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Natures instead of nature—plural perceptions and representations of nature and its challenges for ecological transition: a systematic review of the scientific production

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Abstract

Background Recognizing nature and the environment as sociocultural constructions is critical to enhancing a transformational ecological change. This involves understanding their diverse sociocultural meanings and societal approaches and how these understandings affect equitable ecological transitions. We reviewed empirical studies and essays, categorizing 161 studies into three main categories: opposition, domination, and interdependencies, reflecting varying knowledge, power dynamics, cultures, and contexts. These studies aim to uncover how societies conceptualize, explain, and engage with nature and the environment, shaping society–nature relationships and influencing ecological transitions.

Results This study underscores the diverse perceptions and representations of nature, from a controllable resource to an integrated web of life. Three main categories emerged: (i) nature against society, in a logic of opposition; (ii) nature subordinated to society, in a logic of domination, although integrated into society; and (iii) nature united with society, in a logic of interdependence. Thus, this study advocates discussing "natures" as sociocultural constructs, highlighting the plurality of social perceptions and representations, which can inform policies and challenge socio-political and socio-economic systems.

Conclusions This review may pave the way to, first, give visibility and value that diversity and plurality as an instrument that can enrich policies and defy socio-political and socio-economic systems to change and, second, identify the main drivers and resistances that the implementation of an ecological transformation change may face in different sociocultural contexts.

Keywords Society–nature relations, Nature perceptions and representations, Environment perceptions and representations, Systematic literature review, Ecological transition

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Introduction

Social, cultural, and historical factors shape societies' understanding and interpretation of nature. That is why our cultural and social background influences how we perceive, interpret, and value the natural world. Rather than being an objective reality, nature is deeply intertwined into the fabric of human cognition and social behaviours, created by power relations that govern its perception and use. This insight emphasizes the importance of investigating how different communities understand and value the natural environment and the repercussions of that interpretation on the ecological transition.

Literature has made progress in deconstructing these human–nature relationships. The review of Flint et al. [1] aimed to examine empirically established categories of human–nature interactions considering ecosystem services and actions within landscapes; the work of Raymond et al. [2] explored the use of various metaphors of human–environment relationships for evaluating social–ecological systems or even the work of van den Born [3] which give insight into the visions of nature of lay people and the extent to which these visions of nature reflect those of philosophers. However, gaps still exist, notably in comprehensively addressing the range and complexity of societal perspectives on nature and the environment. Our research aims to fill this gap by conducting a thorough review of existing scientific production, with a dual focus: first, to map out the various conceptions and representations of nature and the environment, and second, to identify the key drivers and barriers to ecological transition, particularly in the multicultural context of Europe.

Our approach is based on the awareness that nature and the environment are socially constructed entities with meanings that differ across cultural and historical contexts [4–7]. Nature frequently refers to the physical world, and its perception is influenced by social variables, resulting in different and context-specific understandings [8]. Because human engagement with nature is closely entangled with societal views, cultural norms, and historical narratives, different civilizations develop their sense of 'nature' based on their cultural origins and historical legacies [9]. In contrast, the term 'environment' refers to natural and human-made elements and serves as the broader framework within which nature operates [9]. This formulation may give the impression of overlooking a fundamental aspect defended by authors in science and technology studies, particularly the idea that nature does not transcend the "social" constructions we impose upon it. This perspective underscores the interconnectedness between humans and more-than-human, a concept central to the "cosmopolitics" advanced by influential figures such as Isabelle Stengers [10, 11] and Bruno Latour. This division, often reflected in concepts like "nature" and "environment," has been extensively discussed by Latour, especially in seminal works like "Reassembling the Social" [12] and "We Have Never Been Modern" [8]. In these works, as well as in his article "Whose Cosmos, Which Cosmopolitics?" [13], Latour delves into the limitations of social constructivism and advocates for a more nuanced understanding that acknowledges the entanglement of human and non-human entities. While our use of the notion of "environment" may seem to perpetuate this dichotomy, it is essential to recognize that our intention was to highlight the plurality of perceptions and representations of nature, thereby challenging dominant discourses of opposition and domination. By acknowledging the existence of multiple "natures" and emphasizing interdependence, we seek to pave the way for a more holistic view of human-nature interactions.

However, these conceptualizations are not divorced from power dynamics. Dominant groups influence society's attitudes and interactions with the environment, sustaining inequalities and exploitative activities. This power asymmetry stems from a Western Cartesian narrative that divides nature and society, maintaining colonial, capitalist, and patriarchal ideas that support environmental injustices [14]. Furthermore, marginalized people, especially women, are doubly disenfranchized under this paradigm, vulnerable to exploitation and dominance alongside nature. Ecofeminist approaches reveal how these interlocking oppressions reinforce colonial logic, sustaining a cycle of exploitation and marginalization. The effects of this mindset go beyond social injustices, increasing global environmental issues like climate change. These repercussions disproportionately affect vulnerable people, expanding the gap between the Global North and South and emphasizing the urgent need for a more equitable and inclusive approach to environmental governance [15–18].

Not all humans are considered on the culture side. Ecofeminism points out that women, nature, and the environment are exploited and dominated by Western society [19]. It reproduces the same colonial logic that represented nature as an object to be exploited and the colonized people as "intuitive," "savage," "emotional," and "instinctive" persons [20–23]. The primary justification was the "rescue" of the non-European world from a state of primitive nature into a state of Civilization [24]. As Cronon [25] states in his essay, this romanticized view of wilderness has led to problematic consequences, including the marginalization of indigenous peoples, a narrow focus on preserving specific "wild" areas, and a disconnection between humans and the rest of the natural world. In a recent review, Beery et al. [26] argue that this disconnection from nature has received

comparatively less attention and lacks comprehensive theoretical development, which would benefit from moving beyond the individual level to encompass broader societal and collective dimensions of disconnection, such as institutional, sociocultural, and power-related factors that contribute to disconnection [26].

In recent years, there has been a rising appreciation for the importance and validity of indigenous and local knowledge systems in improving our understanding of biodiversity governance and ecosystem management for human well-being. Tengo et al. [27] propose incorporating knowledge systems, including indigenous, local, and scientific knowledge, within global assessment frameworks like the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES). Their approach, known as the multiple evidence basis (MEB), emphasizes the value of viewing different knowledge systems as complimentary rather than competing. MEB allows for a more thorough understanding of complex situations and collaborative assessments across knowledge domains by evaluating knowledge inside each system and recognizing the unique insights it provides.

Similarly, Pascual et al. [28] emphasize overcoming hurdles and incorporating nature's values into decision-making processes. Despite international accords and frameworks emphasizing the need to value ecosystem services, present policies frequently prioritize market-based values, leaving out other ways people benefit from nature. Drawing on vast scientific literature and indigenous and local knowledge sources, IPBES evaluated the importance of multiple values in policymaking and recommended value-centred ways to overcome existing impediments. By embracing a larger spectrum of beliefs and viewpoints, governments may work towards more just and sustainable futures that respect people and nature equally across generations.

In addressing these intricacies, our research aims to challenge dominant discourses and pave the path for a more nuanced view of human–nature interactions. As such, it is relevant to ask to what extent representations and perceptions of nature and environment produce hegemonic discourses, which are dominant or prevailing narratives, ideologies, or beliefs about nature and environment that exert significant influence over society's understanding and actions, as well as specific meanings and social-cultural practices as well as specific meanings and social-cultural practices? Moreover, whether these plural perceptions and representations of nature and the environment produce resistance or facilitate the path of ecological transition? First, it is necessary to deconstruct the Western Cartesian narrative to answer those questions. This perspective often stems from Descartes' philosophical dualism, which posited a clear separation between the mind (thinking, rational) and the body (physical, material), which continues to perceive nature and society/culture as antagonistic poles [29]. This separation conceived the modern Western concept of nature as the great outside. It separated from humanity, being the later in command of the former [30]. Secondly, it is vital to recall the agency of nature in the context of ecological transition since it is based on the concept of "interdependence" between natural, economic, and social phenomena, which is crucial to starting along the path of sustainable development. Supported by Nash [31], we argue that human agency–defined as an actor's ability to act in a particular environment—cannot be separated from the "environments" in which that agency exists. Furthermore, we are tempted to argue that humans are not the sole "engine of history." Instead, the interdependence and agency of all living species, whether human or non-human, create the endless possibilities of coexistence and so serves as the agents of history.

Background

Nature has constantly challenged various cultures and civilizations to seek relationships serving each era's dominant visions. Our relationship with nature has always expressed the ambivalence between the need to ensure our survival and the need to respect it as a form of life that shelters multiple lives and makes them possible. The search for knowledge of its diversity and mysteries has both motivated us to try to dominate nature by appropriating its elements and inspired us to understand, as expressed in artistic, philosophical, and scientific production throughout history. These visions are mirrored in the world of life where complex and multifaceted forms of relationship with nature are drawn and affirmed, hence the importance of this study, which seeks to account for these relationships in recent studies. Although living without nature is impossible, that fact cannot justify the abuse and extractive logic that has guided humanity's relationship with nature. Therefore, the possibility of harmonious coexistence and interdependence between people and nature can be achieved in the various forms of social organization that express particular social constructions in their interactions and the references, principles, and virtues articulated by social policies and norms. Talking about the social construction of nature implies an ontological discussion, not only an epistemic one, that is "multinatural" and not multicultural. Considering the insights from Mario Blaser's [32] work on political ontology, deepening our understanding of the ontological dimensions of ecological transitions is essential. Blaser's perspective highlights the need to go beyond merely recognizing different ways of knowing and engage in a broader discussion about the nature of reality itself,

arguing that discussions about the social construction of nature inherently involve ontological considerations, not just epistemic ones. He emphasizes the concept of "multiculturalism," which suggests that there are multiple, interconnected ontologies or ways of being in the world. Blaser's analysis challenges the adequacy of multicultural frameworks in addressing ecological transitions, instead proposing a focus on these movements' ontological dimensions.

