasises the non-essentiality of our presence on the planet for life to persist,[33] while it underscores our fundamental dependence on other beings.

---

[32] *Ivi*, 115.

[33] We will not 'save' the planet; our efforts might only preserve human civilisation and, at most, maintain the current configuration of life, upon which we depend.

Nature does not need humans for its continuity to be preserved; however, over the past millennia, we have acted as an evolutionary force, moulding the biosphere and prompting a global transition from a 'wild' to a 'used' planet. Consequently, due to this unique circumstance, our reliance on nature is now complemented, to some degree, by the dependence of nature (a contaminated, anthropogenic nature, yet not less valuable) on humans. This ecological reality holds a major ethical implication: assuming responsibility by acknowledging the extent of our impact, and acting accordingly to safeguard a liveable future.

The responsibility required for an ethical attitude in the Anthropocene does not solely pertain to the legal accountability for our actions. Instead, it is future-oriented, aiming to ensure that present actions are geared towards preserving dignity and, at a more fundamental level, averting suffering, both in the present and the future, for those 'vulnerable' entities affected by the choices we humans make (though not everyone's choices have the same weight), based on our worldviews and interests.

Fully relinquishing the current ways of life is neither desirable nor feasible for most of us. Rather than attempting to fully replicate past supposedly sustainable societal structures, what we *can* reappraise from the past is the awareness of our strict dependence on the broader natural community. In order to change the current trajectory and make the Anthropocene an epoch of peaceful inter-species coexistence, it is crucial to reevaluate our dominant worldviews and interests. This necessitates a shift away from prioritising 'what we need' and 'what we can take' towards contemplating 'how we can give back' and honour the reciprocity that is an inherent condition for our existence.

If, as Kimmerer contends, «language is our gift», since «we may not have wings or leaves, but we humans do have words»,[34] then engaging in dialogue with those who still hold fragments of worldviews of the past we risk losing, preserving this memory and reflecting on its potential fruitfulness in the present, becomes an act of responsibility towards the vulnerable of the world, human and nonhuman alike. This is what I attempted to achieve with this study.

[34] Kimmerer, *Braiding Sweetgrass*, cit., 347.

ACKNOWLEDGEMENTS – RINGRAZIAMENTI

This dissertation represents a snapshot of an ongoing journey, one that I hope will continue for years to come. It is a quest to better understand the intricate tapestry of our world and to contribute, albeit in a modest way, to the urgent transformative change towards sustainability. My fascination with the interplay between humanity, society, and the natural world has been a driving force for this research, and I feel privileged to have spent three dedicated years exploring these themes.

I have been fortunate to approach the issues related to this topic – above all the environmental crisis, which is, to my sense, the defining feature of our time – from a privileged angle, blending philosophy with science and exploring unconventional research paths with a degree of freedom that I am grateful for. I owe a debt of gratitude to my supervisor, Professor Domenico Fulgione, who has provided both the space for independent exploration and the guidance to navigate the myriad possibilities. I also want to thank him for his continuous encouragement, which has been invaluable, of my efforts in science communication.

I must also extend my thanks to my colleagues and fellow PhDs, members of the "FulgioneLab" at the University of Naples "Federico II". Their patience and warmth in welcoming me – a philosopher! – into an evolutionary biology lab have been remarkable, and including me in naturalistic field trips has provided invaluable hands-on learning experiences. The discussions and collaborations within this research team have been enlightening beyond measure.

I am grateful for the support (also financial) provided by the Department of Humanities at the University of Naples "Federico II", which has allowed me to experience one of the most enjoyable and enlightening aspects of being a researcher: attending conferences. These gatherings have afforded me the opportunity to connect with remarkable people eager to delve into discussions spanning various topics. Their valuable insights and willingness to engage have contributed significantly to my personal and professional development. While it is impossible to acknowledge everyone individually here, I hold a vivid memory of each encounter and am profoundly grateful for the personal and professional growth they have facilitated.

I want to express my sincere appreciation to the *Institut d'Histoire et de Philosophie de Sciences et de Techniques* (IHPST), and especially to Professor

Philippe Huneman, for hosting me in Paris during a crucial phase of my PhD journey. Their expertise in interdisciplinary research and the collaborative ethos of their "philosophy lab" have left an indelible mark on my academic development.

A heartfelt word of thanks is also due to Lorenzo Ciccarese, an excellent researcher in environmental matters and a leading figure in the battle against biodiversity loss through his engagement in science diplomacy. From him, I gleaned invaluable lessons on how passion and competence can go hand in hand, as well as the importance of coupling unwavering commitment to a cause with genuine kindness and attentiveness to others. It is for all these reasons that I especially appreciated the opportunity to collaborate in an exciting journey between science and policymaking, as is the *Global Environment Outlook*. Through this commitment, I have the opportunity to ground my philosophical reflections in real-life contexts, an exercise that I consider crucial for any academic endeavour seeking to make even a modest impact on reality.

I wish to extend my acknowledgement to the reviewers of this dissertation. Joeri Witteveen not only provided an exceptionally generous assessment of this work but also offered insightful and valuable feedback, along with constructive criticism which will undoubtedly contribute to the future advancement of this line of research. Telmo Pievani has provided intriguing suggestions for further exploration of environmental ethics questions and related issues in the philosophy of biology. I am sincerely grateful to both of them for their time, dedication, and thoughtful commentary on this work.

While this PhD journey has been filled with excitement, it has also presented its fair share of challenges. Beginning this programme during Covid times meant contending with a heightened degree of 'research loneliness' while navigating the potentially draining dynamics of academia. Growing out of this *impasse* has not been easy, therefore – last, but not least – I am immensely grateful to my family, friends, and 'significant other' for steadfastly supporting me and navigating with me through this rough sea. They believed in me when I doubted myself and pointed me towards the light at the end of the tunnel when I struggled to see it myself. Their constant encouragement has been precious.

It has been said that the essence of a PhD lies not solely in the knowledge acquired, but rather in the capacity to solve complex problems, master extreme multitasking, develop resilience to stress, and cultivate coping abilities. Throughout this three-year journey, I have wholeheartedly experienced the

truth of these assertions. The "soft skills" I have honed during this time are perhaps the most treasured takeaways. Every person I have had the privilege to interact with has played a significant role, each contributing in their own unique way to my growth and development. I was able to appreciate the central role of relationships in this process, recognising that none of us exists in isolation, but we only live through our connections with others, and with the intricate living world of which we are part.

Questa tesi è un'istantanea di un viaggio ancora *in itinere*, che spero continui negli anni a venire. Con questa ricerca ho cercato di comprendere meglio il complesso intreccio del nostro mondo e di contribuire, anche se in modo modesto, al realizzarsi del cambiamento trasformativo verso la sostenibilità di cui abbiamo urgente bisogno. La mia fascinazione per il tema dell'interazione tra l'umanità – a livello individuale e sociale – e il mondo naturale è stata una forza trainante per le mie ricerche, e mi sento privilegiata per aver potuto dedicare tre anni all'esplorazione di questi temi.

Ho avuto la fortuna di affrontare questi argomenti – in particolare la crisi ambientale, che è, a mio avviso, l'elemento caratterizzante del nostro tempo – da un'angolazione privilegiata, coniugando filosofia e scienza e perlustrando percorsi di ricerca non canonici con un grado di libertà di cui sono grata.

Sono molte le persone che voglio e devo ringraziare per aver contribuito, ognuno in modo diverso, a far sì che io raggiungessi questo obiettivo.

Ringrazio innanzitutto il mio supervisore, il professor Domenico Fulgione, che mi ha fornito sia la libertà di una ricerca indipendente, sia la guida per non annegare nella miriade di strade possibili. Voglio anche ringraziarlo per il suo continuo incoraggiamento, e in alcuni casi partecipazione attiva, ai miei sforzi nella comunicazione scientifica.

Desidero inoltre ringraziare i miei colleghi e compagni di dottorato del "FulgioneLab" dell'Università di Napoli "Federico II". La loro pazienza e il loro calore nell'accogliere me – una filosofa! – in un laboratorio di biologia evoluzionistica sono stati straordinari, e l'avermi dato la possibilità di partecipare al loro lavoro sul campo è stata per me un'esperienza estremamente formativa. Le discussioni e le collaborazioni all'interno di questo gruppo di ricerca si sono rivelate illuminanti sotto ogni punto di vista.

Sono grata per il supporto (anche finanziario) fornito dal Dipartimento di Scienze Umanistiche dell'Università di Napoli "Federico II", che mi ha permesso di vivere uno degli aspetti più piacevoli e arricchenti dell'essere ricercatrice: la partecipazione a conferenze. Questi eventi mi hanno dato l'opportunità di entrare in contatto con persone straordinarie, entusiaste di confrontarsi su vari argomenti. Le preziose osservazioni e la disponibilità a dialogare di questi "compagni di ricerca" hanno contribuito in modo significativo al mio sviluppo personale e professionale. Sebbene sia impossibile menzionare tutti singolarmente in questa sede, conservo un ricordo vivido di ogni incontro e sono profondamente grata per la crescita che hanno stimolato.

Desidero esprimere il mio sincero ringraziamento all'*Institut d'Histoire et de Philosophie de Sciences et de Techniques* (IHPST), e in particolare al professor Philippe Huneman, per avermi ospitato a Parigi durante una fase cruciale del mio percorso di dottorato. La loro competenza nella ricerca interdisciplinare e il clima collaborativo del loro "laboratorio di filosofia" hanno lasciato un segno indelebile nel mio percorso accademico.

Un profondo ringraziamento va anche a Lorenzo Ciccarese, eccellente ricercatore in materia ambientale e figura di spicco nella lotta contro la perdita di biodiversità attraverso il suo impegno nella diplomazia scientifica. Da lui ho tratto preziose lezioni su come passione e competenza possano andare di pari passo, come anche sull'importanza di coniugare l'impegno incondizionato verso una causa con una sincera gentilezza e attenzione verso gli altri. Anche per questo, è stato ancora più bello poter cooperare in un percorso entusiasmante tra scienza e politica, come è il *Global Environment Outlook*. Grazie a questo impegno, sto avendo l'opportunità di calare le mie riflessioni filosofiche in contesti di vita reale, un esercizio che considero fondamentale per qualsiasi impresa accademica che cerchi di avere un impatto, anche modesto, sulla realtà.

Un ringraziamento particolare va ai revisori di questa tesi. Joeri Witteveen non solo ha fornito una valutazione molto generosa di questo lavoro, ma ha anche offerto un riscontro utile e approfondito, insieme a critiche costruttive che contribuiranno senza dubbio al futuro avanzamento di questa linea di ricerca. Telmo Pievani ha fornito interessanti spunti per un'ulteriore esplorazione delle questioni di etica ambientale e dei problemi ad esse correlati

nell'ambito della filosofia della biologia. Sono sinceramente grata a entrambi per il loro tempo, la loro dedizione e i loro attenti commenti a questo lavoro.

Questo dottorato è stato entusiasmante, ma ha anche riservato delle difficoltà. Iniziare tale percorso in tempi di Covid ha comportato un grado particolarmente elevato di "solitudine nella ricerca", affrontata mentre cercavo di barcamenarmi tra le potenzialmente logoranti dinamiche del mondo accademico. Uscire da questa impasse non è stato facile, perciò – ultimi, ma non per importanza – vorrei ringraziare la mia famiglia, i miei amici e il mio compagno di viaggio per avermi sostenuto con costanza e per aver attraversato con me questo mare agitato. Loro hanno creduto in me quando io ne dubitavo, e mi hanno indicato la luce alla fine del tunnel quando io stessa faticavo a vederla. Il loro costante incoraggiamento è stato prezioso.

