

## Article

# Conceptions of Portuguese Science Teachers on the Concept of Ecoethics

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**Abstract:** Ecoethics is a philosophical subject that studies the moral relationship of human beings concerning the environment and its non-human components. Education for ecoethics addresses issues of how to live, how to make environmental choices, and how to think about the consequences of human activities. It is important that, firstly, the concept of ecoethics is clear to all involved, including teachers and students. Knowing that teachers' conceptions strongly influence their practice, and since no studies with teachers in active service were found, it was considered pertinent to investigate the conceptions of Portuguese Biology and Geology teachers about the concept of ecoethics. For data collection, a questionnaire was applied at a national level, with a related open-ended question. Categories of analysis were defined a priori and then the responses were classified based on those categories. The main results show that most respondents define ecoethics as ethics applied to the environment; almost a tenth relate the concept to issues concerning the preservation of life or the quality of life. Given the influence of teachers on students' education, a focus on teachers' training in ecoethics is essential as a starting point for an effective approach to ecoethics issues that can contribute to solving environmental problems.

**Keywords:** conceptions of ecoethics; ecoethics; science education; modalities of environmental ethics; science teachers



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## 1. Introduction

The 21st century seems to surpass previous centuries in the magnitude of ecological changes that threaten the future of human beings, with devastating consequences for ecosystems and unprecedented losses in biodiversity [1]. The attempt to solve environmental challenges has led to the consciousness of acting in defence of the environment and biodiversity [2], as each person is an integral part of their natural place [3]. This fact led to the guiding thread of this work, whose purpose is to contribute to the promotion of ecological awareness in the teaching of earth and life sciences. In this sense, we seek to understand the knowledge of current Portuguese Biology and Geology teachers in environmental ethics, an area that forms ecological awareness. This awareness assumes that science and ethical action are linked in overcoming the ecological crisis we face today. Let us start by understanding the connection between ethics and ecological crisis.

When it comes to deciding and acting in a nature context, human beings have not always chosen according to what is right, highlighting the need to apply ethics to decisions regarding the environment, making it imperative for humans to improve their decisions about and interactions with the environment [2]. In this sense, and as human beings are often faced with multiple possibilities—both individually and collectively, often having to make choices in relation to the environment [2]—ethics is the theoretical area that underpins practical decisions favourable to the environment. It provides guidance so that one's choices—which involve not only reason but also emotions, attitudes, and values,

thus, being complex [4]—are adopted in accordance with practices and policies aimed at the common good of which the environment is an integral part [2]. By its very vocation and meaning, ethics provide methods and resources (rules, principles, or guidelines), which allow consistent decision-making in concrete situations [2], also contributing to the formulation of arguments for and against moral positions and to the ability to make judgements with reference to the evaluation of reasons [4].

The environmental component of ethics is yet insufficiently developed, and the debate on the value of nature remains at an impasse [2]. This is a debate that has not been given the prominence it should because, in general, the major themes of environmental ethics are considered less significant than those concerning interpersonal ethics [2]. The latter circumscribes action to the inter-human universe, because it understands that only the “way Man acts on Man defines Man” [5] (p. 16). On the other hand, it is in the ethical relationship of human beings with the environment, which outlines moral obligations in the face of environmental concerns [6], that environmental ethics or ecoethics is defined [7–11], preferably adopting the term ecoethics in this article.

Given the above, environmental philosophy (where ecoethics is inscribed) is a reflective area, which goes beyond intra-human walls, and perceives human actions in the broad context of the natural world, pursuing the need to fundament the action of the human beings according to respect for nature, in itself [12,13]. Traditional ethical standards (anthropocentric) are characterised by admitting only humans as the centre of moral reflection, considering the human as the only actor and recipient of the different actions [12].

As environmental degradation due to anthropogenic causes became global and dramatic, the question of the intrinsic value of nature became the main topic of debate in ecoethics, against the unlimited instrumentalisation of nature as a mere source of resources [12]. It is in this context of crisis that the need arises for a new philosophical realm—environmental ethics or ecoethics—which reflects on the values that should guide the actions of human beings in their relationship with nature and on their status and that of nature. Therefore, the emergence of ecoethics was due to an awareness of the environmental problems, generated by human activity, affecting the natural world, which has been and continues to be recognised as a problem to be debated and solved for its notorious damage [14].

Determining the precise moment of the beginning of a new subject, such as environmental ethics, is always debatable, but it can be said that both environmental policy and environmental ethics emerged in the sixties of the last century, with Aldo Leopoldo (1887–1948) as the great inspiring figure, with his essay in *A Sand County Almanac* [12,15].

The natural environment was already recognised as vulnerable in the 19th century with the publication of George Perkins Marsh (*Man and Nature* in 1864), but it was only from the middle of the 20th century that it received due attention largely due to pioneering works such as *A Sand County Almanac*, 1949 (A. Leopold) [14], *Silent Spring*, 1962 (Rachel Carson), ‘The historical roots of our ecological crisis’, 1967 (Lynn White), and ‘The Tragedy of the Commons’, 1968 (Garret Hardin) [12,14,16,17]. The latter represents the first moments of philosophical reflection on the environment.

In 1973, Richard Routley and Arne Naess made their contributions to the field. Routley at the World Congress of Philosophy held in Bulgaria, with his speech ‘Is There a Need for a New, an Environmental, Ethic?’, in which he presented the argument of The Last Man, and Naess with his publication ‘The Shallow and the Deep, Long-Range Ecology Movement’, where he defined the meaning and the purpose of Deep Ecology [12,14,16,18]. These articles generated a series of debates and were decisive for the emergence of this new philosophical field: environmental ethics. Soon after, in 1975, Holmes Rolston III made his contribution to environmental ethics with his work ‘Is There an Ecological Ethic?’, proposing the notion of intrinsic ecosystem value. Many other authors followed with contributions to the field, such as Peter Singer [16,19] with *Animal Liberation* (1975), J. Baird Callicott, with *In Defense of the Land Ethic: Essays in Environmental Philosophy* (1989), until recently, for example, Bryan Norton, with *Sustainability: A Philosophy of Adaptive Ecosystem Management* (2005), where

he explores the ethical dimensions of sustainability and offers practical approaches to address current environmental challenges [14]. Over the past five decades, environmental ethics has continued to evolve and expand as environmental challenges persist and new ethical dilemmas emerge [20]. It provides a theoretical framework capable of assessing the moral dimensions of human actions as they relate to the natural environment, promoting pro-environmental practices and fostering a deeper understanding of our responsibility towards nature. In Portugal, it was only in the 90s that environmental ethics took its first steps, mainly driven by the Rio Summit of 92 and by the Education for Sustainable Development (ESD) programs implemented by the United Nations in 1992, and later reinforced with Agenda XXI. This decade marks its introduction into Higher Education at the Faculty of Arts of the University of Lisbon and the appearance of literature by Portuguese authors on environmental ethics. Although environmentalism in Portugal dates to the 1950s, its expression in government policies only gained greater scope at the end of the last decade [21,22].