Ecology studies have proposed one way of perceiving the mutual relationship between nature and society through the "ecosystem services" concept [33]. Initially proposed by the Millennium Ecosystem Assessment [34], this concept is part of the CICES (Common International Classification of Ecosystem Services) and is structured into three typologies: provisioning, regulation/maintenance, and cultural services [35]. Ecology studies have been valuing the "cultural services of ecosystems" to contemplate the multidimensional character of ecosystems, that is, the connections of the environment and nature with spiritual, sociocultural, ethical, epistemological, political, ontological, and emotional dimensions crucial to the human well-being [36–48].

The relationship between ecosystems, environment, and nature stems from their shared focus on the natural world and the recognition of the interconnectedness and interdependence of living organisms and their environment. These concepts have been developed through integrating knowledge and ideas from various disciplines, such as ecology, biology, geology, geography, and social and environmental sciences [49, 50].

While interdisciplinary studies in the field of 'relations nature–environment–society' have flourished in various disciplines, it is imperative to acknowledge the vital role played by the science of education and environmental education in shaping our understanding of these complex relationships. Environmental education can be understood as a means to intellectually, emotionally, and ethically engage people with the environment [51]. However, it should go beyond conveying facts and data to inspire a profound connection and stewardship for the natural world [52]. This becomes apparent in the context of children, as their interactions during childhood with a wide range of living and non-living elements from nature create valuable learning experiences, including developing an understanding of biodiversity [53]. Also, environmental education can bridge disciplinary boundaries, encouraging the integration of diverse knowledge and perspectives in addressing environmental issues. As Beery [54] stated, our capacity to mentally separate ourselves from the broader natural world may partly be responsible for environmental degradation. Therefore, challenging the binary distinction between nature and culture is both valuable and constructive, which can be done by outdoor environmental education transcending this problematic dichotomy and encouraging more relational discourse.

Also, the ecosystem services field is deeply rooted in and influenced by the concept of connectedness theory, as it has played a significant role in shaping how we perceive and study the relationship between nature and human well-being [52], namely emphasizing the need for individuals and societies to foster a sense of kinship, respect, and responsibility towards the environment [55]. The seminal work of Chawla [56] highlights the importance of personal experiences in nature and the development of environmental identity, suggesting that throughout human history and civilizations, various cultures, civilizations, and indigenous knowledge systems have recognized the importance of nature's benefits and have developed ways to harness and protect them.

As scientific understanding advanced, there has been an increasing recognition of ecosystems' complex and dynamic nature, the importance of environmental factors in shaping ecosystems, and the intrinsic value of nature [57]. This has led to these terms' intermingling and overlapping usage, as they are often used interchangeably in everyday language and academic discourse [58]. However, the concept of "ecosystem services" can be problematic in the sense of implying the Western modern anthropocentric rationality behind it, precisely in considering that nature and the environment have essential "services" for human benefit [40]. In that regard, the conceptual model proposed in 2013 by the IPBES introduced an alternative language to identify and classify ecosystem services [59]. In short, IPBES proposed the concept of Nature's Contributions to People [60] to suggest a more inclusive and respectful approach to the different representations of nature. In this approach, nature does not have the function of serving people, and it proposes a holistic logic that is less utilitarian and more inclusive and focused on nature's agency and its intrinsic values.

Therefore, four challenges stand out: (1) to consider the agency and the interdependency of humans and non-humans for a better understanding of social practices [61]; (2) the recognition of different forms of social participation through the engagement of communities with the social-cultural world and nature, implying bottom-up policies to face the effects of climate change [62]; (3) the conception and implementation of policies that consider effectively the local sociocultural specificities and needs, and local effects imposed by climate change, to deal, sustainably and inclusively, with the ecological and environmental crisis [63]; (4) to consider in the deliberative and participatory settings different forms of knowledge (traditional, erudite, ecological, local, scientific, artistic,

popular, lay, among many others), language and actors. Also, it includes the kind of knowledge born out of the struggles of the social movements for human dignity and, thus, the epistemological diversity of the world against the dominant ways of knowing [64–66].

A shift of paradigm is necessary, both in the way we look at nature (which is not at the "service" of humans) and in terms of individual and collective values and behaviours (which are not apart from nature and the environment). In that sense, access to the individual and collective perceptions and representations about nature and the environment is crucial and must be framed within sociocultural backgrounds. Monitoring and understanding these ecological relationships will contribute to an effective, transformative ecological transition by mitigating the harmful effects of climate change on nature and society and combating environmental degradation and biodiversity loss in the world [67, 68]. Social transformation needs a collective awareness of the social construction of nature and the environment to allow an understanding of the drivers and constraints of ecological transition.

Current discussions have moved beyond Latour's and Escobar's classic works. Some critical advances in the field were made by authors like Arturo Escobar's "Thinking-feeling with the Earth: Territorial Struggles and the Ontological Dimension of the Epistemologies of the South" [69], Marisol de la Cadena and Blaser's "The Uncommons: An Introduction" [70], and their books "Earth Beings. Ecologies of Practice Across Andean Worlds" [71] and "Storytelling Globalization from the Chaco and Beyond" [72]. Drawing on Latour's work, Escobar, like Blaser, insists that, rather than speaking of multiculturalism, ecological transition require that diverse knowledge be taken seriously, not as different perspectives or ways of "seeing things," but as different ways of "making the world," which is why it is critical to recognize "multinaturalism" as a starting point.

Methods

This systematic literature review enabled us to identify academic publications based on the main concepts of nature–environment–society–culture relations. It was based on the search for interdisciplinary studies from socio-environmental, biological, philosophical, sociological, environmental, educational, and anthropological perspectives, considering the plurality of social representations and perceptions that emerged from different cultures and their individuals. The systematic literature review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [73].

The research strategy to understand which are the sociocultural representations of nature and environment across different sociocultural contexts was run on the Web of Science, Scopus, and Google Scholar since they are scholarly databases that include documents from different publishers [74, 75]. The authors are aware that most, if not all, countries in the Global South cannot access those commercial databases [76]. They are costly for most universities outside the Global North and represent journals and ideologies that do not encompass or reflect other "natures" and "societies." However, this intentional decision was made to identify these databases' hegemonic narratives and reflect on how they restrict a fair ecological transition.

The multi-stranded search had different searches combined with the Boolean operator OR/AND. The search examined the title, abstract, author keywords, and keywords plus (Table 1).

Since the aim was to consider the diversity of perceptions and representations, there were no restrictions

Table 1 Databases and queries used in the systematic literature review

Databases	Queries
Web of Science	{[TS = (nature)] AND TS = (environment)} AND TS = (representation)
	{[TS = (nature)] AND TS = (environment)} AND TS = (definition)
	{[TS = (nature)] AND TS = (environment)} AND TS = (understanding)
	{[TS = (nature)] AND TS = (environment)} AND TS = (perception)
Scopus	[TITLE-ABS-KEY ("social representations of nature") OR TITLE-ABS-KEY ("social representations of environment")]
	[TITLE-ABS-KEY ("social perceptions of nature") OR TITLE-ABS-KEY ("social perceptions of environment")]
Google Scholar	allintitle: "social representations of nature"
	allintitle: "social representations of environment"
	allintitle: "social perceptions of nature"
	allintitle: "social perceptions of environment"

regarding the publication date, document type, or language. In the case of non-English papers, they were identified during the initial search and subjected to a two-step process. First, we obtained translations of the titles and abstracts of these papers into English. This allowed us to assess the paper's relevance to our research based on the available information. Second, after obtaining translations, the relevance of non-English papers was assessed using the same criteria as for English-language papers. We examined whether the content of the paper pertained to the intersection of "Nature," "Environment," "Representation," "Understanding," "Definition," and "Perception."