Si dice che il dottorato di ricerca non sia soltanto una questione di conoscenze acquisite, ma piuttosto di capacità di risolvere problemi complessi, di padroneggiare un *multitasking* estremo, di sviluppare la resilienza allo stress e la capacità di adattamento. Nel corso di questo cammino triennale, ho sperimentato pienamente la verità di queste affermazioni. Le *soft skills* che ho affinato in questo periodo sono forse quanto di più prezioso porto con me da questa esperienza. Ogni persona con cui ho avuto il privilegio di interagire ha svolto un ruolo significativo, contribuendo in modo unico alla mia crescita e al mio sviluppo. Ho potuto apprezzare, anche sulla mia pelle, il ruolo centrale delle relazioni in questo processo, riconoscendo che nessuno di noi esiste in isolamento, ma viviamo solo grazie ai nostri legami con gli altri, e con l'intreccio del mondo vivente nel quale siamo immersi.

REFERENCES

88th Congress, Second Session, *The Wilderness Act*, 1964. https://wilderness.net/learn-about-wilderness/key-laws/wilderness-act/default.php

Agnoletti, M., ed., *Italian Historical Rural Landscapes: Cultural Values for the Environment and Rural Development* [*Italian Historical Rural Landscapes*], Environmental History, 2013. doi:10.1007/978-94-007-5354-9.

———, 'Italian Historical Rural Landscapes: Dynamics, Data Analysis and Research Findings' ['Italian Historical Rural Landscapes'], in ed. M. Agnoletti, *Italian Historical Rural Landscapes: Cultural Values for the Environment and Rural Development*, Environmental History (Dordrecht, 2013), 3–87. doi:10.1007/978-94-007-5354-9_1.

———, *Paesaggi rurali storici: per un catalogo nazionale* [*Paesaggi rurali storici*] (Bari, 2010).

———, 'Rural Landscape, Nature Conservation and Culture: Some Notes on Research Trends and Management Approaches from a (Southern) European Perspective' ['Rural Landscape, Nature Conservation and Culture'], *Landscape and Urban Planning*, 126 126 (1 June 2014), 66–73. doi:10.1016/j.landurbplan.2014.02.012.

Agnoletti, M., and F. Emanueli, eds., 'Biocultural Diversity and Landscape in Europe: Framing the Issue', *Biocultural Diversity in Europe*, Environmental History, 2016, 1–18. doi:10.1007/978-3-319-26315-1.

———, eds., *Biocultural Diversity in Europe*, Environmental History, 2016. doi:10.1007/978-3-319-26315-1.

Althouse, J., L. Cahen-Fourot, B. Carballa-Smichowski, C. Durand, and S. Knauss, 'Ecologically Unequal Exchange and Uneven Development Patterns along Global Value Chains', *World Development*, 170 170 (1 October 2023), 106308. doi:10.1016/j.worlddev.2023.106308.

Anderson, C.B., S. Athayde, C.M. Raymond, Vatn, P. Arias, R.K. Gould, J. Kenter, et al., 'Chapter 2: Conceptualizing the Diverse Values of Nature and Their Contributions to People', in ed. P. Balvanera, U. Pascual, M. Christie, B. Baptiste, and D. González-Jiménez, *Methodological Assessment Report on the Diverse Values and Valuation of Nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services* (Bonn, Germany, 2022). https://doi.org/10.5281/zenodo.6493134.

Andreozzi, M., *Etiche Dell'ambiente. Voci e Prospettive*, 2012.

Angelini, A., 'Philosophie biologique et naturalismes : Resituer la nature dans la théorie critique' ['Philosophie biologique et naturalismes'], in ed. A. Charpentier, M. Pagan, and M. Dal Pozzolo, *Repenser la nature : Dewey, Canguilhem, Plessner*, Actes de la recherche à l'ENS (Paris, 2023), 95–108. doi:10.4000/books.editionsulm.9805.

Anthropocene Working Group, 'Subcommission on Quaternary Stratigraphy, Working Group on the "Anthropocene". Results of Binding Vote.', 415, no. 6867 415, no. 6867 (2019). http://quaternary.stratigraphy.org/working-groups/anthropocene/.

Antrop, M., 'The Concept of Traditional Landscapes as a Base for Landscape Evaluation and Planning. The Example of Flanders Region', *Landscape and Urban Planning*, 38, no. 1–2 38, no. 1–2 (1 October 1997), 105–117. doi:10.1016/S0169-2046(97)00027-3.

Arcidiaco, L., O. Ciancio, V. Garfì, F. Iovino, G. Menguzzato, and A. Nicolaci, 'Area Di Vegetazione e Campo Di Idoneità Ecologica Del Castagno in Calabria', *L'italia Forestale E Montana* (1 January 2006), 489–506. doi:10.4129/IFM.2006.6.02.

Arias-Maldonado, M., *Environment and Society: Socionatural Relations in the Anthropocene* [*Environment and Society*], SpringerBriefs in Political Science (Cham, 2015). doi:10.1007/978-3-319-15952-2.

Armstrong McKay, D.I., A. Staal, J.F. Abrams, R. Winkelmann, B. Sakschewski, S. Loriani, I. Fetzer, S.E. Cornell, J. Rockström, and T.M. Lenton, 'Exceeding 1.5°C Global Warming Could Trigger Multiple Climate Tipping Points', *Science*, 377, no. 6611 377, no. 6611 (9 September 2022), eabn7950. doi:10.1126/science.abn7950.

Barbera, G., 'Calabria', in ed. M. Agnoletti, *Italian Historical Rural Landscapes: Cultural Values for the Environment and Rural Development*, Environmental History (Dordrecht, 2013), 489–508. doi:10.1007/978-94-007-5354-9_23.

Barbera, G., and R. Biasi, 'I Paesaggi Agrari Tradizionali Dell'albero: Il Significato Moderno Di Forme d'uso Del Suolo Del Passato', *Italus Hortus*, 18, no. 2 18, no. 2 (2011), 21–38.

Barbera, G., and S. Cullotta, 'The Traditional Mediterranean Polycultural Landscape as Cultural Heritage: Its Origin and Historical Importance, Its Agro-Silvo-Pastoral Complexity and the Necessity for Its Identification and Inventory', in ed. M. Agnoletti and F. Emanueli, *Biocultural Diversity in Europe* (Switzerland, 2016), 21–48.

Barnosky, A.D., E.A. Hadly, J. Bascompte, E.L. Berlow, J.H. Brown, M. Fortelius, W.M. Getz, et al., 'Approaching a State Shift in Earth's Biosphere', *Nature*, 486, no. 7401 486, no. 7401 (June 2012), 52–58. doi:10.1038/nature11018.

Barnosky, A.D., P.L. Koch, R.S. Feranec, S.L. Wing, and A.B. Shabel, 'Assessing the Causes of Late Pleistocene Extinctions on the Continents', *Science*, 306, no. 5693 306, no. 5693 (October 2004), 70–75. doi:10.1126/science.1101476.

Belardinelli, S., and T. Pievani, 'From Biophilia to Geophilia: A Challenging but Necessary Expansion', in ed. S. Peppoloni and G. Di Capua, *Geoethics for the Future: Facing Global Challenges*, 2024.

———, 'The Ethics of Gaia: Geoethics From an Evolutionary Perspective' ['The Ethics of Gaia'], in ed. G. Di Capua and L. Oosterbeek, *Bridges to Global Ethics: Geoethics at the Confluence of Humanities and Sciences*, SpringerBriefs in Geoethics (Cham, 2023), 55–72. doi:10.1007/978-3-031-22223-8_5.

Bell, K., 'Can the Capitalist Economic System Deliver Environmental Justice?', *Environmental Research Letters*, 10, no. 12 10, no. 12 (December 2015), 125017. doi:10.1088/1748-9326/10/12/125017.

Bergandi, D., 'Fundamental of ecology de E.P. Odum: véritable "approche holiste" ou reductionnisme masqué?', *Bulletin of Ecology*, 24, no. 1 24, no. 1 (1993), 57–68.

Bergman, J., R.Ø. Pedersen, E.J. Lundgren, R.T. Lemoine, S. Monsarrat, E.A. Pearce, M.H. Schierup, and J.-C. Svenning, 'Worldwide Late Pleistocene and Early Holocene Population Declines in Extant Megafauna Are Associated with Homo Sapiens Expansion Rather than Climate Change', *Nature Communications*, 14, no. 1 14, no. 1 (24 November 2023), 7679. doi:10.1038/s41467-023-43426-5.

Bergthaller, H., and E. Horn, *The Anthropocene: Key Issues for the Humanities* [*The Anthropocene*] (London, 2019). doi:10.4324/9780429439735.

Bermejo, R., 'The Commodification of Nature and Its Consequences', in ed. R. Bermejo, *Handbook for a Sustainable Economy* (Dordrecht, 2014), 19–33. doi:10.1007/978-94-017-8981-3_2.

Blackstock, K.L., K.A. Waylen, K.B. Matthews, A. Juarez-Bourke, D.G. Miller, A. Hague, D.H. Wardell-Johnson, and M. Giampietro, 'Implementing Post-Normal Science with or for EU Policy Actors: Using Quantitative Story-Telling' ['Implementing Post-Normal Science with or for EU Policy Actors'], *Sustainability Science*, 18, no. 3 18, no. 3 (1 May 2023), 1235–1250. doi:10.1007/s11625-022-01265-1.

Bliege Bird, R., and D. Nimmo, 'Restore the Lost Ecological Functions of People', *Nature Ecology & Evolution*, 2, no. 7 2, no. 7 (July 2018), 1050–1052. doi:10.1038/s41559-018-0576-5.

Blondel, J., 'The "Design" of Mediterranean Landscapes: A Millennial Story of Humans and Ecological Systems during the Historic Period' ['The "Design" of Mediterranean Landscapes'], *Human Ecology*, 34, no. 5 34, no. 5 (1 October 2006), 713–729. doi:10.1007/s10745-006-9030-4.

Blondel, J., and J. Aronson, *Biology and Wildlife of the Mediterranean Region*, 1999.

Boddice, R., ed., *Anthropocentrism: Humans, Animals, Environments* [*Anthropocentrism*], 2011. https://brill.com/edcollbook/title/18825.

Boivin, N.L., M.A. Zeder, D.Q. Fuller, A. Crowther, G. Larson, J.M. Erlandson, T. Denham, and M.D. Petraglia, 'Ecological Consequences of Human Niche Construction: Examining Long-Term Anthropogenic Shaping of Global Species Distributions' ['Ecological Consequences of Human Niche Construction'], *Proceedings of the National Academy of Sciences*, 113, no. 23 113, no. 23 (7 June 2016), 6388–6396. doi:10.1073/pnas.1525200113.

———, 'Ecological Consequences of Human Niche Construction: Examining Long-Term Anthropogenic Shaping of Global Species Distributions' ['Ecological Consequences of Human Niche Construction'], *Proceedings of the National Academy of Sciences*, 113, no. 23 113, no. 23 (7 June 2016), 6388–6396. doi:10.1073/pnas.1525200113.