Globally, the Rio Summit, in 1992, was particularly important because the United Nations Framework Convention on Climate Change (UNFCCC 1992) was adopted, with the aim of stabilising greenhouse gas concentrations in the atmosphere. To this end, the Parties to the Convention undertook to implement measures aimed at mitigating climate change and facilitating adequate adaptation to its effects. In the following years, most countries signed and ratified the Convention. The first Conference of the Parties (COP) took place in 1995 and has been held annually, always with the aim of combating climate change, at which Portugal has been present. At the most recent ones, COP26 and COP27, important issues on the environment and climate change were debated, recognising the current global crises and the need to protect, conserve, and restore nature and ecosystems [23], as well as the seriousness of the climate emergency facing the planet, promoting measures that enable energy efficiency and environmentally friendly technologies [24]. Another important mark was the dissemination of the European Green Deal in 2019, a strategy for the EU to become the first climate-neutral continent by 2050 and decouple economic growth from resource use, as well as raising awareness of environmental education and training initiatives and education for sustainable development [25]. This agreement is part of the European Commission's strategy to implement the United Nation's 2030 Agenda and the Sustainable Development Goals (SDG). The SDG, decided by the Heads of State and Government and High Representatives, in the General Assembly A/RES/70/1 of 25 September 2015—*Transforming our world: the 2030 Agenda for Sustainable Development*, are considered a set of universal and transformative goals and targets to achieve a better future for all. They were created as a call for action, involving all countries, to promote prosperity and protection of Earth. Ending poverty must go together with strategies that build economic growth and address a range of social needs, such as education, while tackling climate change and environmental protection in general. In the case of this research, it falls under three SDG, namely, SDG 4, SDG 12, and SDG 13. Regarding SDG4—'Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all', this research contributes by improving access to quality and relevant education for all individuals (such as teachers and students). It will be relevant for the acquisition of knowledge and skills necessary to promote education for ecoethics, as it will thus indirectly contribute to solving current environmental challenges. With regards to SDG 12—'Ensure sustainable consumption and production patterns', this research contributes by teaching about the risks of unethical, harmful, and unsustainable consumption, and promoting environmental awareness of teachers (and students). It will allow them access to relevant information of environmentally sustainable development and lifestyles in harmony with nature. Finally, regarding SDG 13—'Take urgent action to combat climate change and its impacts', this research contributes by promoting environmental and climate literacy, raising environmental awareness and understanding of climate change. It will allow raising awareness on mitigation, adaptation, impact reduction, empowering civic participation,

and early warning measures in relation to climate change, considered one of the main environmental problems of the present time.

Given the above and taking into account the general effort in appropriate environmental policies, it is necessary to sensitise and make citizens aware of the ethical attitude towards environmental problems. Thus, it is necessary to intervene with students, future representatives of society, and as teachers play a central role in the formation of active, informed, and responsible citizens, the aim of this research was to investigate the conceptions of Portuguese Biology and Geology teachers who teach in the 3rd cycle of basic education and in secondary education, on the concept of ecoethics. It becomes relevant to understand what in-service teachers think about the concept of ecoethics, as their practices, and consequently students' learning processes, are very influenced by them. The results of this research may be important for trainers of Biology and Geology teachers, as well as for Biology and Geology teacher training institutions, enabling the creation of initial and continuous teacher training courses.

## 2. Theoretical Foundations

### 2.1. The Concept of Ecoethics and Its Plurality

Ecoethics reflects on the ethical relationship of human beings with the natural environment [6] and, as such, is concerned with the moral relationship between humans and nature [26]. It considers the value and moral status of living beings, ecosystems, and the biosphere [26], and nowadays is a fruitful field that includes the ethics of climate change, environmental justice, and water ethics. In sum, it covers all types of problems, attitudes, and behaviours about the environment and the factors that influence it [27,28]. Ethics leans over judgements about what is right and wrong [29]. The adoption of an environment-centred ethical stance incorporates value judgements [30,31] about human conduct towards the natural environment. It results in a theory and practice about concern for values and duties towards the environment [32–34], assessing the ethical significance of individual living entities with or without consciousness, non-living entities, and collective entities such as species and ecosystems [2]. This enlargement of the sphere of morality is a challenge to the traditional assumption in ethics that only humans deserve moral consideration [29]. Consequently, and in broad sense, environmental ethics, or ecoethics, questions the moral values of agents in relation to the natural environment to which they belong [35]. It also reflects on how the relationship between humans and the natural environment should be shaped within the framework of society's values and rules, i.e., it examines people's responsibilities towards the natural environment [35].

Different authors, throughout time, have proposed different conceptions of ecoethics, depending on their theoretical perspective, specifically as follows:

Aldo Leopold in *A Sand County Almanac* (1949) defends a holistic view of nature, the human being as a member and citizen of the Earth, endowed with ecological awareness and moral conscience. This leads him to act with love and respect for nature, via feelings consummated in his ethical commandment: 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 [36].

Rachel Carson in *Silent Spring* (1962) highlights the ethical implications of human activities on the natural environment, emphasising the interconnectedness of all living things and the consequent need for responsible stewardship of the biotic community [37].

Christopher Stone in 'should Trees Have Standing?—Toward Legal Rights for Natural Objects' (1972) argues for the extension of legal rights to non-human entities (trees, rivers, and other elements), proposing their legitimacy to be represented and defended in court by institutions that represent them [38].

Arne Næss in 'The Shallow and the Deep, Long-Range Ecology Movement' (1973) presents the principles of Deep Ecology, which postulates a deeper and more holistic understanding of the interconnectedness and value of all living beings and ecosystems [39].

Peter Singer in *Animal Liberation: The definitive classic of the animal movement* (1975) argues that the interests of nonhuman animals should be considered in the same way as those of humans [40].

Tom Regan in *The Case for Animal Rights* (1983) advocates the abolition of animal use and exploitation, arguing that animals should have the right to be treated with respect and not be used as resources for human consumption, experimentation, or entertainment [41].

Paul Taylor in *Respect for Nature: A Theory of Environmental Ethic* (1986) advocates a biocentric approach to ethics, defending the inherent value of each living being and thus the moral consideration to all of them, from the simplest to the most complex [42].