The titles and abstracts of bibliographic records were downloaded and imported into Mendeley's bibliographic management software before all duplicate records were deleted. The search was conducted on May 18, 2022, and the flowchart of procedures taken to select relevant studies to be included in this review is shown in Fig. 1. The search returned 27169 documents, and 29 documents were added to the database by searching Google Scholar and Scopus and screening the cited references of the retrieved initial results (hand search). In the case of hand search, we evaluate the documents using the same inclusion criteria applied to the electronically sourced papers. During the hand search, we meticulously examined various sources beyond electronic databases. This included scrutinizing the reference lists of articles and books we identified as relevant through our initial search. We also explored vital journals and conference proceedings,

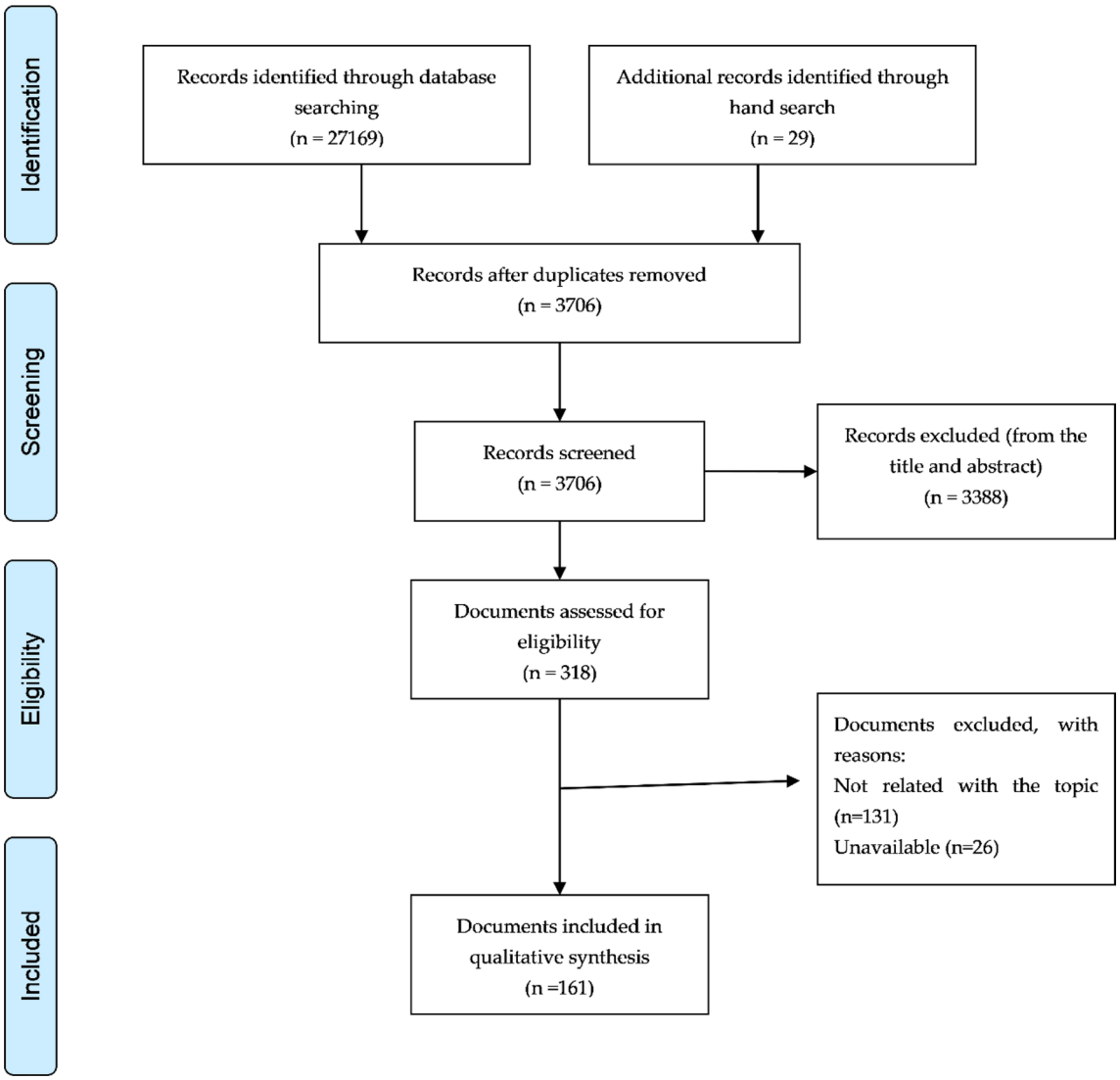

Fig. 1 Procedures for literature search and selection—adapted from Moher et al. [73]

particularly those known for publishing seminal work. After duplicates were removed, we screened 3706 papers. We assessed whether the content of the materials was pertinent to our research objectives, focusing on the portrayal and understanding of "nature" and "environment" in a social context. The next step consisted of screening both titles and abstracts of documents to select those presenting social representations of nature and the environment and, when possible, those describing nature–society relations. The following inclusion criteria were defined to screen the documents. Documents simply mentioning nature or environment concepts without exploring their meanings were excluded, such as documents that were unavailable to consult, i.e., those that are behind paywalls or those that are not accessible online or through the researcher's institution. Additionally, papers that are out of print or not accessible due to restrictions on access imposed by publishers or copyright holders could also be considered unavailable for consultation.

Full texts of the remaining 318 documents were carefully read to retrieve the information related to representations of nature and the environment. During this process, 157 more documents were excluded as they were unavailable or did not include details related to the social representations of nature and the environment.

Despite being aware that some other related documents may exist that have not been identified through our approach, the aim was to systematize the evidence regarding this diversity of perceptions, considering social representations of nature and environment but also the society-nature relations presented in the scientific literature in these databases. Also, the number of documents reviewed is considerable in identifying the plurality of representations and perceptions, which means adding more papers may not necessarily lead to new or different results.

The information retrieved from the analysed studies was organized in a Microsoft Excel sheet such as the database, title, author(s) name(s), year, author(s) affiliation country(ies), study area(s), study scientific area, objectives, methodology and target group (available in supplementary material). Precise and reflexive information was also collected, namely, if nature and environment concepts are conceptualized in the same way, the social representations of nature, the social representations of the environment, and how society-nature relations are described.

The VOSviewer software [77] was used to conduct a bibliometric analysis, and a keyword's minimum number of occurrences was set at 5 to reflect its importance and relatedness to other keywords, automatically generating the figures. Of the 1018 keywords, 25 meet the threshold. Each circle represents a keyword, and the size of the circle varies according to the frequency of the keyword (i.e., the larger the circle, the higher the frequency). The distance between circles and the established networking represented by lines characterizes the relation between keywords (i.e., keywords that are closer and have stronger links are more closely related). Colours are determined by the cluster to which the keyword belongs, which was automatically originated by the VOSviewer software based on the previous input information. The analysis was divided into two phases, and seven distinct colour groups can be observed with different sizes, reflecting the link and strength of keywords.

A manually inductive content-analysis method was adopted to perform a qualitative synthesis of the information collected [78] wherein the authors immersed themselves in the data to identify patterns, themes, and categories through a bottom-up, iterative process without predefined categories. Despite being a time-consuming task, when conducting a systematic review where existing knowledge is somewhat fragmented and dispersed and, as is the case of this review, inductive content analysis is considered a desirable method since no previous assumptions are considered and bias is reduced [79]. However, this qualitative analysis involves subjectivity processes in that the researchers define the categories. The coding of each document integrated into this review was discussed among all the authors.

Results

Global overview

An overview of the 161 documents included in this review revealed that the majority have been published by authors affiliated with North American (36%) or European institutions (33.5%). Regarding Fig. 2, nature and environment representations are mainly described from a Western viewpoint. Africa and Central America represent only 5% of the studies included in this review. On the contrary, regarding the geographical contexts of the studies, the percentage of those conducted in South America and Africa almost doubled, from 5% to 9.3%. In the studies analysed, 72 (44.7%) conceptualized nature in the same way as the environment, and only 33 (20.5%) conceptualized these concepts differently (Fig. 3). Of the 161 studies, it was impossible to identify a clear position on these concepts in 56 (34.8%).

Regarding the type of document, a balance can be observed between empirical research studies (51%) and essays (including perspectives/opinion pieces) (49%). It should be noted that despite a considerable number of essays having been considered, their relevance as a source is recognized, namely as a source of a deep analysis that aims to connect empirical studies and define or advance a theoretical position. The number of publications in this

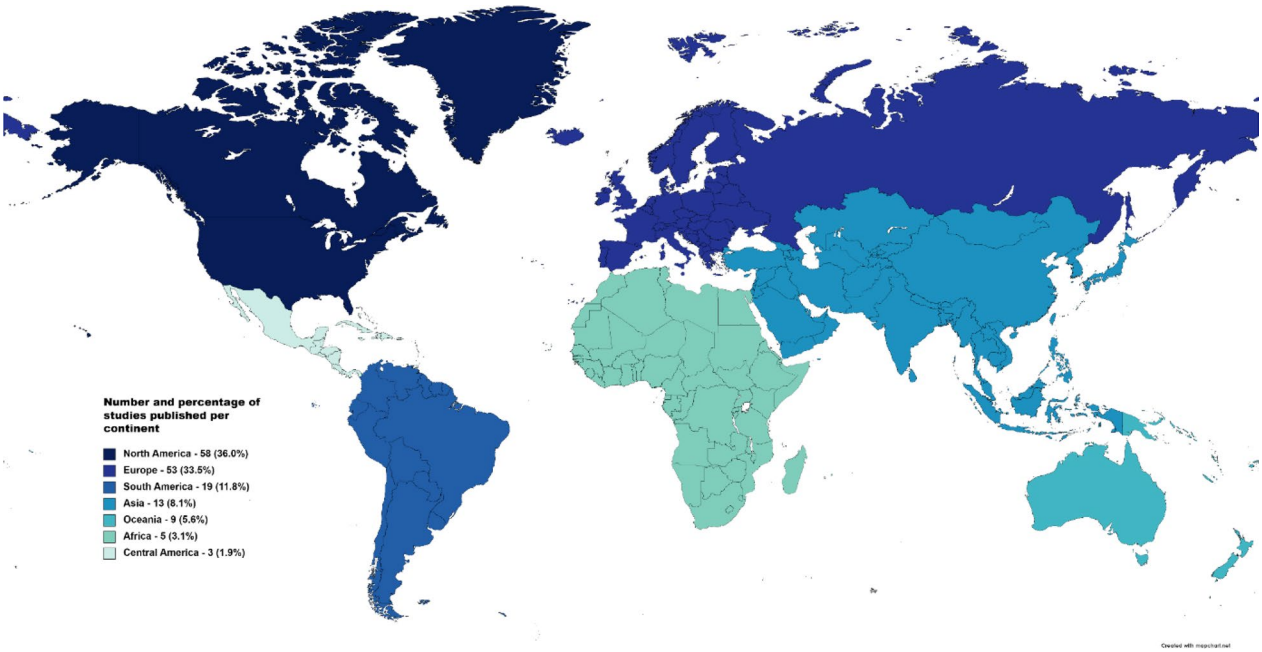

Fig. 2 Number (n) and percentage (%) of studies published per continent included in the review