Bonneuil, C., and J.-B. Fressoz, *The Shock of the Anthropocene: The Earth, History and Us* [*The Shock of the Anthropocene*], 2016.

Bosellini, A., *Storia Geologica d'Italia: Gli Ultimi 200 Milioni Di Anni.* (Bologna, 2005).

Bridgewater, P., and I.D. Rotherham, 'A Critical Perspective on the Concept of Biocultural Diversity and Its Emerging Role in Nature and Heritage Conservation', *People and Nature*, 1, no. 3 1, no. 3 (2019), 291–304. doi:10.1002/pan3.10040.

Bridgewater, P., and S. Upadhaya, 'What is biocultural diversity, and why does it matter?', *The Conversation*, 2022. http://theconversation.com/what-is-biocultural-diversity-and-why-does-it-matter-168881.

Brügger, P., 'Animals and Nature: The Co-Modification of the Sentient Biosphere' ['Animals and Nature'], in ed. B. Clark and T. Diana Wilson, *The Capitalist Commodification of Animals*, vol. 35, vol. 35, Research in Political Economy, 2020, 33–58. doi:10.1108/S0161-723020200000035003.

Butchvarov, P., *Anthropocentrism in Philosophy: Realism, Antirealism, Semirealism* [*Anthropocentrism in Philosophy*], 2015. doi:10.1515/9781614518495.

Callicott, J.B., 'Hume's Is/Ought Dichtomy and the Relation of Ecology to Leopold's Land Ethic', *Environmental Ethics*, 4, no. 2 4, no. 2 (1 May 1982), 163–174. doi:10.5840/enviroethics19824214.

———, *In Defense of the Land Ethic: Essays in Environmental Philosophy* [*In Defense of the Land Ethic*], 1989.

Carducci, M., 'Cambiamento Climatico (Diritto Costituzionale)', ed. R. Sacco, R. Bifulco, A. Celotto, and M. Olivetti, *Digesto Delle Discipline Pubblicistiche*, 2021.

Carson, R., *Silent Spring*, Fortieth anniversary edition (2002)., Fortieth anniversary edition (2002). (Boston, MA, 1962).

CBD, *The Convention on Biological Diversity*, 1992. https://www.cbd.int/convention/.

Ceballos, G., P.R. Ehrlich, A.D. Barnosky, A. García, R.M. Pringle, and T.M. Palmer, 'Accelerated Modern Human–Induced Species Losses: Entering the Sixth Mass Extinction' ['Accelerated Modern Human–Induced Species Losses'], *Science Advances*, 1, no. 5 1, no. 5 (2015), e1400253. doi:10.1126/sciadv.1400253.

Cevasco, R., and D. Moreno, 'Rural Landscapes: The Historical Roots of Biodiversity' ['Rural Landscapes'], in ed. M. Agnoletti, *Italian Historical Rural Landscapes: Cultural Values for the Environment and Rural Development*, Environmental History (Dordrecht, 2013), 141–152. doi:10.1007/978-94-007-5354-9_4.

Chakrabarty, D., 'The Climate of History: Four Theses' ['The Climate of History'], *Critical Inquiry*, 35, no. 2 35, no. 2 (January 2009), 197–222. doi:10.1086/596640.

Chan, K.M.A., P. Balvanera, K. Benessaiah, M. Chapman, S. Díaz, E. Gómez-Baggethun, R. Gould, et al., 'Why Protect Nature? Rethinking Values and the Environment' ['Why Protect Nature?'], *Proceedings of the National Academy of Sciences*, 113, no. 6 113, no. 6 (9 February 2016), 1462–1465. doi:10.1073/pnas.1525002113.

Cocks, M., 'Biocultural Diversity: Moving Beyond the Realm of "Indigenous" and "Local" People' ['Biocultural Diversity'], *Human Ecology*, 34, no. 2 34, no. 2 (1 April 2006), 185–200. doi:10.1007/s10745-006-9013-5.

Cocks, M.L., and F. Wiersum, 'Reappraising the Concept of Biocultural Diversity: A Perspective from South Africa' ['Reappraising the Concept of Biocultural Diversity'], *Human Ecology*, 42, no. 5 42, no. 5 (1 October 2014), 727–737. doi:10.1007/s10745-014-9681-5.

Cohen, K.M., S.C. Finney, P.L. Gibbard, and J.-X. Fan, 'The ICS International Chronostratigraphic Chart', *Episodes*, 36, no. 3 36, no. 3 (1 September 2013), 199–204. doi:10.18814/epiiugs/2013/v36i3/002.

Coletta, T., 'La conservazione dei centri storici minori abbandonati: il caso della Campania' (Tesi di dottorato, Università di Napoli Federico II, 2006). http://www.fedoa.unina.it/2879/.

Colledge, S., J. Conolly, and S. Shennan, 'Archaeobotanical Evidence for the Spread of Farming in the Eastern Mediterranean', *Current Anthropology*, 45, no. S4 45, no. S4 (August 2004), S35–S58. doi:10.1086/422086.

Cooper, J.A.P.C., David E., ed., *Key Thinkers on the Environment* (London, 2017). doi:10.4324/9781315543659.

Corcoran, P.B., 'John Muir 1838–1914', *Key Thinkers on the Environment*, 2017.

Cowell, M., 'Ecological Restoration and Environmental Ethics', *Environmental Ethics*, 15, no. 1 15, no. 1 (1 February 1993), 19–32. doi:10.5840/enviroethics199315136.

Cowie, R.H., P. Bouchet, and B. Fontaine, 'The Sixth Mass Extinction: Fact, Fiction or Speculation?' ['The Sixth Mass Extinction'], *Biological Reviews* (2022). doi:10.1111/brv.12816.

Crutzen, P.J., 'Geology of Mankind', *Nature*, 415, no. 6867 415, no. 6867 (January 2002), 23–23. doi:10.1038/415023a.

Crutzen, P.J., and E.F. Stoermer, 'The "Anthropocene"', *Global Change NewsLetter*, 41 41 (May 2000). https://inters.org/files/crutzenstoermer2000.pdf.

Danchin, É., A. Charmantier, F.A. Champagne, A. Mesoudi, B. Pujol, and S. Blanchet, 'Beyond DNA: Integrating Inclusive Inheritance into an Extended Theory of Evolution' ['Beyond DNA'], *Nature Reviews Genetics*, 12, no. 7 12, no. 7 (July 2011), 475–486. doi:10.1038/nrg3028.

Darnhofer, I., C. Lamine, A. Strauss, and M. Navarrete, 'The Resilience of Family Farms: Towards a Relational Approach' ['The Resilience of Family Farms'], *Journal of Rural Studies*, 44 44 (1 April 2016), 111–122. doi:10.1016/j.jrurstud.2016.01.013.

Darwin, C.R., *Journal of Researches into the Geology and Natural History of the Various Countries Visited by H.M.S. Beagle* (London, 1839).

Dasgupta, P., 'The Economics of Biodiversity: The Dasgupta Review. Final Report' ['The Economics of Biodiversity'], 2021. https://www.gov.uk/government/publications/final-report-the-economics-of-biodiversity-the-dasgupta-review.

Daskalova, G.N., and J. Kamp, 'Abandoning Land Transforms Biodiversity', *Science*, 380, no. 6645 380, no. 6645 (12 May 2023), 581–583. doi:10.1126/science.adf1099.

Deplazes-Zemp, A., 'Beyond Intrinsic and Instrumental: Third-Category Value in Environmental Ethics and Environmental Policy' ['Beyond Intrinsic and Instrumental'], *Ethics, Policy & Environment*, 0, no. 0 0, no. 0 (2023), 1–23. doi:10.1080/21550085.2023.2166341.

Díaz, S., J. Settele, E.S. Brondízio, H.T. Ngo, J. Agard, A. Arneth, P. Balvanera, et al., 'Pervasive Human-Driven Decline of Life on Earth Points to the Need for Transformative Change', *Science*, 366, no. 6471 366, no. 6471 (13 December 2019), eaax3100. doi:10.1126/science.aax3100.

Dirzo, R., H.S. Young, M. Galetti, G. Ceballos, N.J.B. Isaac, and B. Collen, 'Defaunation in the Anthropocene', *Science*, 345, no. 6195 345, no. 6195 (25 July 2014), 401–406. doi:10.1126/science.1251817.

Domina, G., and M. Zapparoli, 'Biodiversity in Italy', *Global Biodiversity*, 2018.

Droz, L., 'Anthropocentrism as the Scapegoat of the Environmental Crisis: A Review' ['Anthropocentrism as the Scapegoat of the Environmental Crisis'], *Ethics in Science and Environmental Politics*, 22 22 (5 May 2022), 25–49. doi:10.3354/esep00200.

Dunne, J.A., H. Maschner, M.W. Betts, N. Huntly, R. Russell, R.J. Williams, and S.A. Wood, 'The Roles and Impacts of Human Hunter-Gatherers in North Pacific Marine Food Webs', *Scientific Reports*, 6, no. 1 6, no. 1 (17 February 2016), 21179. doi:10.1038/srep21179.

Egerton, F.N., 'A History of the Ecological Sciences, Part 23: Linnaeus and the Economy of Nature' ['A History of the Ecological Sciences, Part 23'], *Bulletin of the Ecological Society of America*, 88, no. 1 88, no. 1 (2007), 72–88.

———, 'A History of the Ecological Sciences, Part 32: Humboldt, Nature's Geographer' ['A History of the Ecological Sciences, Part 32'], *Bulletin of the Ecological Society of America*, 90, no. 3 90, no. 3 (2009), 253–282.

———, 'Changing Concepts of the Balance of Nature', *The Quarterly Review of Biology*, 48, no. 2 48, no. 2 (June 1973), 322–350. doi:10.1086/407594.

———, ‘History of Ecological Sciences, Part 37: Charles Darwin’s Voyage on the Beagle’ [‘History of Ecological Sciences, Part 37’], *Bulletin of the Ecological Society of America*, 91, no. 4 91, no. 4 (2010), 398–431.

———, ‘History of Ecological Sciences, Part 40: Darwin’s Evolutionary Ecology’ [‘History of Ecological Sciences, Part 40’], *Bulletin of the Ecological Society of America*, 92, no. 4 92, no. 4 (2011), 351–375.

———, ‘History of Ecological Sciences, Part 47: Ernst Haeckel’s Ecology’ [‘History of Ecological Sciences, Part 47’], *Bulletin of the Ecological Society of America*, 94, no. 3 94, no. 3 (2013), 222–244.

———, ‘History of Ecological Sciences, Part 53: Organizing Ecologists before 1946’ [‘History of Ecological Sciences, Part 53’], *Bulletin of the Ecological Society of America*, 96, no. 2 96, no. 2 (2015), 239–311.

Ehrlich, P.R., *The Population Bomb* (New York, 1968).

Ehrlich, P.R., and A.H. Ehrlich, ‘The Population Bomb Revisited’, *The Electronic Journal of Sustainable Development*, 1, no. 3 1, no. 3 (2009), 63–71.