Holmes Rolston III in *Environmental Ethics: Duties to and Values in the Natural World* (1988) explores the ethical dimensions of the human relationship with the natural environment, designing a moral theory that recognises the intrinsic value of nature and therefore advocates the preservation and conservation of the natural world [43].

J. Baird Callicott in *Beyond the Land Ethic: More Essays in Environmental Philosophy* (1999), inspired by Aldo Leopold, argues in favour of extending the moral community to biotic and abiotic entities, given the interdependent and relational structuring of planetary life [44]. He also alerts to the challenges posed by globalisation and the need for a perspective centred on a planetary citizenship in symbiosis with the Earth [44].

Bryan G. Norton in *Sustainability: A Philosophy of Adaptive Ecosystem Management* (2005) refers to environmental ethics as the field that explores the moral obligations and responsibilities of individuals, societies, and institutions in relation to the natural environment, advocating for the protection, preservation, and sustainable use of natural resources and ecosystems [45].

Clare Palmer in *Animal Ethics in Context* (2010) addresses issues such as animal welfare, rights, and the ethical treatment of animals [46].

Stephen M. Gardiner is an environmental philosopher who, in *Perfect Moral Storm: The Ethical Tragedy of Climate Change* (2011), reflects on the climate emergency, arguing that climate change presents a unique moral challenge due to its global and intergenerational nature [47].

Marc Bekoff, with *Ignoring nature no more: The case for Compassionate Conservation* (2013), advocates treating all wild animals with respect, fairness, and compassion, recognising that all wildlife has intrinsic value, following the principles of do no harm, inclusion, and peaceful co-existence [48].

Paul B. Thompson in *From field to fork: Food ethics for everyone* (2015) addresses the ethical dimensions of the food system, namely food safety, animal welfare, and genetically modified organisms (GMO) [49]. He highlights that the choices of consumers, producers, and policy-makers can shape a more ethical and sustainable food system [49]. These are just some of the many other authors who have contributed to this field of knowledge.

This burgeoning field with multiple themes that go from the more traditional to the emergent ones, such as climate change, water, and food, gives rise to a plurality of modalities of environmental ethics. According to the purposes of this work, its focus is only on the general classification of environmental ethics [50] into two distinct and main matrices: anthropocentric and non-anthropocentric (Table 1). While anthropocentric environmental ethics considers the human being as the unique moral subject, non-anthropocentric environmental ethics considers a plurality of moral subjects, depending on the approach [12,15]. In non-anthropocentric ethics, moral status is assigned either to sentient beings—animal ethics, or to living beings—biocentric ethics, or to non-living beings and ecosystems—ecocentric ethics [12,15]. Table 1 presents a brief summary of the modalities of the main matrices of environmental ethics that are considered to have the most practical scope, reflecting both the legal, political, and pedagogical spheres. This description and classification of environmental ethics approaches enabled the creation of a basic conceptual framework in order to define tools for clarification, organization, and explanation of responses. Without this framework, both the preparation of the survey and the analysis of responses would be almost impossible. On the other hand, the methodology of the work follows the purpose of



highlighting the significance of ecoethics in the teaching of Natural Sciences/Biology and Geology, and as such the introductory emphasis on the theme seemed crucial.

**Table 1.** Ecoethics matrices and main modalities.

Matrix				
Anthropocentric		Non-Anthropocentric		
Ethics of Environmental Responsibility	Christian Environmental Ethics (Stewardship)	Ecocentric	Non-ecocentric	
		Land Ethic	Deep Ecology	Biocentrism
Principle	Principle	Principle	Principle	Principle
Responsibility for being-in-the-world; Action as freedom and responsibility, projected into the future, encompassing the breadth of being-in-the-world	Respect for creation; Action as service, praise, and a way to the good	Relationship and interdependence; Action subordinated to the whole; The intrinsic value of nature/the whole	Biocentric egalitarianism; Intrinsic value of life in general; Transpersonal character of action	Inherent value of life in all its singular organic forms; The action of non-interference in the life of organic beings
Values	Values	Values	Values	Values
Responsibility, prudence, caution, wisdom	Responsibility, care, fidelity, humility	Community belonging, respect, love, harmony	Authenticity, solidarity, cosmic identification, self-realisation	Interconnection, empathy, compassion, non-maleficence
Ethical imperative	Ethical imperative	Ethical imperative	Ethical imperative	Ethical imperative
Duty to ensure the future of humanity by preserving planetary life	Duty to care for and protect the Earth and its resources in an ethical and ontological commitment to the Creator	Duty to preserve the integrity, balance, beauty of the biotic community	Duty not to affect or interfere with the natural world and to promote the self-realisation of beings	Duty to recognise and protect the inherent value of all living beings
Common goal				
Save the Planet; Conserve and preserve life on Earth				

Although some argue that environmentalism requires a radical critique of the anthropocentric ethical tradition, in practice, concerns for human self-interest and well-being have been the most powerful argument and moral force for the creation of policies and legislation aimed at promoting the protection of the natural environment and environmental sustainability [9]. This is the case with the ethics of Hans Jonas, whose concepts of ‘future generations’ and the ‘principle of precaution’ have been adopted by the UN in the framework of environmental policies.

Within the anthropocentric environmental matrix, two modalities stand out: the ethics of environmental responsibility and Christian environmental ethics (Stewardship). As shown in Table 1, the first one includes Hans Jonas’s *Responsibility Principle* (1979). This Principle raises the issue of human responsibility towards future generations, arguing that the impacts of human behaviour on the environment degrade and compromise the quality of life of future generations, which requires from current generations a reconfiguration of ethics, centred on human responsibility for the preservation of planetary life [51]. It is important to note here that Jonas approaches Virtue Ethics, an ethics that focuses more on the character of the agent than on action, by declaring the virtues of prudence and wisdom as inherent to moral agency. The second modality, Christian environmental ethics (Stewardship), argues that humans should act not as exploiters of the Earth, but as caretakers or stewards of God’s created ‘work’, committing to it [52]. We draw attention in this item to Pope Francis’ commitment to promoting and disseminating ecological awareness with the Encyclical *Laudato Si* (2015), and more recently with the exhortation *Laudato Deum* (2023), which embody principles of Stewardship ethics.