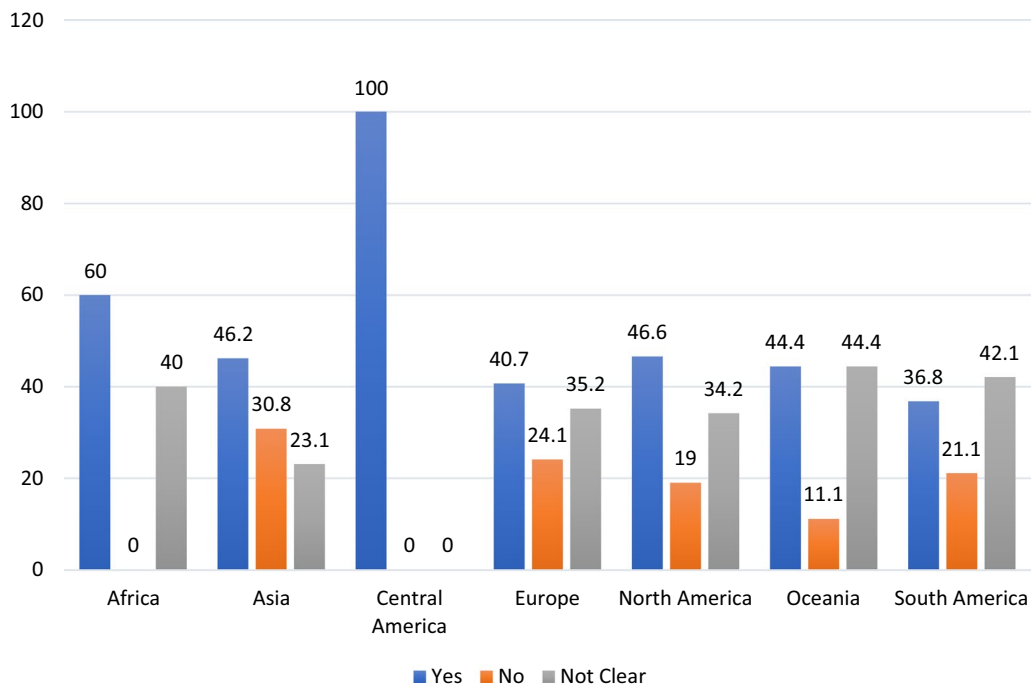

Fig. 3 Percentage of studies (%) by continent and how if they conceptualized Nature and Environment concepts in the same way

area spanned from 1969–2022 (about five decades) and has increased consistently since 2012, reaching the maximum in 2019 (Fig. 4). This trend matches the date of the publication of the conceptual framework for the IPBES [59], which aimed to enhance "a positive transformation in the elements and interlinkages that are the causes of detrimental changes in biodiversity and ecosystems and

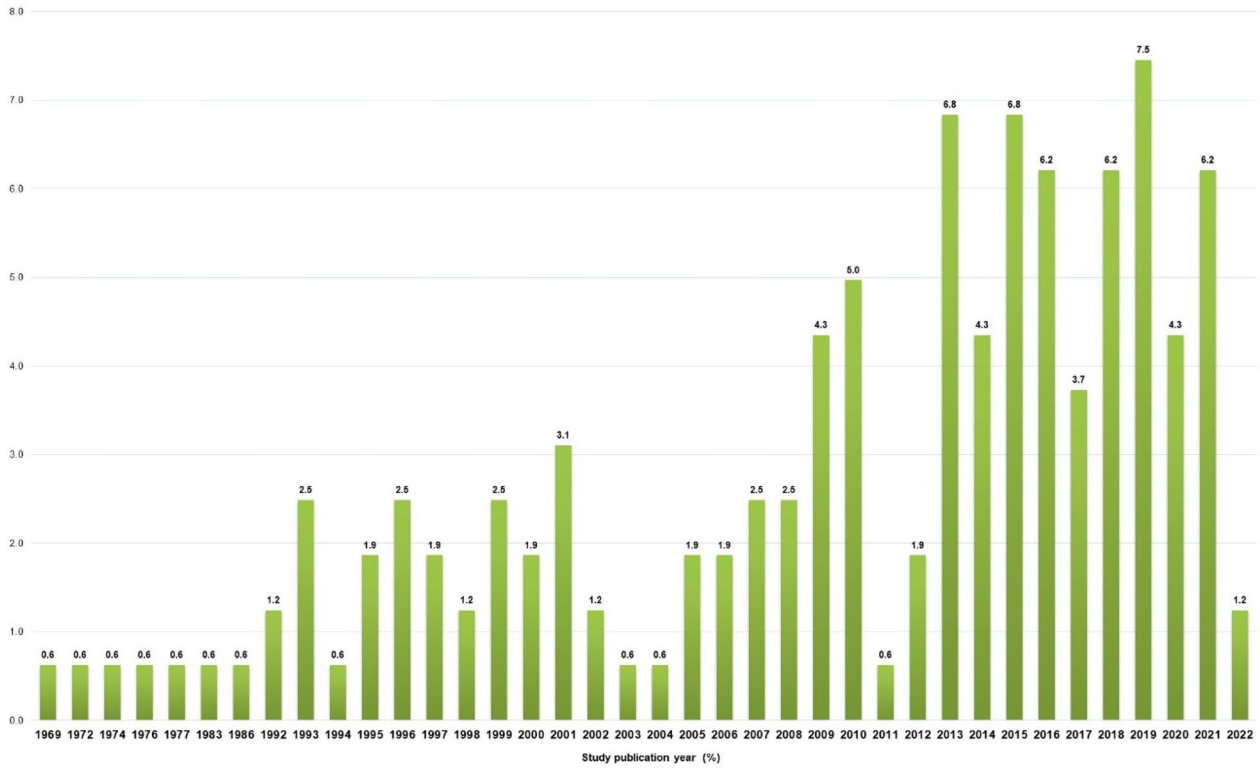

Fig. 4 Percentage of studies (%) by year of publication

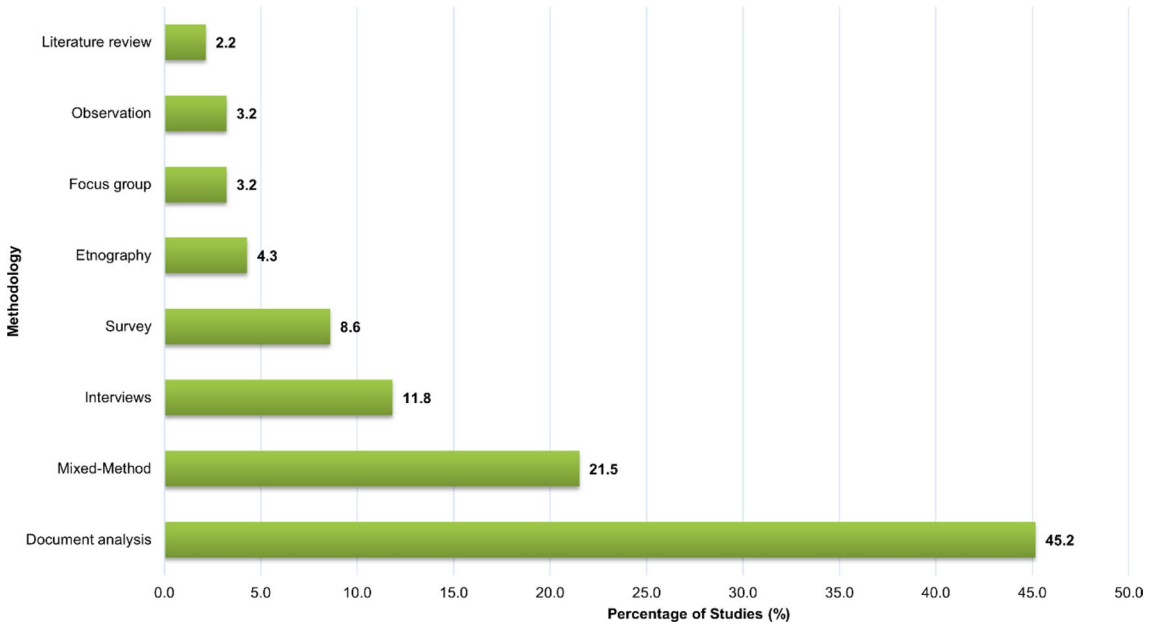

Fig. 5 Percentage of empirical research studies (%) by methodological approach

subsequent loss of their benefits to present and future generations" [80].