Elands, B.H.M., K.F. Wiersum, A.E. Buijs, and K. Vierikko, ‘Policy Interpretations and Manifestation of Biocultural Diversity in Urbanized Europe: Conservation of Lived Biodiversity’ [‘Policy Interpretations and Manifestation of Biocultural Diversity in Urbanized Europe’], *Biodiversity and Conservation*, 24, no. 13 24, no. 13 (1 December 2015), 3347–3366. doi:10.1007/s10531-015-0985-6.

Ellis, E.C., *Anthropocene: A Very Short Introduction* [*Anthropocene*] (New York, 2018).

———, ‘Anthropogenic Transformation of the Terrestrial Biosphere’, *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 369, no. 1938 369, no. 1938 (13 March 2011), 1010–1035. doi:10.1098/rsta.2010.0331.

———, ‘Ecology in an Anthropogenic Biosphere’, *Ecological Monographs*, 85, no. 3 85, no. 3 (2015), 287–331. doi:10.1890/14-2274.1.

———, ‘Land Use and Ecological Change: A 12,000-Year History’ [‘Land Use and Ecological Change’], *Annual Review of Environment and Resources*, 46, no. 1 46, no. 1 (2021), 1–33. doi:10.1146/annurev-environ-012220-010822.

———, ‘Why I Resigned from the Anthropocene Working Group’, 2023. https://anthroecology.org/why-i-resigned-from-the-anthropocene-working-group/.

Ellis, E.C., N. Gauthier, K.K. Goldewijk, R.B. Bird, N. Boivin, S. Díaz, D.Q. Fuller, et al., ‘People Have Shaped Most of Terrestrial Nature for at Least 12,000 Years’, *Proceedings of the National Academy of Sciences*, 118, no. 17 118, no. 17 (27 April 2021). doi:10.1073/pnas.2023483118.

Ellis, E.C., J.O. Kaplan, D.Q. Fuller, S. Vavrus, K. Klein Goldewijk, and P.H. Verburg, ‘Used Planet: A Global History’ [‘Used Planet’], *Proceedings of the National Academy of Sciences*, 110, no. 20 110, no. 20 (14 May 2013), 7978–7985. doi:10.1073/pnas.1217241110.

Ellis, E.C., and N. Ramankutty, ‘Putting People in the Map: Anthropogenic Biomes of the World’ [‘Putting People in the Map’], *Frontiers in Ecology and the Environment*, 6, no. 8 6, no. 8 (2008), 439–447. doi:10.1890/070062.

Eriksen, T.H., ‘The Loss of Diversity in the Anthropocene Biological and Cultural Dimensions’, *Frontiers in Political Science*, 3 3 (2021). https://www.frontiersin.org/article/10.3389/fpos.2021.743610.

Falcucci, A., L. Maiorano, and L. Boitani, ‘Changes in Land-Use/Land-Cover Patterns in Italy and Their Implications for Biodiversity Conservation’, *Landscape*

Ecology, 22, no. 4 22, no. 4 (1 April 2007), 617–631. doi:10.1007/s10980-006-9056-4.

Farina, A., 'The Cultural Landscape as a Model for the Integration of Ecology and Economics', *BioScience*, 50, no. 4 50, no. 4 (1 April 2000), 313–320. doi:10.1641/0006-3568(2000)050[0313:TCLAAM]2.3.CO;2.

Fedele, G., C.I. Donatti, I. Bornacelly, and D.G. Hole, 'Nature-Dependent People: Mapping Human Direct Use of Nature for Basic Needs across the Tropics' ['Nature-Dependent People'], *Global Environmental Change*, 71 71 (1 November 2021), 102368. doi:10.1016/j.gloenvcha.2021.102368.

Federau, A., 'Anthropocene', in ed. N. Wallenhorst and C. Wulf, *Handbook of the Anthropocene: Humans between Heritage and Future* (Cham, 2023), 323–326. doi:10.1007/978-3-031-25910-4_49.

Ferrara, A., M. Biró, L. Malatesta, Z. Molnár, S. Mugnoz, F.M. Tardella, and A. Catorci, 'Land-Use Modifications and Ecological Implications over the Past 160 Years in the Central Apennine Mountains', *Landscape Research*, 46, no. 7 46, no. 7 (3 October 2021), 932–944. doi:10.1080/01426397.2021.1922997.

Fischer, J., T. Hartel, and T. Kuemmerle, 'Conservation Policy in Traditional Farming Landscapes', *Conservation Letters*, 5, no. 3 5, no. 3 (2012), 167–175. doi:10.1111/j.1755-263X.2012.00227.x.

Foley, R.A., and M. Mirazón Lahr, 'The Evolution of the Diversity of Cultures', *Philosophical Transactions of the Royal Society B: Biological Sciences*, 366, no. 1567 366, no. 1567 (12 April 2011), 1080–1089. doi:10.1098/rstb.2010.0370.

Folke, C., S. Polasky, J. Rockström, V. Galaz, F. Westley, M. Lamont, M. Scheffer, et al., 'Our Future in the Anthropocene Biosphere', *Ambio*, 50, no. 4 50, no. 4 (1 April 2021), 834–869. doi:10.1007/s13280-021-01544-8.

Fox, W., 'A Critical Overview of Environmental Ethics', *World Futures*, 46, no. 1 46, no. 1 (1 January 1996), 1–21. doi:10.1080/02604027.1996.9972562.

Fratianni, S., and F. Acquaotta, 'The Climate of Italy', in ed. M. Soldati and M. Marchetti, *Landscapes and Landforms of Italy*, World Geomorphological Landscapes (Cham, 2017), 29–38. doi:10.1007/978-3-319-26194-2_4.

Fredi, P., and E. Lupia Palmieri, 'Morphological Regions of Italy', in ed. M. Soldati and M. Marchetti, *Landscapes and Landforms of Italy*, World Geomorphological Landscapes (Cham, 2017), 39–74. doi:10.1007/978-3-319-26194-2_5.

Fremaux, A., *After the Anthropocene. Green Republicanism in a Post-Capitalist World* (Cham, Switzerland, 2019). https://doi.org/10.1007/978-3-030-11120-5.

Frey, R.S., P.K. Gellert, and H.F. Dahms, eds., *Ecologically Unequal Exchange: Environmental Injustice in Comparative and Historical Perspective* (Cham, 2019). https://doi.org/10.1007/978-3-319- 89740-0_7.

Fulgione, D., and C. Troiano, 'Clima, Abbandono Ed Evoluzione Del Paesaggio Mediterraneo', *Ambiente Rischio Comunicazione*, 16 16 (2019), 65–69.

Funtowicz, S., and J.R. Ravetz, 'Post-Normal Science', *Internet Encyclopaedia of Ecological Economics*, 2003.

———, 'Science for the Post-Normal Age', *Futures*, 25, no. 7 25, no. 7 (1 September 1993), 739–755. doi:10.1016/0016-3287(93)90022-L.

Garnett, S.T., N.D. Burgess, J.E. Fa, Á. Fernández-Llamazares, Z. Molnár, C.J. Robinson, J.E.M. Watson, et al., 'A Spatial Overview of the Global Importance of Indigenous Lands for Conservation', *Nature Sustainability*, 1, no. 7 1, no. 7 (July 2018), 369–374. doi:10.1038/s41893-018-0100-6.

Gartzia, M., C.L. Alados, and F. Pérez-Cabello, 'Assessment of the Effects of Biophysical and Anthropogenic Factors on Woody Plant Encroachment in Dense and Sparse Mountain Grasslands Based on Remote Sensing Data', *Progress in Physical Geography: Earth and Environment*, 38, no. 2 38, no. 2 (1 April 2014), 201–217. doi:10.1177/0309133314524429.

Gibbard, P., M. Walker, A. Bauer, M. Edgeworth, L. Edwards, E. Ellis, S. Finney, et al., 'The Anthropocene as an Event, Not an Epoch', *Journal of Quaternary Science*, 37, no. 3 37, no. 3 (2022), 395–399. doi:10.1002/jqs.3416.

Giordano Bonomo, P., *L'archivio della memoria* (Sanza, 1992).

Giordano Eboli, R., L. Eboli, A. Apadula Fusco, M. Caiafa Fusco, M. Buono Senatore, and T. Caiafa, *A l'Usu re Sanza*, Quaderni (Sanza, 2009).

Givens, J.E., X. Huang, and A.K. Jorgenson, 'Ecologically Unequal Exchange: A Theory of Global Environmental Injustice' ['Ecologically Unequal Exchange'], *Sociology Compass*, 13, no. 5 13, no. 5 (2019), e12693. doi:10.1111/soc4.12693.

von Glasenapp, M., and T.F. Thornton, 'Traditional Ecological Knowledge of Swiss Alpine Farmers and Their Resilience to Socioecological Change', *Human Ecology*, 39, no. 6 39, no. 6 (1 December 2011), 769–781. doi:10.1007/s10745-011-9427-6.

Gómez-Baggethun, E., E. Corbera, and V. Reyes-García, 'Traditional Ecological Knowledge and Global Environmental Change: Research Findings and Policy Implications' ['Traditional Ecological Knowledge and Global Environmental Change'], *Ecology and Society : A Journal of Integrative Science for Resilience and Sustainability*, 18, no. 4 18, no. 4 (1 December 2013), 72. doi:10.5751/ES-06288-180472.

Gómez-Baggethun, E., R. de Groot, P.L. Lomas, and C. Montes, 'The History of Ecosystem Services in Economic Theory and Practice: From Early Notions to Markets and Payment Schemes' ['The History of Ecosystem Services in Economic Theory and Practice'], *Ecological Economics*, 69, no. 6 69, no. 6, Special Section - Payments for Environmental Services: Reconciling Theory and Practice (1 April 2010), 1209–1218. doi:10.1016/j.ecolecon.2009.11.007.

Gómez-Baggethun, E., and M. Ruiz-Pérez, 'Economic Valuation and the Commodification of Ecosystem Services', *Progress in Physical Geography: Earth and Environment*, 35, no. 5 35, no. 5 (1 October 2011), 613–628. doi:10.1177/0309133311421708.

Grant, C., 'Analogies and Links between Cultural and Biological Diversity', *Journal of Cultural Heritage Management and Sustainable Development*, 2, no. 2 2, no. 2 (1 January 2012), 153–163. doi:10.1108/20441261211273644.

Greenberg, J.H., 'The Measurement of Linguistic Diversity', *Language*, 32, no. 1 32, no. 1 (1956), 109–115. doi:10.2307/410659.

Guarrera, P.M., *Usi e tradizioni della flora italiana. Medicina popolare ed etnobotanica*, 2007. http://www.aracneeditrice.it/aracneweb/index.php/pubblicazione.html?item=9788854809642.

Guarrera, P.M., V. Savo, and G. Caneva, 'Traditional Uses of Plants in the Tolfa–Cerite–Manziate Area (Central Italy)', *Ethnobiology Letters*, 6, no. 1 6, no. 1 (2015), 119–161.

Gunderson, R., 'Commodification of Nature', *International Encyclopedia of Geography*, 2017, 1–20. doi:10.1002/9781118786352.wbieg0332.

Hadjichambis, A.CH., D. Paraskeva-Hadjichambi, A. Della, M. Elena Giusti, C. De Pasquale, C. Lenzarini, E. Censorii, et al., 'Wild and Semi-Domesticated Food

Plant Consumption in Seven Circum-Mediterranean Areas', *International Journal of Food Sciences and Nutrition*, 59, no. 5 59, no. 5 (1 January 2008), 383–414. doi:10.1080/09637480701566495.