Within the non-anthropocentric matrix, there are two most widespread modalities: ecocentric, which includes Land Ethic and Deep Ecology; and non-ecocentric, which includes biocentrism (Table 1). The first modality emphasises the intrinsic value of ecosystems and

the natural environment, prioritising their balance and integrity above human interests [14], and the second recognises the intrinsic value of all living beings, deeming them worthy of ethical consideration regardless of their utility or relationship to humans [14,50]. It should be noted that also for Paul Taylor, the good character of the moral agent is fundamental to fulfilling the ethical purpose he defends. Thus, according to the philosopher, the moral agent must possess a series of virtues, such as compassion, fairness, caring, and benevolence [42].

These different modalities of environmental ethics also provide different perspectives in understanding the root causes of the environmental crisis. As such, ecocentrists, biocentrists, animal rights advocates, environmental pragmatists, among others, take distinct and complementary ontological and epistemological positions on the environmental crisis [16,19]. However, both anthropocentric and non-anthropocentric environmental perspectives argue for the need to rethink the role of humans in nature [16,19].

## 2.2. *Ecoethics, Science Education, and Science Teachers' Conceptions of the Concept of Ecoethics*

Science education has an important role to play in developing an understanding of the concepts that underpin environmental issues, potentially leading to pro-environmental behaviour [53]. Science education should therefore combine the scientific component with the ethical component in order to contribute to the development of environmental awareness. Ecoethics not only provides valuable tools for moving from moral reflection to action and for creating effective policies in favour of the environment [54] but also maintains a close interdependence with science [55]. It is relevant that science education be built on the complementarity between ecoethics and scientific knowledge, as science education provides the fundamental literacy for bio-ecological understanding of the natural world [56]. This will enable conscious decision-making, i.e., ethical reasoning, about human interactions with the natural environment [56]. Thus, the pedagogical alliance between science education and ecoethics promotes scientific understanding, assisting in the comprehension of ecological processes and the interconnections between humans and the natural environment. This provides the basis for informed and ethically considered decision-making, as well as an awareness of current environmental challenges and their impacts [57–60]. It fosters the consolidation of values and attitudes and works as guidance in the evaluation of individuals' moral considerations, through reflection on value systems, responsibilities, and moral obligations towards the natural environment [57–60]. It motivates practices in accordance with environmental sustainability, critical thinking, and decision-making based on ethical principles, as well as promotes an interdisciplinary approach, which facilitate the understanding of current environmental challenges [57–60]. The relationship between ecoethics and scientific knowledge motivates the development of environmental literacy [61], which encompasses the knowledge, skills, attitudes, and values that enable individuals to understand and address environmental issues. In this sense, individuals come to possess both the scientific knowledge and the ethical understanding to address environmental issues and make choices in respect to the environment. In curricular terms, the indications given by the Portuguese Ministry of Education are unclear and not very explicit regarding the inclusion of issues related to ecoethics, or even non-existent in the guidelines of some subjects [62]. Nonetheless, efforts have been made to include these themes in teaching practice guidelines [63], in general. In Portugal, these themes appear mainly (and in a superficial way) in the National Strategy for Citizenship Education (NSCE), which includes some complementary guiding documents of teachers practice, but they are not the main ones. NSCE is supposed to be transversal to all school years and subject areas, not a specific subject where there is official (in curriculum) time and space to address these issues.

The clarification and understanding of concepts are something complex and very relevant to the human learning process [64]. As such, it is relevant to analyse and elucidate the concept of ecoethics so that it can be used effectively in the teaching and learning process. Equally relevant, both for the teaching and learning process and for indirectly helping

to solve contemporary environmental problems, are the conceptions of science teachers on this subject. This aspect is especially relevant since teachers who educate on ecoethics have the possibility to train thinking, critical, and dynamic citizens, capable of evaluating arguments on how to better manage and act in relation to the environment [65]. Teachers' conceptions inform how they perceive, evaluate, and act on a given phenomenon [66], strongly influencing their teaching practice [67]. It is therefore important to know them to detect teachers' inadequate conceptions about ecoethics (and ecoethics-orientated teaching), which can lead to inadequate practices by teachers, resulting in insufficient learning by students. Although no studies were found related to in-service science teachers' conceptions of the concept of ecoethics, studies with future science teachers show that the majority defined this concept as the exploration of moral relations between humans and nature, and others, in a smaller percentage, as a theory of sustainable and preserved environment for the next generations [68]; they often relate the concept of environmental ethics to the concepts of socio-environmental duties or responsibilities [69].

Regarding the positioning of science teachers in the different modalities of ecoethics, some studies show that there is different positioning among them. There are teachers who tend to identify more with an ecocentric attitude than an anthropocentric one [70–72], mostly agreeing with statements such as 'We should set aside areas to protect endangered species', 'Human beings will die if we do not live in harmony with nature', 'It is interesting to know what kind of animals live in ponds or rivers', and 'all contemporary plant species should be preserved because they can help in the discovery of new medicines' [70]. There are teachers who identify with the ecocentric matrix but whose actual behaviours do not reflect this identification [71]. There are teachers who, in addition to identifying more with the ecocentric matrix, report having a more "ecocentric" than "anthropocentric" attitude in their daily practice [73]. There are teachers who defend a more anthropocentric attitude, relying more on scientists to solve environmental problems than on their own contribution, valuing, consequently, the transmission of knowledge more than changing behaviours towards the environment [72]. There are also teachers who show preference for biocentric and ecocentric modalities [74].

Ecoethics education addresses questions about how to live, how to make environmental choices, and how to reflect on the consequences of our actions or activities [57]. Given the importance of the teacher's role in society in general, as they intervene in the formation of students, preparing them to act as informed and critical citizens to cope with environmental issues, it is important that science teachers can teach about issues related to ecoethics as it promotes ethical awareness and internalisation of values and attitudes such as empathy, responsibility, care. Teaching these subjects also promotes critical thinking, decision-making, and environmental problem-solving based on ethical principles and scientific information. It motivates environmentally sustainable and responsible citizenship, empowering students to become informed, responsible adults who feel part of the problem and its resolution. Finally, due to its multidisciplinary nature, it motivates a holistic understanding of environmental problems, as well as motivates proactivity and leadership skills in students, future representatives, and agents of change.

### 3. Materials and Methods

#### 3.1. Type of Study

The present study is a descriptive type of research, as it involves the collection of data to describe and analyse characteristics or variables of a specific population [75]. The dimension analysed in this article ('Teachers' conceptions about ecoethics') involved an analysis of the participants' responses content, and it is included in a larger study of the quantitative type. This study is part of a doctoral research project in educational sciences, specialising in science education, in which the specific area of intervention is Biology and Geology.