Concerning the empirical research, it can be observed from Fig. 5 that most of the studies adopted a document analysis approach (45.2%). This qualitative approach aims to interpret the sources to give voice and meaning to an assessment topic [81]. Also, 21.6% adopt a mixed-method approach to deal with nature representations, meaning that one approach may not be enough to embrace the complexity of this topic.

In a dynamic field like nature and environment representations, where new concepts and perspectives may be continually evolving, it can be helpful to analyse the co-occurrence of keywords used in the documents reviewed. Also, performing this analysis may reveal gaps in the literature where specific keywords or themes are not well-connected or are underrepresented.

The first cluster relates to the co-occurrence network of the keyword map (Fig. 6). The red cluster joined keywords like ecocriticism, ecology, environmentalism, history, place, and sustainability. The green cluster comprises keywords such as Anthropocene, climate change, culture, environmental ethics, and perception. The blue cluster includes keywords such as children, animals, environmental education, health, and nature. The conservation, landscape, nature conservation, and social representations materialize the yellow cluster. The last cluster, purple, is made of keywords like discourse, environment, representation, and sustainable development. The second analysis aimed to examine the network of keywords spanned through time (Fig. 7), revealing that the environment keyword was used before the keyword nature.

Qualitative analysis of the studies

After the overview of the documents included in this review, a manually inductive content-analysis method was adopted to identify the main categories that emerged. From the qualitative analysis of the 161 studies, a first attempt to categorise these studies identified three significant categories, anchored in designations that echo from previous attempts (such as Muhar et al. [82] and Van der Born [83]), and which will be analysed in more detail in the following sections: (i) nature against society, in a logic of opposition [84], dualism; (ii) nature subordinated to society, in a logic of domination [85], although integrated into the society; (iii) nature united

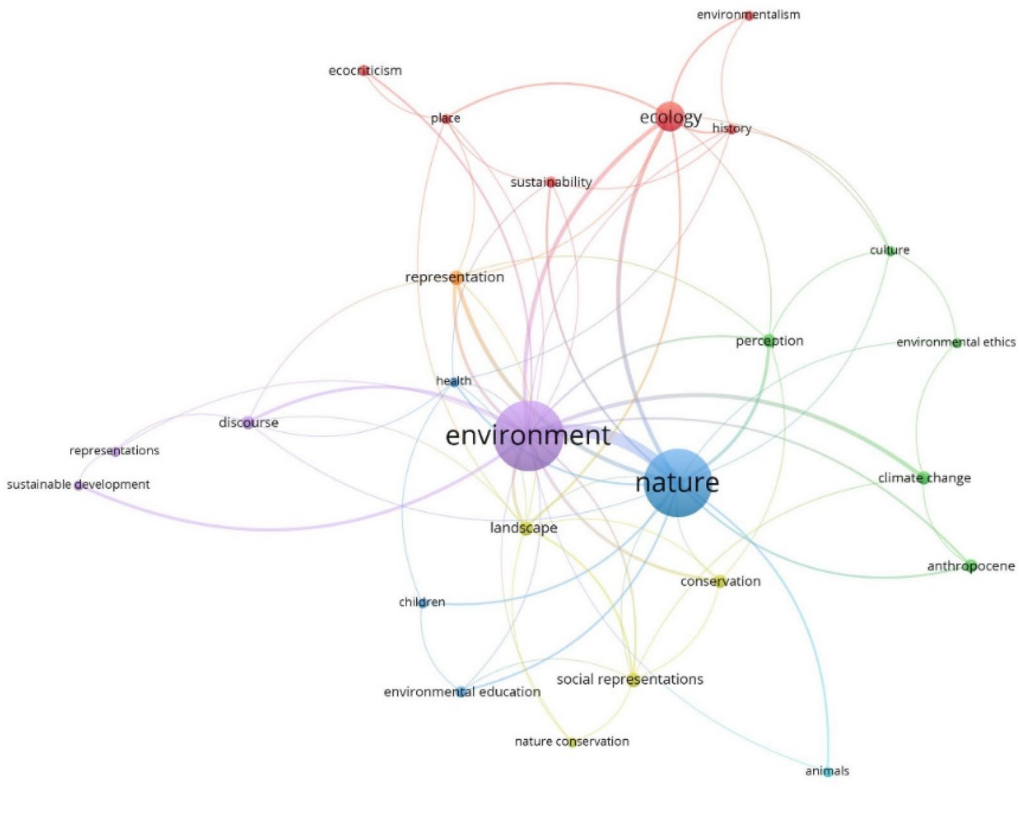

Fig. 6 Co-occurrence network of keyword map, generated using the software VOSviewer 1.6.11

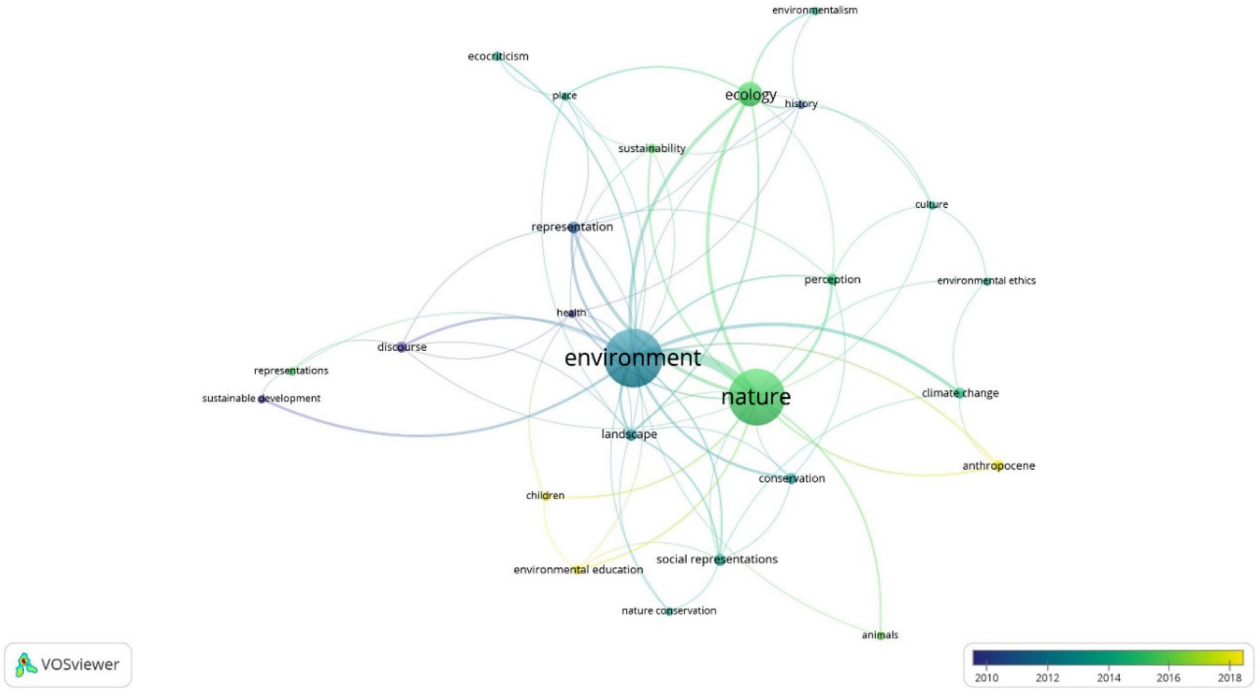

Fig. 7 Co-occurrence network of keyword map spanned through the time, generated using the software VOSviewer 1.6.11

with society, in a logic of interdependence [86]. Figure 8 was constructed using a qualitative analysis of the three categories identified from the literature review and seeks to systematize in a relational logic the multiple interactions between: ethical claim, nature understanding, and society–nature relations. Assuming that the boundaries between the categories are not watertight—for example, the objectification of nature occurs in the category of opposition as well as in domination—but rather communicable, this exercise seeks to highlight the need to foster interdependent relationships between all elements that make up each ecosystem, human and non-human, so that the ecological transition can be successful.