Haila, Y., 'Beyond the Nature-Culture Dualism', *Biology and Philosophy*, 15, no. 2 15, no. 2 (1 March 2000), 155–175. doi:10.1023/A:1006625830102.

Haq, S.M., A. Pieroni, R.W. Bussmann, A.M. Abd-ElGawad, and H.O. El-Ansary, 'Integrating Traditional Ecological Knowledge into Habitat Restoration: Implications for Meeting Forest Restoration Challenges' ['Integrating Traditional Ecological Knowledge into Habitat Restoration'], *Journal of Ethnobiology and Ethnomedicine*, 19, no. 1 19, no. 1 (10 August 2023), 33. doi:10.1186/s13002-023-00606-3.

Hardin, G., 'The Tragedy of the Commons', *Science*, 162, no. 3859 162, no. 3859 (13 December 1968), 1243–1248. doi:10.1126/science.162.3859.1243.

Head, M.J., W. Steffen, D. Fagerlind, C.N. Waters, C. Poirier, J. Syvitski, J.A. Zalasiewicz, et al., 'The Great Acceleration Is Real and Provides a Quantitative Basis for the Proposed Anthropocene Series/Epoch', *Episodes Journal of International Geoscience*, 45, no. 4 45, no. 4 (1 December 2022), 359–376. doi:10.18814/epiiugs/2021/021031.

Heckenberger, M.J., J.C. Russell, J.R. Toney, and M.J. Schmidt, 'The Legacy of Cultural Landscapes in the Brazilian Amazon: Implications for Biodiversity' ['The Legacy of Cultural Landscapes in the Brazilian Amazon'], *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 362, no. 1478 362, no. 1478 (28 February 2007), 197–208. doi:10.1098/rstb.2006.1979.

Heidegger, M., *The Question Concerning Technology, and Other Essays*, 1977. http://archive.org/details/questionconcerni00heid.

Himes, A., and B. Muraca, 'Relational Values: The Key to Pluralistic Valuation of Ecosystem Services' ['Relational Values'], *Current Opinion in Environmental Sustainability*, 35 35, Sustainability Challenges: Relational Values (1 December 2018), 1–7. doi:10.1016/j.cosust.2018.09.005.

Holt, L.A., 'Why Shouldn't We Cut the Human-Biosphere Umbilical Cord?', *Futures*, 133 133 (1 October 2021), 102821. doi:10.1016/j.futures.2021.102821.

Hourdequin, M., and D.B. Wong, 'A Relational Approach to Environmental Ethics', *Journal of Chinese Philosophy*, 32, no. 1 32, no. 1 (2005), 19–33. doi:10.1111/j.1540-6253.2005.00172.x.

Hubacek, K., and J.C.J.M. van den Bergh, 'Changing Concepts of Land in Economic Theory: From Single to Multi-Disciplinary Approaches' ['Changing Concepts of Land in Economic Theory'], *Ecological Economics*, 56, no. 1 56, no. 1 (2006), 5–27. doi:10.1016/j.ecolecon.2005.03.033.

Humboldt, A. von, *Ideen Zu Einer Geographie Der Pflanzen : Nebst Einem Naturgemälde Der Tropenländer : Auf Beobachtungen Und Messungen Gegründet, Welche Vom 10ten Grade Nördlicher Bis Zum 10ten Grade Südlicher Breite, in Den Jahren 1799, 1800, 1801, 1802 Und 1803 Angestellt Worden Sind* [*Ideen Zu Einer Geographie Der Pflanzen*] (Tübingen, 1807). doi:10.5962/bhl.title.9310.

IPBES, *Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*, 4 May 2019. doi:10.5281/zenodo.6417333.

———, *Methodological Assessment of the Diverse Values and Valuation of Nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*, 26 April 2022. doi:10.5281/zenodo.7687931.

IPCC, *AR6 Synthesis Report: Climate Change 2023* [*AR6 Synthesis Report*], 2023. https://www.ipcc.ch/report/sixth-assessment-report-cycle/.

Johnson, C.N., A. Balmford, B.W. Brook, J.C. Buettel, M. Galetti, L. Guangchun, and J.M. Wilmshurst, 'Biodiversity Losses and Conservation Responses in the Anthropocene', *Science*, 356, no. 6335 356, no. 6335 (21 April 2017), 270–275. doi:10.1126/science.aam9317.

Jonas, H., *The Imperative of Responsibility*, University of Chicago Press., University of Chicago Press. (Chicago, 1984). https://press.uchicago.edu/ucp/books/book/chicago/I/bo5953283.html.

Katz, E., 'Ethics and Philosophy of the Environment: A Brief Review of the Major Literature' ['Ethics and Philosophy of the Environment'], *Environmental History Review*, 15, no. 2 15, no. 2 (1 June 1991), 79–86. doi:10.2307/3984972.

Kawall, J., 'A History of Environmental Ethics', in ed. S.M. Gardiner and A. Thompson, *The Oxford Handbook of Environmental Ethics*, 2017, 0. doi:10.1093/oxfordhb/9780199941339.013.6.

Kelly, C., A. Ferrara, G.A. Wilson, F. Ripullone, A. Nolè, N. Harmer, and L. Salvati, 'Community Resilience and Land Degradation in Forest and Shrubland Socio-Ecological Systems: Evidence from Gorgoglione, Basilicata, Italy' ['Community Resilience and Land Degradation in Forest and Shrubland Socio-Ecological Systems'], *Land Use Policy*, 46 46 (1 July 2015), 11–20. doi:10.1016/j.landusepol.2015.01.026.

Kendal, J., J.J. Tehrani, and J. Odling-Smee, 'Human Niche Construction in Interdisciplinary Focus', *Philosophical Transactions of the Royal Society B: Biological Sciences*, 366, no. 1566 366, no. 1566 (27 March 2011), 785–792. doi:10.1098/rstb.2010.0306.

Keulartz, J., 'Conservation through Commodification?', *Ethics, Policy & Environment*, 16, no. 3 16, no. 3 (1 October 2013), 297–307. doi:10.1080/21550085.2013.843379.

Keys, A.B., and M. Keys, *How to Eat Well and Stay Well the Mediterranean Way*, 1975. http://archive.org/details/howtoeatwellstay0000keys.

Kimmerer, R.W., *Braiding Sweetgrass* (Minneapolis, 2013).

King, R., and J. Killingbeck, 'Carlo Levi, the Mezzogiorno and Emigration: Fifty Years of Demographic Change at Aliano' ['Carlo Levi, the Mezzogiorno and Emigration'], *Geography*, 74, no. 2 74, no. 2 (1989), 128–143.

King, R., and J. Killingbeck, 'Agricultural and Land Use Change in Central Basilicata', *Land Use Policy*, 7, no. 1 7, no. 1 (January 1990), 7–26. doi:10.1016/0264-8377(90)90051-Y.

Kohn, E., 'Anthropology of Ontologies', *Annual Review of Anthropology*, 44, no. 1 44, no. 1 (2015), 311–327. doi:10.1146/annurev-anthro-102214-014127.

Kremen, C., and A.M. Merenlender, 'Landscapes That Work for Biodiversity and People', *Science*, 362, no. 6412 362, no. 6412 (19 October 2018), eaau6020. doi:10.1126/science.aau6020.

Kutschera, U., G.S. Levit, and U. Hossfeld, 'Ernst Haeckel (1834–1919): The German Darwin and His Impact on Modern Biology' ['Ernst Haeckel (1834–1919)'], *Theory in Biosciences*, 138, no. 1 138, no. 1 (1 May 2019), 1–7. doi:10.1007/s12064-019-00276-4.

Lade, S.J., W. Steffen, W. de Vries, S.R. Carpenter, J.F. Donges, D. Gerten, H. Hoff, T. Newbold, K. Richardson, and J. Rockström, 'Human Impacts on Planetary Boundaries Amplified by Earth System Interactions', *Nature Sustainability*, 3, no. 2 3, no. 2 (February 2020), 119–128. doi:10.1038/s41893-019-0454-4.

Leopold, A., *A Sand County Almanac: And Sketches Here and There*, 1949.

Levi, C., *Cristo si è fermato a Eboli* (Milano, 1945).

Lewis, M.P., G.F. Simons, and C.D. Fennig, eds., *Ethnologue: Languages of the World*, Seventeenth edition., Seventeenth edition. (Dallas, Texas, 2014).

Lewis, M.A., and S.L. Maslin, *The Human Planet. How We Created the Anthropocene* [*The Human Planet*] (London, 2016). https://www.penguin.co.uk/books/298037/the-human-planet-by-simon-l-lewis-and-mark-a-maslin/9780241280881.

Linnaeus, C., 'Oeconomy of Nature', in ed. B. Stillingfleet, *Miscellaneous Tracts Relating to Natural History, Husbandry, and Physick*, 2nd ed., 2nd ed. (London, 1762), 32–129.

———, 'Police of Nature', in ed. F.J. Brand, *Select Dissertations from the Amoenitates Academicae*, vol. 1, vol. 1 (London, 1781), 129–166.

Loh, J., 'Biocultural Diversity: Threatened Species, Endangered Languages' ['Biocultural Diversity'] (1 January 2014). https://www.academia.edu/42083878/Biocultural_Diversity_Threatened_species_endangered_languages.

Loh, J., and D. Harmon, 'A Global Index of Biocultural Diversity', *Ecological Indicators*, 5, no. 3 5, no. 3 (1 August 2005), 231–241. doi:10.1016/j.ecolind.2005.02.005.

Lombardo, U., J. Iriarte, L. Hilbert, J. Ruiz-Pérez, J.M. Capriles, and H. Veit, 'Early Holocene Crop Cultivation and Landscape Modification in Amazonia', *Nature*, 581, no. 7807 581, no. 7807 (May 2020), 190–193. doi:10.1038/s41586-020-2162-7.

Low, F.M., P.D. Gluckman, and M.A. Hanson, 'Niche Modification, Human Cultural Evolution and the Anthropocene', *Trends in Ecology & Evolution*, 34, no. 10 34, no. 10 (1 October 2019), 883–885. doi:10.1016/j.tree.2019.07.005.

Luczaj, L., A. Pieroni, J. Tardio, M. Pardo-de-Santayana, R. Soukand, I. Svanberg, and R. Kalle, 'Wild Food Plant Use in 21 St Century Europe, the Disapperance of Old Traditions and the Search for New Cuisines Involving Wild Edibles', *Acta Societatis Botanicorum Poloniae*, 81, no. 4 81, no. 4 (2012). http://agro.icm.edu.pl/agro/element/bwmeta1.element.agro-53ddc6c3-8ae6-448c-934e-e7c4fc8896f5.

Lytle, M.H., *The Gentle Subversive: Rachel Carson, Silent Spring, and the Rise of the Environmental Movement* [*The Gentle Subversive*], 2007.

Maffi, L., 'Biocultural Diversity', *The International Encyclopedia of Anthropology*, 2018, 1–14. doi:10.1002/9781118924396.wbiea1797.

———, 'Linguistic, Cultural, and Biological Diversity', *Annual Review of Anthropology*, 34, no. 1 34, no. 1 (2005), 599–617. doi:10.1146/annurev.anthro.34.081804.120437.