### 3.2. Sample of the Study

In Portugal, to teach Biology and Geology, teachers have dual training (Biology and Geology), and there are no teachers trained only in Biology or only in Geology. Thus, the universe considered was made up of Biology and Geology teachers who taught in public schools/groupings of schools in mainland Portugal, in the 2021/2022 school year. All Biology and Geology school teachers, teaching in public schools/groupings of schools of Portugal, comprising 3rd cycle and secondary schools, with 3 or more years of service, were invited to participate in the study. This resulted in a sample of 293 teachers. According to the most recent report on the profile of teachers in Portugal [76], there were 5611 active Biology and Geology teachers in the 2021/2022 school year in Portuguese public schools. This means that this sample (293 teachers) is higher than the sample required for a 90% confidence level with 5% margin of error (which would be around 260), for this population (5611 teachers).

For data analysis and interpretation, firstly, frequency and percentage values were calculated according to the answers given by the participants to the questions examining their sociodemographic characteristics (Table 2).

**Table 2.** Sociodemographic characteristics of the sample ( $n = 293$ ).

Categories	Subcategories	f	%
Gender	Female	235	80.2
	Male	57	19.5
Age	40 years old or less	13	4.4
	41–50 years old	107	36.5
	51 years old or more	173	59.0
Professional qualifications	Degree in Teaching/Educational Branch (Pre-Bologna)	256	87.4
	Master's in teaching (Post-Bologna)	11	3.8
	In-service professionalisation or equivalent	26	8.9
Time in service	15 years or less	39	13.3
	16–25 years	79	27.0
	26 years or more	175	59.7
Contractual situation	School board	221	75.4
	Pedagogical zone board	17	5.8
	Hired	54	18.4
Level of education predominantly taught in the last 3 years	3rd Cycle of Basic Education	142	48.5
	Secondary Education	151	51.5

This dimension of the questionnaire, as shown in Table 2, was about personal and professional data, namely gender, age, professional qualifications, length of service, contractual situation, and level of teaching predominantly taught in the last 3 years. When analysing Table 2, it can be seen that the sample is composed of mostly (about 80.0%) female respondents and higher age groups, with 51-or-more-year-olds (59.0%). About 87% of respondents have professional qualifications at the degree level and many years of teaching service, with 26 or more years of service (59.7%). Respondents are mostly from the school board (75.4%), and approximately 49% of teachers mentioned teaching predominantly in the 3rd cycle of basic education and about 51% of teachers mentioned teaching in secondary education.

In addition to these main characteristics, it was also possible to ascertain that most respondents (63.1%) did not attend any further academic training in addition to their initial teacher training. Respondents represent all districts of Portugal, with the most represented cities being Porto (18.1%), Lisbon (14.3%), and Braga (13.3%). Frequently, respondents often have accumulated management functions, namely Class Management (66.6%).

### 3.3. Data Collection Tools

Given the nature of the aim of this study [75], data collection was carried out through the survey technique. Therefore, a questionnaire survey was applied, using the Google Forms tool, to Biology and Geology teachers who taught in public schools/groupings of schools in mainland Portugal.

For the data collection for this study, in addition to the sociodemographic data collected, the dimension of the questionnaire was ‘Teachers’ conceptions about ecoethics’, consisting of an open-ended question, about the concept of ecoethics, and it concentrated mainly on ethics related to biodiversity or conservation or to nature. The questionnaire that applied to teachers who teach Biology and Geology in the 3rd cycle of basic education and secondary education in public schools of Portugal was developed in the context of a doctoral research and covers other dimensions in addition to the dimension analysed in this study (‘Teachers’ conceptions about ecoethics’). In the case of this specific study, the open question in this dimension of the questionnaire is as follows: ‘How would you explain to a student what ecoethics (or environmental ethics) is?’. The question was posed in this way, rather than asking more directly (What is ecoethics?), so that the teachers would not feel assessed, which could condition their answers. The questionnaire was submitted to content validity analysis [77], and authorisation for its application was requested from the Portuguese ministry of education and the university’s ethics council.

### 3.4. Data Analysis

As already mentioned, teachers were asked to answer an open-ended question. In processing the data, a priori categories were defined, and teachers’ responses were categorised based on those categories. The categories defined a priori were based on the concept of ecoethics, resulting in the following categories: ‘Ethics applied to the environment’; ‘Preservation of life or the quality of life on Earth’; ‘Awareness of non-separation human-nature and biotic-abiotic interrelationship’; ‘Recognition of the moral value of entities other than human beings’. However, one of the categories emerged from the data analysis—‘Rights of living beings’, so it was created a posteriori and the respective responses were classified based also on that category. Regarding the process of the definition of the categories, they were defined a priori to consider elements that in the literature review were associated to the concept of ecoethics. These elements made it possible to define a priori categories. The category defined a posteriori was the only one that stood out more frequently in the participants’ responses, which we detected and decided to include later. The answers varied greatly; there were longer answers and others that were very brief. Some answers had parts that were included in different categories, meaning that sometimes the same answer was included in more than one category.

Nvivo software (Version 14) was chosen for data processing and analysis as it is a software that can import and support various types of data formats and types and is a useful tool for classifying, organising, and analysing data [78]. In the Nvivo 14 software, it was possible to insert a document that includes all the answers of the participants in the study, as well as to create the categories of analysis and to make the respective coding of the answers or part of the answers of the participants. The ‘Word frequency query’ function of Nvivo 14 was also explored to analyse the results. Alongside this software, Microsoft Excel was used to convert frequencies into percentages and to create and format tables for clearer presentation of the results. Responses that were not aligned with the interview question were excluded from the results analysis.

### 3.5. Confidentiality

The conditions of confidentiality and anonymity of teachers and public schools/groupings of schools were guaranteed. Respondents were informed about the research and asked to agree with the conditions before proceeding to answer the questionnaire. Authorisation for the application of the questionnaire was conceded from the Portuguese Ministry of Education and from the University’s Ethics Council.

#### 4. Results and Discussion

To achieve the proposed aim, science teachers were asked to answer an open question regarding the concept of ecoethics. As a result of data analysis, according to Table 3, it appears that the majority of teachers (66.2%) referred to ecoethics in little depth, as ethical issues applied to the environment. If verified, this conception of the concept of ecoethics may indicate that teacher training in ecoethics may not be sufficient for them to be able to deal effectively with the subject at any level of schooling, particularly when approaching the concept. An in-depth knowledge on the concept by science teachers can enable them to adapt strategies and levels of depth in teaching this content to each group of students according to their level of schooling.