The story of opposition emerges in the category of nature against society, showing nature as distinct from and frequently at odds with human society. This viewpoint emphasizes historical and cultural narratives that depict nature as a realm to be conquered or controlled by human efforts. While this division may appear to be a precondition for society's dominance over nature, it is critical to recognize that these notions are not incompatible. Instead, the concept of opposition allows

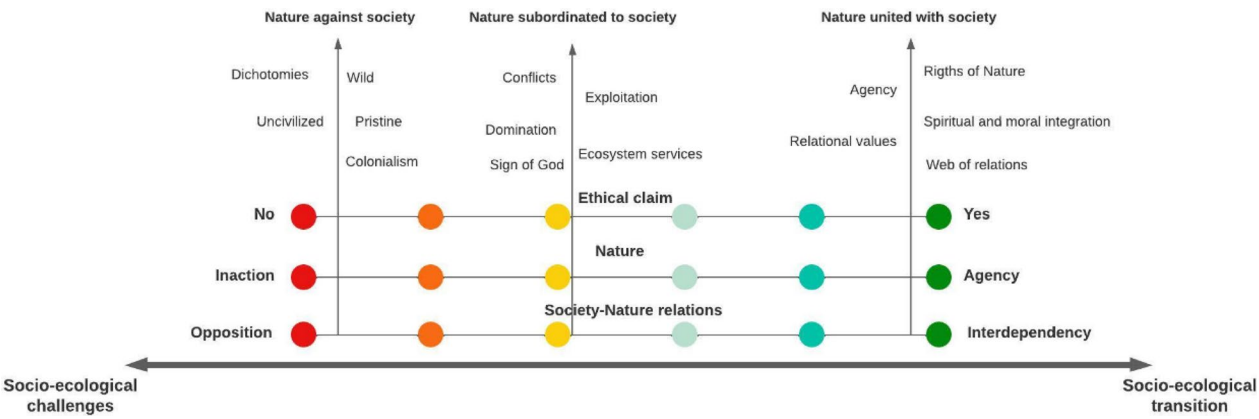

Fig. 8 Model of analysis considering the three categories that emerged from the reviewed studies, their characteristics and according to their ethical claim, nature representation, and how society-nature relations are described

for investigating how society's attitudes and actions towards nature can perpetuate destructive practices like exploitation and environmental destruction. On the other hand, the nature category subordinated to society delves into power dynamics, where nature is seen as subordinate to human interests and desires. This concept encompasses notions of controlling, exploiting, and manipulating natural resources for human benefit. While separation may facilitate domination, it is crucial to acknowledge that domination can occur even in contexts where there is an acknowledgment of the interconnectedness between nature and society. Understanding domination involves examining the various mechanisms through which power is exercised over nature, including economic, political, and cultural systems.

In contrast, the category of nature united with society—interdependence—emphasizes the links and mutual reliance between humans and non-humans. This viewpoint acknowledges that humans are essential components of ecosystems, and their well-being is inextricably linked to environmental health. While antagonism and domination may imply a one-sided interaction between humans and nature, interdependence recognizes that both elements impact each other in multiple ways. Exploring interdependence enables the exploration of long-term approaches to human–nature relationships that prioritize mutual respect, cooperation, and coexistence over dominance or antagonism.

An analysis of these three categories' distribution by the year of their publication reveals some noticeable tendencies in the portrayal of nature in scientific production throughout different periods and categories (Fig. 9). The fraction of publications portraying nature as opposed to society varies with time, with maxima in 1980–1989, 1970–1979, and 2020. The percentage of publications showing nature as subordinate to society appears to be declining over time, with a notable drop from 1980–1989 to 2000–2009. This tendency indicates a lessening emphasis on human dominance over nature in scientific discourse. Finally, from 2000–2009 to 2010–2019, the percentage of publications depicting nature as intertwined with society fluctuated but increased. This shows that scientific literature has increasingly recognized the connectivity and mutual dependency of human societies and the natural world in recent decades. These tendencies point to changing viewpoints on the interaction between nature and society in scientific discourse across time.

Nature against society—opposition

The "Opposition" category represents 19.9% of the studies analysed in this review. Most (84.4%) of these studies were conducted in Europe and North America, a set of studies that do not distinguish the concepts of nature and environment (46.9%). In this category, nature is conceptualized as something that has no human intervention [87–90], in the sense of being wild [91, 92], untouched,

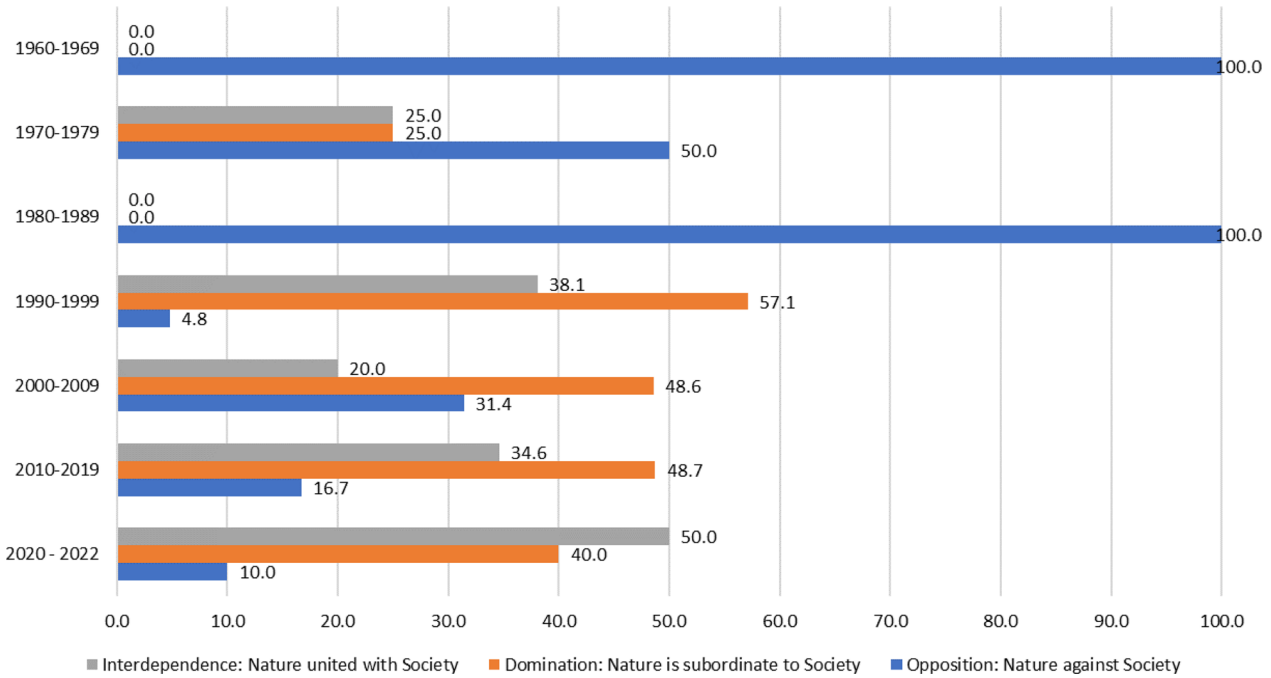

Fig. 9 Distribution of the three categories that emerged from the reviewed studies (%) according to their year of publication

pristine [93–96], undisturbed [97–104], the place of the non-humans [105]. This perspective finds support in a colonialist perspective, in which Europeans, associated with the "society" side, saw themselves as separate from an externalized "nature," seen as the outside of humans [106]. In this context, colonization found support in the idea of 'rescue' of the non-European world from a state of association with primitive nature and its transformation into a state of civilization and culture [103, 107].

In these studies, nature is represented as the "world" where uncivilized creatures live [108], physically and intellectually. Some studies reproduced an idea of dangerous nature [109], harbouring ruthless exploiters and criminals who must be banished from the land [110], a destructive entity [111], supporting the defeat of nature as societal progress [112]. This portrays indigenous people as "uncivilized" humanity, commonly represented as free, wild, mystical, and even as sexually promiscuous and violent (as in tribal warfare, cannibalism and headhunting), "all explicitly associate such "natives" with nature, as humans in their supposedly untamed, uncontrolled free state" [24]. Therefore, it is a place for the "ignoble savage," irresponsible beings that, from a paternalistic viewpoint, must be domesticated and controlled since they are primitive [113]. Here, non-human nature is present only as a form of absence and nullity and does not present an ethical challenge or claim [114]. In this set of studies, the relationship between humans and nature is understood as one where it is impossible ever to achieve the kind of reciprocity available in human society. Whatever form our respect for nature takes will always be different from our relationships with those we consider human [115].

Nature subordinated to society—domination

Despite being linked with the "Opposition" category, namely, through the logic of the superiority of humans over non-humans, the "Domination" category has some nuances. It represents 47.2% of the studies analysed. In this set of studies, 57.9% were developed in Europe and North America, and 15.8% were developed in Central and South America. It is also significant that, like in the previous category, 44.7% of the articles accessed do not distinguish between nature and environment, using both concepts interchangeably. In this vision, nature appears represented in a logic of exploitation and at the disposal of human will and desires [116–127], considering nature as a source of human survival that must be dominated to meet humanity's needs [128–142]. Despite being separated ideas, there exists a potential risk where in the imperative to survive can inadvertently foster a mindset wherein nature is perceived solely as a means of human survival, leading to a viewpoint that it must be subjugated to fulfil humanity's needs. Nature is a resource that maintains the human way of life, associated with the ecosystem services concept [143–147], a capitalist dogma that deprives nature of its agency while propagating endless growth and human supremacy [148]. From the documents previously analysed, nature becomes commodified, valued primarily for its utility in meeting human needs and desires, rather than respected for its inherent worth and complexity. Moreover, this capitalist perspective fosters a narrative of promoting the belief that exploiting natural resources is essential for economic progress and human well-being, often overlooking the long-term consequences of such actions on ecosystems and biodiversity.