———, 'What Is Linguistic Diversity, And Why Does It Matter?', in ed. L. Maffi and O. Dilts, *Biocultural Diversity Toolkit*, vol. Vol. 2-Assessing the State of The World's Languages, vol. Vol. 2-Assessing the State of The World's Languages, 2014, 7–12.

Maffi, L., and O. Dilts, eds., *Biocultural Diversity Toolkit*, vol. Vol. 2-Assessing the State of The World's Languages, vol. Vol. 2-Assessing the State of The World's Languages, 2014.

Malandra, F., A. Vitali, C. Urbinati, and M. Garbarino, '70 Years of Land Use/Land Cover Changes in the Apennines (Italy): A Meta-Analysis' ['70 Years of Land Use/Land Cover Changes in the Apennines (Italy)'], *Forests*, 9, no. 9 9, no. 9 (September 2018), 551. doi:10.3390/f9090551.

Mancilla García, M., T. Hertz, and M. Schlüter, 'Towards a Process Epistemology for the Analysis of Social-Ecological System', *Environmental Values*, 29, no. 2 29, no. 2 (2020), 221–239. doi:10.3197/096327119X15579936382608.

Mancilla García, M., T. Hertz, M. Schlüter, R. Preiser, and M. Woermann, 'Adopting Process-Relational Perspectives To Tackle The Challenges of Social-Ecological Systems Research', SSRN Scholarly Paper (Rochester, NY, 2020). https://papers.ssrn.com/abstract=4152646.

Marchetti, M., M. Vizzarri, L. Sallustio, M. di Cristofaro, B. Lasserre, F. Lombardi, C. Giancola, A. Perone, A. Simpatico, and G. Santopuoli, 'Behind Forest Cover Changes: Is Natural Regrowth Supporting Landscape Restoration? Findings from Central Italy' ['Behind Forest Cover Changes'], *Plant Biosystems - An International Journal Dealing with All Aspects of Plant Biology*, 152, no. 3 152, no. 3 (4 May 2018), 524–535. doi:10.1080/11263504.2018.1435585.

Marchetti, M., M. Soldati, and V. Vandelli, 'The Great Diversity of Italian Landscapes and Landforms: Their Origin and Human Imprint' ['The Great Diversity of Italian Landscapes and Landforms'], in ed. M. Soldati and M. Marchetti, *Landscapes and Landforms of Italy*, World Geomorphological Landscapes (Cham, 2017), 7–20. doi:10.1007/978-3-319-26194-2_2.

Marietta, Jr., D.E., 'The Interrelationship of Ecological Science and Environmental Ethics', *Environmental Ethics*, 1, no. 3 1, no. 3 (1 August 1979), 195–207. doi:10.5840/enviroethics19791327.

Maruca, G., G. Laghetti, F. Losavio, D. Pignone, and K. Hammer, 'Historical and Traditional Notes on Collecting Crop Genetic Resources in Central Part of Calabria Region', *Journal of Environmental Science and Engineering B*, 2 2 (2013), 117–126.

Maruca, G., G. Spampinato, D. Turiano, G. Laghetti, and C.M. Musarella, 'Ethnobotanical Notes about Medicinal and Useful Plants of the Reventino Massif Tradition (Calabria Region, Southern Italy)', *Genetic Resources and Crop Evolution*, 66, no. 5 66, no. 5 (1 June 2019), 1027–1040. doi:10.1007/s10722-019-00768-8.

Mazzoleni, S., G. Di Pasquale, M. Mulligan, P. Di Martino, and F. Rego, eds., *Recent Dynamics of the Mediterranean Vegetation and Landscapes* (Chichester, 2004).

McGlinn, D.J., X. Xiao, F. May, N.J. Gotelli, T. Engel, S.A. Blowes, T.M. Knight, O. Purschke, J.M. Chase, and B.J. McGill, 'Measurement of Biodiversity (MoB): A Method to Separate the Scale-Dependent Effects of Species Abundance Distribution, Density, and Aggregation on Diversity Change' ['Measurement of Biodiversity (MoB)'], *Methods in Ecology and Evolution*, 10, no. 2 10, no. 2 (2019), 258–269. doi:10.1111/2041-210X.13102.

McNeill, J.R., and P. Engelke, *The Great Acceleration: An Environmental History of the Anthropocene since 1945* [*The Great Acceleration*], 2014. https://www.jstor.org/stable/j.ctvjf9wcc.

Mearns, R., and A. Norton, eds., *Social Dimensions of Climate Change. Equity and Vulnerability in a Warming World* [*Social Dimensions of Climate Change*], New Frontiers of Social Policy (Washington, D.C., 2010). https://openknowledge.worldbank.org/server/api/core/bitstreams/57ef7f5d-df55-552f-91b8-843eb7b286a3/content.

Meneganzin, A., T. Pievani, and S. Caserini, 'Anthropogenic Climate Change as a Monumental Niche Construction Process: Background and Philosophical Aspects' ['Anthropogenic Climate Change as a Monumental Niche

Construction Process'], *Biology & Philosophy*, 35, no. 4 35, no. 4 (29 June 2020), 38. doi:10.1007/s10539-020-09754-2.

Mensing, S.A., E.M. Schoolman, I. Tunno, P.J. Noble, L. Sagnotti, F. Florindo, and G. Piovesan, 'Historical Ecology Reveals Landscape Transformation Coincident with Cultural Development in Central Italy since the Roman Period', *Scientific Reports*, 8, no. 1 8, no. 1 (1 February 2018), 2138. doi:10.1038/s41598-018-20286-4.

Mesle, C.R., *Process-Relational Philosophy: An Introduction to Alfred North Whitehead* [*Process-Relational Philosophy*], 2008.

Ministry for the Environment, Land and Sea, *Italy's Fifth National Report to the Convention on Biological Diversity (2009-2013)* (Rome, 2014). https://www.mase.gov.it/sites/default/files/archivio/allegati/biodiversita/italian_fifth_report_cbd.pdf.

Minteer, B., 'Anthropocentrism', ed. J.B. Callicott and R. Frodeman, *Encyclopedia of Environmental Ethics and Philosophy*, 2009.

Mohan, A.V., and K. Tamma, 'The Lasting Contribution of Alexander von Humboldt to Our Understanding of the Natural World', *Resonance*, 26, no. 8 26, no. 8 (1 August 2021), 1041–1050. doi:10.1007/s12045-021-1207-z.

Mrozowski, S.A., 'Colonization and the Commodification of Nature', *International Journal of Historical Archaeology*, 3, no. 3 3, no. 3 (1 September 1999), 153–166. doi:10.1023/A:1021957902956.

Muraca, B., 'Re-Appropriating the Ecosystem Services Concept for a Decolonization of "Nature"', 2016, 143–156.

———, 'Relational Values: A Whiteheadian Alternative for Environmental Philosophy and Global Environmental Justice' ['Relational Values'], *Balkan Journal of Philosophy*, 8, no. 1 8, no. 1 (8 August 2016), 19–38. doi:10.5840/bjp2016813.

———, 'The Map of Moral Significance: A New Axiological Matrix for Environmental Ethics' ['The Map of Moral Significance'], *Environmental Values*, 20, no. 3 20, no. 3 (2011), 375–396.

Myers, N., 'The Rich Diversity of Biodiversity Issues', in ed. M.L. Reaka-Kudla, D.E. Wilson, and E.O. Wilson, *Biodiversity II. Understanding and Protecting Our Biological Resources* (Washington, D.C., 1997), 125–138.

Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A.B. da Fonseca, and J. Kent, 'Biodiversity Hotspots for Conservation Priorities', *Nature*, 403, no. 6772 403, no. 6772 (February 2000), 853–858. doi:10.1038/35002501.

Mylius, B., 'Three Types of Anthropocentrism', *Environmental Philosophy*, 15, no. 2 15, no. 2 (2018), 159–194.

Nash, R., *The Rights of Nature: A History of Environmental Ethics* [*The Rights of Nature*] (Madison, Wisconsin, 1989). http://archive.org/details/rightsofnaturehi0000nash.

Naudé, P., 'Can We Overcome the Anthropocentrism Bias in Sustainability Discourse?', *African Journal of Business Ethics*, 11, no. 2 11, no. 2 (2017). doi:10.15249/11-2-189.

Nazari, V., S. Belardinelli, A. Pieroni, R. Motti, A. Chiarucci, G.D. Bisol, G. Vacchiano, et al., 'Biocultural Diversity in Italy', *Human Ecology* (13 December 2023). doi:10.1007/s10745-023-00455-4.

Nedelcheva, A., Y. Dogan, D. Obratov-Petkovic, and I.M. Padure, 'The Traditional Use of Plants for Handicrafts in Southeastern Europe', *Human Ecology*, 39, no. 6 39, no. 6 (1 December 2011), 813–828. doi:10.1007/s10745-011-9432-9.

Nedelcheva, A.M., Y. Dogan, and P.M. Guarrera, 'Plants Traditionally Used to Make Brooms in Several European Countries', *Journal of Ethnobiology and Ethnomedicine*, 3, no. 1 3, no. 1 (2 May 2007), 20. doi:10.1186/1746-4269-3-20.

Nelson, R.H., 'Ecological Science as a Creation Story', *The Independent Review*, 14, no. 4 14, no. 4 (2010), 513–534.

Nimmo, R., 'The Making of the Human: Anthropocentrism in Modern Social Thought', in ed. R. Boddice, *Anthropocentrism*, 2011, 59–79. https://brill.com/display/book/edcoll/9789004214941/Bej.9789004187948.i-348_005.xml.

Norgaard, R.B., 'Ecosystem Services: From Eye-Opening Metaphor to Complexity Blinder' ['Ecosystem Services'], *Ecological Economics*, 69, no. 6 69, no. 6, Special Section - Payments for Environmental Services: Reconciling Theory and Practice (1 April 2010), 1219–1227. doi:10.1016/j.ecolecon.2009.11.009.

Odling-Smee, J., and K.N. Laland, 'Ecological Inheritance and Cultural Inheritance: What Are They and How Do They Differ?' ['Ecological Inheritance and Cultural Inheritance'], *Biological Theory*, 6, no. 3 6, no. 3 (1 September 2011), 220–230. doi:10.1007/s13752-012-0030-x.

Odling-Smee, J., K.N. Laland, and M.W. Feldman, *Niche Construction: The Neglected Process in Evolution* (Princeton, 2003).

Odum, E.P., *Fundamentals of Ecology*, 1st ed., 1st ed. (Philadelphia, 1953).

———, *Fundamentals of Ecology*, 3rd ed., 3rd ed. (Philadelphia, 1971).

———, 'The Emergence of Ecology as a New Integrative Discipline', *Science*, 195, no. 4284 195, no. 4284 (25 March 1977), 1289–1293. doi:10.1126/science.195.4284.1289.

Ojeda, J., A.K. Salomon, J.K. Rowe, and N.C. Ban, 'Reciprocal Contributions between People and Nature: A Conceptual Intervention' ['Reciprocal Contributions between People and Nature'], *BioScience*, 72, no. 10 72, no. 10 (1 October 2022), 952–962. doi:10.1093/biosci/biac053.