**Table 3.** Categories of analysis related to the ecoethics concept ( $n = 293$ ).

Categories of Analysis	f	%
Ethics applied to the environment	194	66.2
Preservation of life or the quality of life on Earth	26	8.9
Rights of living beings	17	5.8
Awareness of non-separation human-nature and biotic-abiotic interrelationship	14	4.8
Recognition of the moral value of entities other than human beings	1	0.3
Does not reply	64	21.8

Below are some examples of responses for this category—‘Ethics applied to the environment’:

*“Ecoethics is the responsibility that every human being has towards the environment/nature”.*

*“Set of values/attitudes that Man should respect in contact with nature”.*

This sense of responsibility is aligned with the results of one study [69], although related to future teachers and not in-service teachers, but where they often relate the concept of environmental ethics to the concepts of socio-environmental duties or responsibilities.

In comparably lower percentages (Table 3), teachers referred to the concept of ecoethics as the preservation of life and its existence with quality (8.9%), seeming to refer to the common goal presented before in Table 1 that contains a summary of the main ecoethics modalities, as well as an awareness of the close interrelations between living and non-living beings (4.8%). The following are examples of responses for the category ‘Preservation of life or the quality of life on Earth’, as they focus more on the conversation of life on Earth:

*“It considers that the conservation of human life is intrinsically linked to the conservation of the life of all beings”.*

*“Act according to our needs for a quality life, but without destroying resources by preventing access to them for subsequent generations and respecting other living beings and their function in ecosystems”.*

Examples of responses for the category ‘Awareness of non-separation human-nature and biotic-abiotic interrelationship’ focus on the awareness of non-separation Human-nature and the inclusive and interrelational awareness of planetary biotic and abiotic diversity, understanding them integrated in a chain of multiple interactions:

*“To simplify the concept, it is to become aware of the needs of the planet, understanding them as Human needs, which go beyond countries, being global”.*

*“Nature functions in a dynamic balance (between all living and non-living systems) and this dynamic must be respected and, as far as possible, preserved taking into account the different contexts and all subsystems”.*

Although no studies were found with in-service science teachers, a study with future teachers shows that they mostly define ecoethics as the exploration of moral relationships between humans and nature [68], contrary to the results of this research, where the moral

aspect is mentioned only by 0.3% (Table 3), when it recognises the moral value of entities other than human beings:

*“[. . .] According to this concept, all beings are equal. Man, although steeped in rationality, can no longer see other beings as inferior and therefore cannot act in a predatory manner towards them. Man ceases to be the “master” of nature and becomes part of Nature again”.*

These responses, in general, adding the high percentage of teachers who did not reply (21.8%), which include blank answers and answers that deviate from what is asked in the question, may suggest that Portuguese Biology and Geology teachers are not very familiar with the concept, making it difficult to explore it in a school context. This is important information, given the relevance that conceptions about environmental issues have both for adopting attitudes and for developing appropriate behaviours towards the environment [72].

There was also almost 6% of teachers that referred to ecoethics as a right of living beings to have a clean environment and good conditions for their survival, as well as that of future generations. This category emerged from the data analysis and some examples are given below:

*“All living beings have a right, now and in the future, to a clean and sustainable environment, and we are all responsible for striving towards these goals”.*

*“Ecoethics incorporates a new dimension to traditional ethics, of an intertemporal nature, which legitimises the right of all beings, now and in the future, to a clean, harmonious and sustainable environment”.*

As mentioned, although no studies with in-service science teachers were found, these responses are in line with some authors opinions over time, but more regarding human rights, such as the right to a healthy environment is essential for protecting human health and well-being [79]; addressing environmental problems requires recognizing the rights of future generations to a habitable planet [80]. The issue of rights even arises in Portuguese legislation, more specifically in Article 5(1) of Law No. 19/2014 of 14 April, a law on the basis of environmental policy, which states, “Everyone has the right to the environment and quality of life, under constitutional and internationally established terms”.

Using Nvivo 14's 'Word frequency query' functionality, it was possible to realise that the words most mentioned by respondents were 'environment', 'nature', 'ethics', and 'respect'. However, the most mentioned word by a wide margin was 'environment', appearing 157 times in participants' responses compared to 69 times for the word 'nature', which is the second most mentioned word. 'Environment' seems to be the concept most associated with the concept of ecoethics, by the teachers participating in the study, which may be a result of the concept of 'environment' being presented in the Referential of Environmental Education for Sustainability, which is the most representative guiding document of the Portuguese Ministry of Education for science teachers in the field of Environmental Education. This document is part of Portuguese National Strategy for Citizenship Education (NSCE). In this document, the environment is considered as “a set of physical, chemical, biological, and social components capable of causing direct or indirect effects, in a short or long term, on living beings and human activities” [81] (p. 7). The second most mentioned word, 'nature', seems to be commonly used by teachers with the same meaning as 'environment', as the following response examples show:

*“Ecoethics is the responsibility that every human being has towards the environment/nature”.*

*“Respect nature as we are just one of the elements that it comprises”.*

This perception is in line with results obtained in other studies [82,83], whose authors mention the apparent confusion between the concepts of environment and nature, by teachers and future teachers participating in the study. These authors also draw attention to the importance of future teachers reflecting on and discussing the different concepts they will often use in their teaching practices [83].

At last, through some of the teachers' responses, it was also possible to perceive that they essentially positioned in the environmental anthropocentric matrix (81.1%), as shown in Table 4, which is a conceptual framework that recognizes the interdependence between humans and the environment and that emphasizes the central role of human beings in environmental decision making and the responsibility to sustainably manage natural resources. The remaining 18.9% (Table 4) tend to be positioned in a non-anthropocentric matrix.

**Table 4.** Matrix positioning trend ( $n = 122$ ).

Matrix	f	%
Anthropocentric	99	81.1
Non-anthropocentric	23	18.9

The following are examples of responses that fit more into the anthropocentric environmental matrix, more specifically in the ethics of environmental responsibility, whose central subject, as demonstrated before in Table 1, is the human being, as well as highlighting its responsibilities in the sustainable use of resources and towards future generations:

*"It is a rational use of resources, without jeopardising the future of subsequent generations, as well as the needs of everyone today".*

*"A new ethic is needed: an ethic oriented towards the future, towards sustainability [...] since Nature is at the mercy of Man and can be radically altered, he has to maintain a relationship with it that is also one of great responsibility".*

The following are examples of responses that fit more into the non-anthropocentric matrix, as the central subjects are entities other than human beings, ranging from ecocentrism, where duties are to preserve the integrity, balance, and beauty of the biotic community and not to affect or interfere with the natural world and to promote the self-realisation of beings (Table 1):