In this category, nature is represented by two interlinked logics of domination: in the first logic, nature is a resource intended for human exploitation and for the generation of wealth in the name of societal progress, where environmental degradation or destruction—ecocide—is treated as an economic externality to be managed [149, 150]. This understanding of nature facilitates mechanisms of exploitation and poverty, taking advantage of the favourable environmental, economic, and sociocultural conditions existing in the regions to extract minerals and other riches of nature [151]. As an object distant from humans, nature is only valued and protected because it can enhance humans' quality of life or provide material resources for humankind, translating the instrumental value [152–154]. Nevertheless, within this category, the socioenvironmental conflicts gained particular relevance [155–157] as an "arena of citizen activism" [158] of a dispute over the management of the use of natural resources, putting local understandings of nature and scientific knowledge that foster social conflicts face to face, namely in what configures "domination" and what does not. Several studies documented experiences and complexities, mostly with farmers, which justify the dominion for using and developing nature through farming methods and technologies. Often, dominion is used alongside or within an understanding of stewardship [153, 159–161], which exhorts responsibility towards nature, seeing farmers as co-creators with God, able to make creation more than it was [162, 163]. Therefore, and considering this, it is understood that they are not damaging the environment [164].

On the other hand, nature also brings to the discussion an association with structural traditional systems of domination. Controlling nature and controlling women are anchored in the same logic of domination. Women and the environment are exploited and dominated by white, middle-class men in Western society [165]. In fact, when looking at history and some communities worldwide, women are more dependent on nature under the sexual division of labour: women are primarily responsible for

gathering fuel, fodder and wild foods and growing subsistence crops for survival [19]. The elements of nature, non-humans, are used as tools by those who dominate and abuse to punish and control others [166]. From another dimension, the idealization of beauty is anchored in gendered ideals that disallow the agency of both nature and women. They are the others positioned outside [167]. Similarly, postcolonial states were consistently willing to sacrifice the environment and people with low incomes to further a longer-term vision of commercial growth and industrial modernity [168]. This logic appropriate nature as a space of conflict and exploitation of low-income people as subordinate actors, fragile and strictly vulnerable to environmental changes [169].

In a second logic, nature is a sign of God, from whom He holds power under His submission: created and controlled by God [170, 171]. Human beings seek to merge harmoniously with nature as they transform it into an environment [172, 173], being their power over non-humans guided and constrained by God's supreme authority [174, 175]. While God creates and governs all creation, God is not equally close to all. The lower creatures can approach divine goodness only through their relationship with the higher ones, in this case, humans [176, 177]. As rational creatures, humans are superior to other animals and all inanimate creations [178]. Their proximity to the divine makes' humans more perfect and dominant over other creatures. It is here that the concept of "domesticated nature" can be integrated and translated into gardens, a Biblical representation of the Garden of Eden [179], which symbolizes successful control over nature [128, 180]. The combination of these two dimensions makes it clear that the concept of nature is often used to moralize and exclude [181]. In this sense, the environment is understood in these studies as the human background, a planned and improved nature [118, 182], and a domain of ideas and entities accessible only with science and technology, the scientific aspect of nature [183, 184].

Nature united with society—interdependence

The third category, "Interdependence," represents 32.9% of the analysed studies. In this category, the most significant presence of studies undertaken in Central and South America are visible (18.9%), despite those developed in Europe and North America continuing to be the majority (64.2%). It is also the set of studies where environment and nature concepts are not used interchangeably (37.7%). Endowed with works that seek to promote a theoretical and interdisciplinary debate, they represent nature as a real, living entity: an entity with agency and transformative power [52, 185–197], since nature, or "Mother Nature," is a unity of which humanity is an integral part [198–203]. These studies reject a dichotomous view between nature–society and nature–culture, as they argue that we live in a symbiotic community that is a large, unique, and underappreciated sphere of life, where nature and humanity are essentially integrated at the spiritual and moral plans [5, 204–217], a "conjoint constitution" stated by Freudenburg et al. [218]. These studies demonstrate that acknowledging our interconnectedness with nature might instil a sense of appreciation, responsibility, and stewardship for the natural world. This viewpoint emphasizes the ecological need to maintain nature and the ethical imperative of respecting and nurturing the complex web of life that supports us.

It is also in this group of studies that a fruitful debate on the rights of nature can be identified, perhaps because it includes researchers from Latin America, where the first amendment to the constitution is identified, consecrating the Rights of Nature (Ecuador) with rights and limits to be respected: in this perspective, nature is viewed as a coherent whole, with each entity having inherent rights and boundaries that must be maintained. Any violation of any element's right to exist within this interconnected system is considered a breach of both the individual entity and the fundamental integrity of the natural order [219–225]. In this topic, interdependent communities of humans and non-humans are defended, expressed in rivers, rocks, mountains, and trees, representing a spiritual and affective connection [226–229]. No less important is the reference to the value of nature, which is valid by itself, regardless of its usefulness for or recognition of humans, approaching the concept of relational values, rejecting the instrumental view and services of nature [230].

Understanding nature and human relationships with the environment are cultural expressions used to define who we were, who we are, and who we hope to be at this place and in this common home [231]. This category contends that the way cultures engage with nature mimics how they interact with one another [232]. This idea is especially prevalent in societies where clans are identified with various animals, and there is a notion that humans and animals can turn into one another. In these communities, animals are said to hold the spirits of humans, gods, and creators, and several cultural beliefs link nature and human culture. Being socially constructed, the plurality of meanings regarding the concept of "nature" should be valued, rejecting a standard definition that limits our possibilities to understand societies: the concept of "natures" appears as a possibility since the most significant problem lies in trying to define the nature concept first, neglecting to understand how societies and communities reason about it [233–236]. Considering this, nature is seen as a cohesion factor; it conveys interaction,

creates links, and takes down symbolic barriers [237]. From this range of studies, it is concluded that nature is not subordinated to humans but works with them, influencing them in a way that highlights the limits of anthropocentric narratives.

Discussion

Reproduction of western representations and the hiding of plural visions

Implementing an ecological transition may result in a risk of considering that Europe is a homogenous territory. Moreover, this is not only limited to nationality. Within the same country, region, city, and even street, a plurality of ways of living related to nature and environment can be found, influenced by socioeconomic conditions, cultural/religious specificities, labour conditions, or even gender. Nevertheless, suppose we want to just refer to nationality, this premise can be grounded in the fact that Europe is marked by cultural diversity and foreign-born populations: the median share of immigrants in the population is 12.2% [238]. By recognizing this evidence, we must consider the diversity of perceptions and representations towards nature and the environment to make the ecological transition a truly ecological transformational change that is effective, fair, and inclusive.

Moreover, by recognising and considering this variability, we may avoid imposing standard answers that may not be appropriate or acceptable in all settings. Instead, we can adapt interventions to meet unique needs and values, improving their efficacy and relevance. Set against this background, providing an overview of the diversity of perceptions and representations towards nature and the environment and identifying the underlying processes that support these viewpoints is critical for developing policies and initiatives that resonate with a wide range of stakeholders while effectively addressing their needs and concerns. It also enables us to understand how historical legacies, social inequities, and power dynamics shape people's perceptions and behaviours towards nature, which may raise the opportunity to encourage meaningful debate and collaboration among stakeholders.

Non-Western science and knowledge marginalization began in ancient Greece [239]. It intensified during the Renaissance period—between the XIV and XVI centuries—when a few European nations were considered the home—and legitimate owners—of modern science, framed by the scientific revolution [240, 241]. The spread of Western science, dominating the scientific circuits, had several consequences, namely legitimating what is knowledge and neglecting what remained. This process had implications for ways of knowing and organizing society and, importantly, how to respond to the ecological crisis [242].

The results achieved in this review of the literature produced unveil a pattern of inequality inscribed in systems of scientific knowledge [243], reproducing structural inequalities and favouring historically dominant groups [244, 245], namely from Anglophone and Western nations, which contribute to shape our understanding of nature and, in some cases, justify various technological interventions in the environment [7]. Therefore, the documents included in this review may represent those circulating in the international scientific publications' channels. However, it should be emphasized that scientific production on this topic is not limited to these studies. On the other hand, this does not mean there is no knowledge production in the non-Western world. It exists, but their knowledge and epistemologies have been put aside to the periphery, outside of the circuits of Western scientific production and publication, which are dominant [246]. Most of all countries in the Global South cannot access those mercantile databases, and they are costly for most universities outside the Global North. This has different implications for the ecological transition: First, because views of nature are intricately tied to varied belief systems based on various sociocultural contexts, restricting access to these databases may contribute to a lack of diversity in societal perceptions of nature. This disparity in access precludes scholars in the Global South from engaging with a wide set of ideas and empirical facts, potentially leading to ideological uniformity [247, 248]; second, the dominance of Western scientific perspectives poses considerable challenges for researchers from emerging countries. It not only inhibits their capacity to publish in high-quality international journals but also impedes their ability to investigate and address local environmental issues [249]. In short, limited access to scientific publication databases exacerbates existing inequities in knowledge generation and transmission, inhibiting the formation of various perspectives and stifling the promotion of sustainable practices required for the worldwide ecological transition. Addressing this inequality is critical for increasing inclusivity, equity, and efficacy in global initiatives to promote environmental sustainability.

When we look at the percentage of studies in each category, two of the three categories—opposition and domination (67.1% of the analysed studies)—represent the dominant Western view of nature, which prevails in the studies analysed. This vision, anchored in an anthropocentric vision where nature is exterior to humanity [5, 8], understood the environment as something that does not belong, which is in line with Serre's statement "…the word environment, commonly used in this context (…) [,] assumes that we humans are at the center of a system of nature" [250]. The environment in the Western world is

humanity's reservoir of potential resources to satisfy the needs and desires associated with capitalism.