Oteros-Rozas, E., R. Ontillera-Sánchez, P. Sanosa, E. Gómez-Baggethun, V. Reyes-García, and J. González, 'Traditional Ecological Knowledge among Transhumant Pastoralists in Mediterranean Spain', *Ecology and Society*, 18, no. 3 18, no. 3 (20 September 2013). doi:10.5751/ES-05597-180333.

Palombo, C., G. Chirici, M. Marchetti, and R. Tognetti, 'Is Land Abandonment Affecting Forest Dynamics at High Elevation in Mediterranean Mountains More than Climate Change?', *Plant Biosystems - An International Journal Dealing with All Aspects of Plant Biology*, 147, no. 1 147, no. 1 (1 March 2013), 1–11. doi:10.1080/11263504.2013.772081.

Pascual, U., P. Balvanera, S. Díaz, G. Pataki, E. Roth, M. Stenseke, R.T. Watson, et al., 'Valuing Nature's Contributions to People: The IPBES Approach' ['Valuing Nature's Contributions to People'], *Current Opinion in Environmental Sustainability*, 26–27 26–27 (June 2017), 7–16. doi:10.1016/j.cosust.2016.12.006.

Pence, C.H., and D.G. Swaim, 'The Economy of Nature: The Structure of Evolution in Linnaeus, Darwin, and the Modern Synthesis' ['The Economy of Nature'], *European Journal for Philosophy of Science*, 8, no. 3 8, no. 3 (1 October 2018), 435–454. doi:10.1007/s13194-017-0194-0.

Peppoloni, S., and G. Di Capua, 'Geoethics for Redefining Human-Earth System Nexus', in ed. G. Di Capua and L. Oosterbeek, *Bridges to Global Ethics: Geoethics at the Confluence of Humanities and Sciences*, SpringerBriefs in Geoethics (Cham, 2023), 5–23. doi:10.1007/978-3-031-22223-8_2.

———, *Geoethics: Manifesto for an Ethics of Responsibility Towards the Earth* [*Geoethics*] (Cham, 2022). doi:10.1007/978-3-030-98044-3.

Perkins, S., 'Researchers Move Closer to Defining the Anthropocene', *Proceedings of the National Academy of Sciences*, 120, no. 29 120, no. 29 (18 July 2023), e2310613120. doi:10.1073/pnas.2310613120.

Petrillo, P.L., 'Biocultural Diversity and the Mediterranean Diet', in ed. B. Burlingame and S. Dernini, *Sustainable Diets and Biodiversity. Directions and Solutions for Policy, Research and Action* (Roma, 2012), 224–229.

Pigliucci, M., 'Do We Need an Extended Evolutionary Theory?', *Evolution*, 61, no. 12 61, no. 12 (1 December 2007), 2743–2749. doi:10.1111/j.1558-5646.2007.00246.x.

Piketty, T., *A Brief History of Equality* (Cambridge, MA, 2022).

Pilgrim, S.E., L.C. Cullen, D.J. Smith, and J. Pretty, 'Ecological Knowledge Is Lost in Wealthier Communities and Countries', *Environmental Science & Technology*, 42, no. 4 42, no. 4 (1 February 2008), 1004–1009. doi:10.1021/es070837v.

Plieninger, T., R. Kohsaka, C. Bieling, S. Hashimoto, C. Kamiyama, T. Kizos, M. Penker, et al., 'Fostering Biocultural Diversity in Landscapes through Place-Based Food Networks: A "Solution Scan" of European and Japanese Models' ['Fostering Biocultural Diversity in Landscapes through Place-Based Food Networks'], *Sustainability Science*, 13, no. 1 13, no. 1 (1 January 2018), 219–233. doi:10.1007/s11625-017-0455-z.

Popper, K.R., *Objective Knowledge: An Evolutionary Approach* [*Objective Knowledge*], 1979.

Pörtner, H.-O., R.J. Scholes, A. Arneth, D.K.A. Barnes, M.T. Burrows, S.E. Diamond, C.M. Duarte, et al., 'Overcoming the Coupled Climate and Biodiversity Crises and Their Societal Impacts', *Science*, 380, no. 6642 380, no. 6642 (21 April 2023), eabl4881. doi:10.1126/science.abl4881.

Pretty, J., 'Interdisciplinary Progress in Approaches to Address Social-Ecological and Ecocultural Systems', *Environmental Conservation*, 38, no. 2 38, no. 2 (June 2011), 127–139. doi:10.1017/S0376892910000937.

Pretty, J., J. Pretty, B. Adams, F. Berkes, S.F. de Athayde, N. Dudley, E. Hunn, et al., 'The Intersections of Biological Diversity and Cultural Diversity: Towards Integration' ['The Intersections of Biological Diversity and Cultural Diversity'], *Conservation and Society*, 7, no. 2 7, no. 2 (2009), 100–100.

Prus, B., M. Uruszczak, and J. Hernik, 'Arguments Based on Biocultural Diversity to Cease Abandonment of Traditional Agricultural Systems: Lessons from Poland' ['Arguments Based on Biocultural Diversity to Cease Abandonment of Traditional Agricultural Systems'], *Biodiversity and Conservation*, 31, no. 10 31, no. 10 (1 August 2022), 1–26. doi:10.1007/s10531-021-02297-2.

Pungetti, G., 'Biocultural Diversity for Sustainable Ecological, Cultural and Sacred Landscapes: The Biocultural Landscape Approach' ['Biocultural Diversity for Sustainable Ecological, Cultural and Sacred Landscapes'], in ed. B. Fu and K.B. Jones, *Landscape Ecology for Sustainable Environment and Culture* (Dordrecht, 2013), 55–76. doi:10.1007/978-94-007-6530-6_4.

Pyle, R.M., *The Thunder Tree. Lessons from an Urban Wildland* (Corvallis, OR, 1993).

Queiroz, C., R. Beilin, C. Folke, and R. Lindborg, 'Farmland Abandonment: Threat or Opportunity for Biodiversity Conservation? A Global Review' ['Farmland Abandonment'], *Frontiers in Ecology and the Environment*, 12, no. 5 12, no. 5 (2014), 288–296. doi:10.1890/120348.

Rae, G., 'Anthropocentrism', in ed. H. ten Have, *Encyclopedia of Global Bioethics* (Cham, 2017), 1–12. doi:10.1007/978-3-319-05544-2_24-1.

Rapport, D., and L. Maffi, 'The Dual Erosion of Biological and Cultural Diversity: Implications for the Health of Ecocultural Systems' ['The Dual Erosion of Biological and Cultural Diversity'], *Nature and Culture*, 2010.

Ravetz, J.R., 'What Is Post-Normal Science', *Futures*, 31 31 (1999), 647–653.

Ray, S., 'Weaving the Links: Traditional Knowledge into Modern Science' ['Weaving the Links'], *Futures*, 145 145 (1 January 2023), 103081. doi:10.1016/j.futures.2022.103081.

Reyes-García, V., L. Aceituno-Mata, L. Calvet-Mir, T. Garnatje, E. Gómez-Baggethun, J.J. Lastra, R. Ontillera, et al., 'Resilience of Traditional Knowledge Systems: The Case of Agricultural Knowledge in Home Gardens of the Iberian Peninsula' ['Resilience of Traditional Knowledge Systems'], *Global Environmental Change*, 24 24 (1 January 2014), 223–231. doi:10.1016/j.gloenvcha.2013.11.022.

Rizhinashvili, A.L., 'Ernst Haeckel's "Ecology" in Russia of the First Half of the Twentieth Century', *Theory in Biosciences*, 138, no. 1 138, no. 1 (1 May 2019), 89–103. doi:10.1007/s12064-019-00281-7.

Rolston III, H., 'Value in Nature and the Nature of Value', in ed. R. Attfield and R. Belsey, *Philosophy and the Natural Environment* (Cambridge, 1994), 13–30.

Rotherham, I.D., 'Cultural Severance and the End of Tradition', in ed. I.D. Rotherham, *Cultural Severance and the Environment: The Ending of Traditional and Customary Practice on Commons and Landscapes Managed in Common* (Dordrecht, 2013), 11–30. doi:10.1007/978-94-007-6159-9_2.

———, 'The Implications of Cultural Severance in Managing Vegetation for Conservation', *Aspects of Applied Biology*, 108 108 (2011), 95–104.

Rozzi, R., 'The Reciprocal Links between Evolutionary-Ecological Sciences and Environmental Ethics', *BioScience*, 49, no. 11 49, no. 11 (1 November 1999), 911–921. doi:10.2307/1313650.

Rozzi, R., J.J. Armesto, and R. Frodeman, 'Integrating Ecological Sciences and Environmental Ethics into Biocultural Conservation', *Environmental Ethics*, 30, no. 3 30, no. 3 (1 June 2008), 229–234. doi:10.5840/enviroethics200830329.

Russo, N., *Filosofia ed ecologia* (Napoli, 2000).

Russo, V., 'Historical "Ghost" Towns: Sustainable Conservation Issues in Southern Italy', in ed. Mileto, Vegas, García Soriano, and Cristini, *Vernacular Architecture: Towards a Sustainable Future* (London, 2015), 655–660.

Sagoff, M., 'Fact and Value in Ecological Science', *Environ. Ethics; (United States)*, 7:2 7:2 (1 January 1985). doi:10.5840/enviroethics19857222.

Salomon, A.K., 'Ecosystems', in ed. S.E. Jørgensen and B.D. Fath, *Encyclopedia of Ecology* (Oxford, 2008), 1155–1165. doi:10.1016/B978-008045405-4.00482-1.

Saxena, A.K., D. Chatti, K. Overstreet, and M.R. Dove, 'From Moral Ecology to Diverse Ontologies: Relational Values in Human Ecological Research, Past and Present' ['From Moral Ecology to Diverse Ontologies'], *Current Opinion in Environmental Sustainability*, 35 35, Sustainability Challenges: Relational Values (1 December 2018), 54–60. doi:10.1016/j.cosust.2018.10.021.

Schmitt, T., U. Fritz, M. Delfino, W. Ulrich, and J.C. Habel, 'Biogeography of Italy Revisited: Genetic Lineages Confirm Major Phylogeographic Patterns and a Pre-Pleistocene Origin of Its Biota' ['Biogeography of Italy Revisited'],

Frontiers in Zoology, 18, no. 34 18, no. 34 (29 June 2021). doi:10.1186/s12983-021-00418-9.

Shmida, A., and M.V. Wilson, 'Biological Determinants of Species Diversity', *Journal of Biogeography*, 12, no. 1 12, no. 1 (1985), 1–20. doi:10.2307/2845026.

Skutnabb-Kangas, T., and D. Harmon, *Biological Diversity and Language Diversity*, 2017. doi:10.4324/9781315687391.ch1.

Skutnabb-Kangas, T., L. Maffi, and D. Harmon, *Sharing A World of Difference. The Earth's Linguistic, Cultural, and Biological Diversity*, 2003.

Smith, B.D., 'The Ultimate Ecosystem Engineers', *Science*, 315, no. 5820 315, no. 5820 (30 March 2007), 1797–1798. doi:10.1126/science.1137740.

Soga, M., and K.J. Gaston, 'Extinction of Experience: The Loss of Human–Nature Interactions' ['Extinction of Experience'], *Frontiers in Ecology and the Environment*, 14, no. 2 14, no. 2 (2016), 94–101. doi:10.1002/fee.1225.