*"Respect nature as we are just one of the elements that it comprises".*

*"We must respect nature as it is, respect the rhythm of nature, especially the rhythm of its renewal, and help in a positive way in this renewal. Man must not jeopardise the balance of ecosystems".*

To biocentrism, where duties are to recognise and protect the inherent value of all living beings (Table 1):

*"Ecoethics is the respect for Nature/Biosphere, of which we are part together with all living beings, on whose balance and preservation we all vitally depend".*

These results contradict the findings of some studies [70–73,84], in which teachers identify with a more ecocentric than anthropocentric attitude, as well as other studies [74,85], in which they show a preference for biocentric and ecocentric modalities, and another one whose sample of teachers expressing anthropocentric conceptions of the environment is also low, showing potential value in exploring the promotion of ecocentrism through initial teacher training [50]. In addition, in one study [62], teachers identify more with ecocentrism, although less expressively. This author also mentions that sometimes the same teacher has values and conceptions that lead him to position himself in an anthropocentric or ecocentric ethics, depending on the situations or contexts [62]. This can also be seen in another study [85], in which teachers identify more with the anthropocentric matrix in two specific themes, namely those related to the consumption of ecological products, showing empathy for the consumer society model, and in the positioning towards the technological enterprise, highlighting the positive side associated with technology. This author also highlights that teachers often transmit an anthropocentric perspective of the human-nature relationship to their students, albeit unconsciously [85].



## 5. Conclusions and Limitations

It is well known that adolescence is confronted with the “self” in its relationship with the world. The great ideals of “saving the world” emerge here and continue beyond the age of 17. The planetary commitment, environmental preservation, and concrete knowledge implied in the desire to save the planet must be subliminal to the contents taught in Natural Sciences/Biology and Geology. In other words, it is important to encourage interest and knowledge in the natural world that surrounds students—the living river in his childhood memory, the free surroundings in which he played so many times and which will now be replaced by buildings, the grassy fields, in short, realities that are part of his lived experience and that, in some way, are degraded or are on the verge of disappearing. Or, still, that, continuing there, constitute sources of bio-ecological information to be known and deepened. A version of Environmental Education with a more conjunctural and behaviourist tendency and with an explicit political-economic focus aimed at populations in general, should not underestimate a version whose scope is fundamentally pedagogical with a view to the integral formation of future citizens, of predominantly structural order. On the contrary, the development of a constructivist perspective aimed at acquisitions of environmental values from early childhood to the end of adolescence should be considered in the effort for the formal integration of Environmental Ethics into the educational system, which is a growing trend in educational policies in several countries around the world. This is an effort that, it must be said, comes up against a countless number of questions that arise in the field (what should be taught? how? by whom?), especially in the times we live in—that of a “society at risk”, product of unlimited growth and consumption, which engenders increasing levels of complexity and leads to a horizon of unpredictability, uncertainty, controversy, and conflict. Environmental ethics, in its multidisciplinary richness and breadth, proposes to us an education model and urges us to embrace it. This assumption has led this research and defined its tools of analysis and methodology.

The main results of the present research show that the teachers who participated in it (Biology and Geology) seemed to reveal an incipient domain of environmental ethics. Therefore, they cannot integrate this aspect in their pedagogical component in an effective way and be capable of contributing to the developing formation in their students of a genuine planetary citizenship, one responsible and committed to the natural world. Both in their initial teacher training and in the guiding documents for teaching practice, ecoethics is not given significant weight, thus not calling for an environmental rationality not only in their own training as teachers, but also in the training of the generations that will be called upon to make environmental decisions in the future. Since ecoethics is a fundamental component of Environmental Education, in curricular terms, it could be officially and more expressively part of this area of knowledge. However, very often, an approach to ecoethics could be included in the subjects of Natural Sciences, Biology and Geology, Physical and Chemical Sciences, and even in other subjects whose relationship with these subjects is not so obvious (Portuguese, Maths, etc.), which shows its transversal nature. Insofar as environmental problems are closely related to very important scientific topics, with social relevance due to their ethical implications, raising ethical questions, schools in general and teachers in particular must be able to address them in a way that facilitates students’ learning and their formation as conscious and critical individuals of the world to which they belong. In this way, and increasingly, education for ecoethics is an important resource for the training and professional development of teachers in this area, so that they can contribute to an effective and meaningful education of their students in the awareness of environmental issues, contributing to the personal and collective formation of environmental awareness.

Since this research contributes to getting to know the conceptions of ecoethics of in-service Biology and Geology teachers, its results can be useful for the context of teacher education, given the importance that ecoethics has in the context of science teaching. However, in order to be able to draw more in-depth conclusions about the knowledge and opinions of in-service Biology and Geology teachers on this topic, interviews would

be desirable as a complement. Thus, further studies should be carried out in order to deepen the results obtained with the present study, as well as others that involve teachers' knowledge on the subject, to enable them to address it in their teaching practices.

The main limitation experienced was the low adherence of teachers to the study, possibly due to the high number of requests they often receive to participate in scientific studies, and it was necessary to reinforce the need for their collaboration to obtain a reasonable number of responses. Despite this, this research, which is of scientific and social relevance, aims to be a contribution to deepen the knowledge of Biology and Geology teachers regarding the subject, and the results may be relevant for trainers of Biology and Geology teachers, as well as for Biology and Geology teacher training institutions, enabling the creation of initial and continuous teacher training courses.

Science does not tire of warning about the serious threats to the health and life of humanity and the Earth, caused by the serious and dramatic changes that human actions are causing on the planet. The concept of citizenship in the face of this situation has broadened and is now understood broadly as planetary citizenship, i.e., as integrating the environmental dimension into citizens' rights and duties. The scope of this research is precisely the pedagogy for a citizenship committed to the planet, emphasising the urgent need to train students and teachers in a plan that combines ecological literacy with environmentally correct action. This may be one of the ways of responding to the challenges that the global environmental crisis poses to each and every human being, thus contributing to the formation of a responsible and engaged conscience with the planet and with humanity's future.