Environment precedes nature: the anthropocentric paradigm

The bibliometric analysis of the keywords presented in the documents reviewed allows us to construct and visualize their co-occurrence networks. In a first attempt, the connection between the clusters allows some reflections: looking at the green cluster, the interlinks between the keywords support the discussion around the anthropogenic impact on climate, i.e., climate change, which is directly connected with the human culture and the ethics towards the environment [251]. Moving to the blue cluster, it is visible that the focus of the discussion remains on children's contact with nature, mainly represented by animals (non-humans). As Herrmann et al. [252], "anthropocentrism is not an initial step in conceptual development, but is instead an acquired perspective, one that emerges between 3 and 5 years of age in children raised in urban environments." [252], suggesting the need for early contact with nature, especially in urban areas, to develop a sense of interdependencies and ecocentrism.

The yellow cluster represents the emphasis on nature conservation and the social representations linked to it, which may reflect an anthropocentric viewpoint where nature is conserved for human purposes—conserved for whom? [253, 254]. There is a need to resignify what it means to conserve and integrate moral arguments instead of only considering perceived human interests, and this change needs to be considered in the ecological transition.

Finally, the red cluster is centred on environmental discourse and sustainable development, where the environment is central to humanity's survival and sustaining life patterns. From this overview, the absence of issues regarding rights of nature is noticeable. This may reflect that social representations of nature and environment, both society–nature relations, have been framed by an anthropocentric outlook where an instrumental view prevails [255]. As stated by Kotzé and Adelan [256], the sustainable development narrative cannot be considered "socio-ecologically friendly" since, despite their "well-meaning intentions," it is anchored in the facilitation of continuous exploitation of economic activities, exacerbating inequalities and socio-environmental injustices, without "protecting all life forms." Other authors, such as Beery and Wolf-Watz [52], explore this issue stating that the environment, defined as "nature," is often depicted as a geographically unspecified force possessing the intrinsic ability to influence human attitudes and conduct. Building on this premise, they suggest substituting the elusive notion of "nature" with the more relational concept of "place." Therefore, the implementation of Ecological Transition may also be an opportunity to rethink and resignify the sustainable development concept to avoid the exploitation and degradation of humans and non-humans, especially the vulnerable living ones. However, as stated before, this first overview can be related to the predominant presence of Western publications, a consequence of the search in the selected databases.

Nature representations categories and their implications for the ecological transition

The nature representations categories proposed in this review—"Opposition", "Domination", and "Interdependencies"—should not be considered closed. Instead, they should be seen as a reflexive exercise whose aim is to help articulate the complexity around society–nature relations. Nevertheless, beyond that, these categories may be helpful when framing the barriers and drivers towards the ecological transition, especially in a multicultural European territory or territories. Despite being a plan for Europe and the world, the ecological transition may face specificities which, as explained before, vary according to the sociocultural–environmental–political–economic characteristics.

The ecological crisis that we all face, although with different degrees of intensity, has been triggered by the well-known Cartesian separation between society and nature. This separation—described in the opposition category—has removed the agency of nature and assigned the need to rescue her and all its elements—some classes of humans and non-humans—from the incivility that they lived. However, this colonialism strategy is not over. So, we can identify this as one of the barriers to the ecological transition since extractivism and expropriation also favours the economic and capitalist system. However, beyond this barrier, the epistemological and ontological artificial separation between humans and non-humans may be the greatest threat to a just transition. How is it possible to reimagine a sustainable future without considering all forms of life? How is it possible to have a successful, just, and inclusive transition where only some rights are recognized, humans and non-humans? Is not a reconceptualization of nature at the heart of this ecological transition? Although it may seem like a past viewpoint, this understanding of society–nature relations is perpetuated and needs to be addressed appropriately.

With different nuances but supported by the same logic of the superiority of humans over non-humans, the domination category also challenges the ecological transition. Firstly, because the domination of natural elements or non-humans is still visible at practical and theoretical levels; secondly, because it is the basis of the society–nature paradox: we, as a species, cannot

survive without nature, and we need the benefits that are provided for this purpose; However, this need should not be a vital justification for the abuse and extractive logic that has guided our relationship with nature. Beyond this paradox, this category is framed in crucial challenges that should not be neglected.

The high dependence on new-renewable resources is a barrier to the ecological transition, and the economies are also highly dependent on it. Moreover, this makes the choice to adopt a sustainable life pattern difficult for the social groups experiencing economic privation. Capitalism is also at the core of the Domination category, and it is also the biggest threat to this transition—decision-making has been in the hands of those who support this economic model. However, this transition is also an economic shift, a new way of investing that not only considers the final product regardless of the process and associated damages. The social and economic model sustained by this Domination category—capitalism—has diminished the Earth's carrying capacity. So, there is a call, in this transition, to reimagine new ways of co-living on the Planet. This should be accomplished by revaluing public open spaces and community care and shared responsibilities instead of individualizing and privatising circuits. This refers to the decision-making in ecological transition that should not be based on the logic of equality but equity, with fairness and democracy: what, how, and whom.

This need to reimagine sustainable and inclusive futures for all living beings found a higher opportunity in the interdependencies category. Recognizing interdependencies between all elements of nature, humans and non-humans, makes the transition easier since adopting sustainable life patterns is driven by respecting all life forms, especially those more vulnerable. Despite these drivers, this category may face some barriers towards the ecological transition: firstly, the reconceptualization of work, since the transition does not condone extractive industries of non-renewable resources so a new way of labour division is needed, by distributing paid jobs and wealth more fairly; secondly, this viewpoint also faces the barrier of the undemocratic economy, where a decision is taken without considering citizens and their different viewpoints—here the ecological transition should insist on the need to reinvent the democratic innovation and citizen participation in environmental decision-making; and together with the regeneration of labour and economic sectors, the redistribution of power is crucial to avoid that ecological transition is, once again, a strategy that only benefits a few. Nevertheless, this depends on political will.

Limitations

Some limitations concerning the search parameters employed in this study need to be pointed out. As described, reliance on specific search terms imposes significant constraints and increases the chance of overlooking large quantities of relevant material. This limitation underlines the possibilities of untapped research areas, as well as the potential benefit of future investigations that employ a more expansive and varied search technique to give a thorough understanding of the subject matter. However, due to the number of studies screened and those included in this review, it can be stated that an overview is provided, namely, nature-society relationships.

Conclusions

Through the systematic literature review where 161 documents were analysed, the aim was to conduct a systematic analysis of how nature and environment were represented in scientific production and how nature–society–culture relations were described in the leading scientific databases, without losing sight of the place of these relationships in the ecological transition. Considering this attempt to categorize the perceptions and representations of nature and the environment, it is important to highlight the dominant view in science, profoundly extractivist and Western, which contributed to an impoverishment of knowledge and the hiding of plural visions. This results in a weakening in response to ecological challenges as it disregards other possibilities of relationship with nature and its cycles, hindered the necessary processes of societal transformation, ecological and epistemic, with obvious environmental and climatic, political, social, economic, and ethical consequences.

Allied with the previous reflection, there is the fact that the concept of nature is not universal since opposing and conflicting views on nature coexist simultaneously. Thus, we propose to use the concept of "natures" in the plural as a way of considering the different possibilities of social constructions about the concept and the socio-psycho-cultural contexts in which they are elaborated, as initially developed by Donna Haraway as "natureculture" to highlight the essential bond between nature and culture, emphasizing their interconnectedness and how the physical and symbolic realms, human bodies and language, narratives and realities are intertwined, and also from the connectedness theory [26, 52, 257, 258]. From the analysed production, the concept of nature has been used as a form of exclusion and moralization of certain groups, humans and non-humans, subjugating them to power relations that place dominant and dominated on opposite sides. On the

other hand, disruptive voices contradict this vision and consider nature as a living and autonomous entity independent of human action endowed with agency.

Considering the documents analysed, the idea of humanity's superiority over nature has been, in a way, founded on the notion of protection that symbolically translates to an anthropocentric point of view. The category of Interdependencies proposes a change in how we relate to nature, where a logic of dependence—where the human being cannot be separated from nature—replaces the paternalistic idea of protection. Moreover, when considering this paradigm shift in a diverse European territory, both from the point of view of its biophysical characteristics and from the point of view of its multiculturalism, which allows different possibilities of sociocultural mosaics at different scales, only by integrating the plurality of knowledge and visions and the characteristics of the territories, will it be possible to expect the possibility of a fair, plural and transformative Ecological Transition.

Supplementary Information

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Additional file1 (XLSX 68 KB)

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Author contributions
Fátima Alves and Diogo Guedes Vidal conceived the ideas and designed the methodology; Diogo Guedes Vidal collected the data; Fátima Alves and Diogo Guedes Vidal analysed the data; Fátima Alves, Diogo Guedes Vidal e Cristina Sá Valentim participated in the writing of the manuscript. Helena Freitas is the project's principal investigator at the University of Coimbra, and Fátima Alves is the coordinator of the task in which this study is integrated. All authors contributed critically to the drafts and gave final approval for publication. The authors' order reflects the contribution level to this paper; therefore, Fátima Alves and Diogo Guedes Vidal should be considered the first authors.

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