Spampinato, G., R. Crisarà, P. Cameriere, A. Cano-Ortiz, and C.M. Musarella, 'Analysis of the Forest Landscape and Its Transformations through Phytotoponyms: A Case Study in Calabria (Southern Italy)' ['Analysis of the Forest Landscape and Its Transformations through Phytotoponyms'], *Land*, 11, no. 4 11, no. 4 (April 2022), 518. doi:10.3390/land11040518.

Steffen, W., P.J. Crutzen, and J.R. McNeill, 'The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature' ['The Anthropocene'], *AMBIO: A Journal of the Human Environment*, 36, no. 8 36, no. 8 (December 2007), 614–621. doi:10.1579/0044-7447(2007)36[614:TAAHNO]2.0.CO;2.

Steffen, W., J. Grinevald, P. Crutzen, and J. McNeill, 'The Anthropocene: Conceptual and Historical Perspectives' ['The Anthropocene'], *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 369, no. 1938 369, no. 1938 (13 March 2011), 842–867. doi:10.1098/rsta.2010.0327.

Steffen, W., K. Richardson, J. Rockström, S.E. Cornell, I. Fetzer, E.M. Bennett, R. Biggs, et al., 'Planetary Boundaries: Guiding Human Development on a Changing Planet' ['Planetary Boundaries'], *Science*, 347, no. 6223 347, no. 6223 (13 February 2015), 1259855. doi:10.1126/science.1259855.

Stephens, L., D. Fuller, N. Boivin, T. Rick, N. Gauthier, A. Kay, B. Marwick, et al., 'Archaeological Assessment Reveals Earth's Early Transformation through Land Use', *Science*, 365, no. 6456 365, no. 6456 (30 August 2019), 897–902. doi:10.1126/science.aax1192.

Stork, N.E., 'Measuring Global Biodiversity and Its Decline', in ed. M.L. Reaka-Kudla, D.E. Wilson, and E.O. Wilson, *Biodiversity II. Understanding and Protecting Our Biological Resources* (Washington, D.C., 1997), 41–68.

Sullivan, A.P., D.W. Bird, and G.H. Perry, 'Human Behaviour as a Long-Term Ecological Driver of Non-Human Evolution', *Nature Ecology & Evolution*, 1, no. 3 1, no. 3 (21 February 2017), 1–11. doi:10.1038/s41559-016-0065.

Swindles, G.T., T.P. Roland, and A. Ruffell, 'The "Anthropocene" Is Most Useful as an Informal Concept', *Journal of Quaternary Science*, 38, no. 4 38, no. 4 (2023), 453–454. doi:10.1002/jqs.3492.

Sze, J.S., L.R. Carrasco, D. Childs, and D.P. Edwards, 'Reduced Deforestation and Degradation in Indigenous Lands Pan-Tropically', *Nature Sustainability*, 5, no. 2 5, no. 2 (February 2022), 123–130. doi:10.1038/s41893-021-00815-2.

Taberlet, P., L. Fumagalli, A.-G. Wust-Saucy, and J.-F. Cosson, 'Comparative Phylogeography and Postglacial Colonization Routes in Europe', *Molecular*

Ecology, 7, no. 4 7, no. 4 (1998), 453–464. doi:10.1046/j.1365-294x.1998.00289.x.

Taylor, K., and J. Lennon, 'Cultural Landscapes: A Bridge between Culture and Nature?' ['Cultural Landscapes'], *International Journal of Heritage Studies*, 17, no. 6 17, no. 6 (1 November 2011), 537–554. doi:10.1080/13527258.2011.618246.

Taylor, P.W., *Respect for Nature: A Theory of Environmental Ethics* [*Respect for Nature*], *Respect for Nature*, 1986. doi:10.1515/9781400838530.

The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind [*The Limits to Growth*] (New York, 1972). https://bac-lac.on.worldcat.org/oclc/299359279.

Thompson, A., 'Anthropocentrism. Humanity as Peril and Promise', in ed. S.M. Gardiner and A. Thompson, *The Oxford Handbook of Environmental Ethics* (Oxford, New York, 2017), 77–90.

Tonutti, S., 'Anthropocentrism And The Definition Of "Culture" As A Marker Of The Human/Animal Divide', *Anthropocentrism*, 2011, 183–200. https://brill.com/display/book/edcoll/9789004214941/Bej.9789004187948.i-348_010.xml.

Trewin, B., D. Morgan-Bulled, and S. Cooper, *Australia State of the Environment 2021* (Canberra, 2021). doi:10.26194/rdze-5d59.

Troiano, C., M. Buglione, S. Petrelli, S. Belardinelli, A. De Natale, J.-C. Svenning, and D. Fulgione, 'Traditional Free-Ranging Livestock Farming as a Management Strategy for Biological and Cultural Landscape Diversity: A Case from the Southern Apennines' ['Traditional Free-Ranging Livestock Farming as a Management Strategy for Biological and Cultural Landscape Diversity'], *Land*, 10, no. 9 10, no. 9 (September 2021), 957. doi:10.3390/land10090957.

Tulloch, L., 'On Science, Ecology and Environmentalism', *Policy Futures in Education*, 11, no. 1 11, no. 1 (1 March 2013), 100–114. doi:10.2304/pfie.2013.11.1.100.

UNEP, 'Outcomes Document of the Scoping Meeting for the Seventh Edition of UNEP's Global Environment Outlook (GEO-7)', 7 December 2022.

UNESCO, *Universal Declaration on Cultural Diversity*, 2001. http://portal.unesco.org/en/ev.php-URL_ID=13179%26URL_DO=DO_TOPIC%26URL_SECTION=201.html.

Vacchiano, G., M. Garbarino, E. Lingua, and R. Motta, 'Forest Dynamics and Disturbance Regimes in the Italian Apennines', *Forest Ecology and Management*, 388 388, Ecology of Mountain Forest Ecosystems in Europe (15 March 2017), 57–66. doi:10.1016/j.foreco.2016.10.033.

Wallenhorst, N., 'Dating Debate', in ed. N. Wallenhorst and C. Wulf, *Handbook of the Anthropocene: Humans between Heritage and Future* (Cham, 2023), 349–357. doi:10.1007/978-3-031-25910-4_53.

Wallenhorst, N., and C. Wulf, eds., *Handbook of the Anthropocene. Humans between Heritage and Future* [*Handbook of the Anthropocene*], 2023. https://doi.org/10.1007/978-3-031-25910-4.

Walsh, Z., J. Böhme, and C. Wamsler, 'Towards a Relational Paradigm in Sustainability Research, Practice, and Education', *Ambio*, 50, no. 1 50, no. 1 (2020), 74–84. doi:10.1007/s13280-020-01322-y.

Waters, C.N., M. Williams, J. Zalasiewicz, S.D. Turner, A.D. Barnosky, M.J. Head, S.L. Wing, et al., 'Epochs, Events and Episodes: Marking the Geological

Impact of Humans' ['Epochs, Events and Episodes'], *Earth-Science Reviews*, 234 234 (1 November 2022), 104171. doi:10.1016/j.earscirev.2022.104171.

Wegner, G., and U. Pascual, 'Cost-Benefit Analysis in the Context of Ecosystem Services for Human Well-Being: A Multidisciplinary Critique' ['Cost-Benefit Analysis in the Context of Ecosystem Services for Human Well-Being'], *Global Environmental Change*, 21, no. 2 21, no. 2, Special Issue on The Politics and Policy of Carbon Capture and Storage (1 May 2011), 492–504. doi:10.1016/j.gloenvcha.2010.12.008.

West, S., L.J. Haider, S. Stålhammar, and S. Woroniecki, 'A Relational Turn for Sustainability Science? Relational Thinking, Leverage Points and Transformations' ['A Relational Turn for Sustainability Science?'], *Ecosystems and People*, 16, no. 1 16, no. 1 (1 January 2020), 304–325. doi:10.1080/26395916.2020.1814417.

White, Jr., L., 'The Historical Roots of Our Ecologic Crisis', *Science*, 155, no. 3767 155, no. 3767 (1967), 1203–1207. doi:10.1126/science.155.3767.1203.

Whyte, K.P., 'On the Role of Traditional Ecological Knowledge as a Collaborative Concept: A Philosophical Study' ['On the Role of Traditional Ecological Knowledge as a Collaborative Concept'], *Ecological Processes*, 2, no. 1 2, no. 1 (5 April 2013), 7. doi:10.1186/2192-1709-2-7.

Wilson, E.O., *Biophilia. The Human Bond with Other Species* [*Biophilia*] (Cambridge, MA, 1984).

———, 'The Biological Diversity Crisis: A Challenge to Science' ['The Biological Diversity Crisis'], *Issues in Science and Technology*, 2, no. 1 2, no. 1 (1985), 20–29.

Worm, B., and R.T. Paine, 'Humans as a Hyperkeystone Species', *Trends in Ecology & Evolution*, 31, no. 8 31, no. 8 (1 August 2016), 600–607. doi:10.1016/j.tree.2016.05.008.

Worster, D., 'John Muir and the Modern Passion for Nature', *Environmental History*, 10, no. 1 10, no. 1 (2005), 8–19.

Xu, C., T.A. Kohler, T.M. Lenton, J.-C. Svenning, and M. Scheffer, 'Future of the Human Climate Niche', *Proceedings of the National Academy of Sciences*, 117, no. 21 117, no. 21 (26 May 2020), 11350–11355. doi:10.1073/pnas.1910114117.

Zalasiewicz, J., C.N. Waters, E.C. Ellis, M.J. Head, D. Vidas, W. Steffen, J.A. Thomas, et al., 'The Anthropocene: Comparing Its Meaning in Geology (Chronostratigraphy) with Conceptual Approaches Arising in Other Disciplines' ['The Anthropocene'], *Earth's Future*, 9, no. 3 9, no. 3 (2021), e2020EF001896. doi:10.1029/2020EF001896.

Zammito, J.H., P.J. Ivanhoe, H. Longino, and P.R. Sloan, 'Philosophical Approaches to Nature', in ed. B.A. Lustig, B. Baruch A., and M. Gerald P., *Altering Nature*, vol. Volume One: Concepts of 'Nature' and 'The Natural' in Biotechnology Debates, vol. Volume One: Concepts of 'Nature' and 'The Natural' in Biotechnology Debates, 2008, 63–136.

Zeder, M.A., 'Domestication and Early Agriculture in the Mediterranean Basin: Origins, Diffusion, and Impact' ['Domestication and Early Agriculture in the Mediterranean Basin'], *Proceedings of the National Academy of Sciences*, 105, no. 33 105, no. 33 (19 August 2008), 11597–11604. doi:10.1073/pnas.0801317105.

Zent, S., and E. Zent, 'Processual Perspectives on Traditional Environmental Knowledge Continuity, Erosion, Transformation, Innovation', in ed. R. Ellen, S.J. Lycett, and S.E. Johns, *Understanding Cultural Transmission in*

Anthropology: A Critical Synthesis (New York and Oxford, 2013). https://www.academia.edu/4484275/Processual_Perspectives_on_Traditional_Environmental_Knowledge_Continuity_Erosion_Transformation_Innovation.

Zohary, D., M. Hopf (deceased), and E. Weiss, *Domestication of Plants in the Old World: The Origin and Spread of Domesticated Plants in Southwest Asia, Europe, and the Mediterranean Basin* [*Domestication of Plants in the Old World*], 2012.