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## References

1. IPBES. *Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*; Brondizio, E.S., Settele, J., Díaz, S., Ngo, H.T., Eds.; IPBES Secretariat: Bonn, Germany, 2019. [CrossRef]
2. Sandler, R. *Environmental Ethics: Theory in Practice*; Oxford University Press: New York, NY, USA, 2018.
3. Boylan, M. *Environmental Ethics*, 2nd ed.; John Wiley & Sons, Inc.: Hoboken, NJ, USA, 2014.
4. Franck, O.; Osbeck, C. *Ethical Literacies and Education for Sustainable Development: Young People, Subjectivity and Democratic Participation*; Springer Nature: Berlin/Heidelberg, Germany, 2017.
5. Neves, M.; Soromenho-Marques, V. *Ética Aplicada: Ambiente*; Edições 70: Coimbra, Portugal, 2017.
6. Cochrane, A. *Environmental Ethics*. Available online: <https://iep.utm.edu/envi-eth/> (accessed on 24 October 2023).
7. García Gómez Héras, J.M.; Romero Muñoz, J. Introducción ecoética y ecopolítica: ¿Nuevos marcos filosóficos para el siglo XXI? *Azafea Rev. Filos.* **2019**, *21*, 7–10. [CrossRef]
8. Ehrlich, P. Ecoethics: Now central to all ethics. *Bioethical Inq.* **2009**, *6*, 417–436. [CrossRef]
9. French, W. Ecoethics. In *Encyclopedia of Violence, Peace and Conflict*; Kurtz, L., Ed.; Elsevier Academic Press: Amsterdam, The Netherlands, 2008; pp. 607–621.

10. Dall'Agnol, D. Pressupostos metaéticos e normativos para uma nova Ética ambiental. *Princípios* **2007**, *14*, 67–82.
11. Kwon, H. A research for complex systems approach of the ecoethics studies. In Proceedings of the 49th Annual Meeting of the International Society for the Systems Sciences, ISSS 2005, Cancun, México, 1–5 July 2005; pp. 251–262.
12. Vaz, S.; Delfino, A. *Manual de Ética Ambiental*; Universidade Aberta: Lisboa, Portugal, 2010.
13. Varandas, M.J. Para uma ética ambiental: Percursos fundamentais. In *Ética aplicada-Ambiente*; Neves, M.C., Soromenho Marques, V., Eds.; Ed. 70: Coimbra, Portugal, 2017; pp. 31–55.
14. Attfield, R. *Environmental Ethics: A Very Short Introduction*; Oxford University Press: Oxford, UK, 2018.
15. Varandas, M.J. Fundamentos da ética da Terra. In *Éticas e Políticas Ambientais*; Beckert, C., Varandas, M.J., Eds.; Centro de Filosofia da Universidade de Lisboa: Lisboa, Portugal, 2004; pp. 153–168.
16. Vaz, S.; Bina, O. Environmental ethics: Philosophy, ecology and other species. In *Routledge Handbook of Global Environmental Politics*, 2nd ed.; Harris, P., Ed.; Routledge: London, UK, 2022; pp. 362–374.
17. Varandas, M.J. Ethics and the Anthropocene crisis: On the moral consideration of nature. *Philos. Study* **2021**, *11*, 622–630. [[CrossRef](#)]
18. Marques da Silva, J. Ecologia profunda: Da ecofilosofia à política ambiental. In *Éticas e Políticas Ambientais*; Beckert, C., Varandas, M.J., Eds.; Centro de Filosofia da Universidade de Lisboa: Lisboa, Portugal, 2004; pp. 211–224.
19. Beckert, C.; Varandas, M.J. *Éticas e Políticas Ambientais*; Centro de Filosofia da Universidade de Lisboa: Lisboa, Portugal, 2004.
20. Varandas, M.J. Dilemas de ética ambiental. In *Filosofia e Arquitetura da Paisagem, um Manual*; Serrão, A., Coord, Eds.; Centro de Filosofia da Universidade de Lisboa: Lisboa, Portugal, 2012; pp. 220–236.
21. Soromenho-Marques, J. Environmental Policy in Portugal: Balance and Perspectives. In *O Futuro Frágil. Os Desafios da Crise Global do Ambiente*; Soromenho-Marques, J., Ed.; Publicações Europa-América: Mem Martins, Portugal, 1998; pp. 71–106.
22. Teixeira, F. Environmental education: A persistent and critical itinerary for the expansion of citizenship. *Philosophica* **2012**, *40*, 95–122.
23. Moosmann, L.; Siemons, A.; Fallasch, F.; Schneider, L.; Urrutia, C.; Wissner, N.; Oppelt, D. *The COP26 Climate Change Conference, Status of Climate Negotiations and Issues at Stake*; Study for the Committee on the Environment, Public Health and Food Safety, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament: Luxembourg, 2021.
24. Moosmann, L.; Siemons, A.; Fallasch, F.; Schneider, L.; Urrutia, C.; Wissner, N.; Mendelevitch, R.; Hermann, H.; Healy, S.; Oppelt, D.; et al. *The COP27 Climate Change Conference: Status of Climate Negotiations and Issues at Stake*; Study for the Committee on the Environment, Public Health and Food Safety, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament: Luxembourg, 2022.
25. European Union. *Implementing the European Green Deal: Handbook for Local and Regional Governments*; European Committee of the Regions: Brussels, Belgium, 2022.
26. ten Have, H.; Neves, M.C. *Dictionary of Global Bioethics*; Springer International Publishing: Cham, Switzerland, 2021. [[CrossRef](#)]
27. Karakaya, F.; Yilmaz, M. Environmental ethics awareness of teachers. *Int. Electron. J. Environ. Educ.* **2017**, *7*, 105–115.
28. Karaca, C. Approaches to environmental problems and solutions within the framework of environment, human and ethics. *Univ. J. Econ. Adm. Sci.* **2007**, *11*, 1–19.
29. Smith, K. *Exploring Environmental Ethics: An Introduction*; Springer: New York, NY, USA, 2018.
30. Keleş, Ö.; Özer, N. Determination of pre-service science teachers' level of awareness of environmental ethics in relation to different variables. *Int. J. Environ. Sci. Educ.* **2016**, *11*, 7286–7297.
31. Gola, B. Is formal environmental education friendly to nature? *Environmental ethics in science textbooks for primary school pupils in Poland. Ethics Educ.* **2017**, *12*, 320–336. [[CrossRef](#)]
32. Heck, J. Bioética: Contexto histórico, desafios e responsabilidade. *Ethic-Int. J. Moral Philos.* **2005**, *4*, 123–139.
33. Karataş, A. Environmental ethics education as a tool for the prevention of environmental problems in the community. *Eur. J. Sustain. Dev.* **2014**, *3*, 263–268. [[CrossRef](#)]
34. Rolston, H. Environmental ethics. In *The Blackwell Companion to Philosophy*; Bunnin, N., Tsui-James, E., Eds.; Blackwell Publishers: Malden, MA, USA, 2003; pp. 517–530.
35. İlhan, D. Approaches to Environmental Ethics Promoted in Turkey: An Example of Voluntary Environmental Organizations. Master's Thesis, Gazi University, Ankara, Türkiye, 2013.
36. Leopold, A. *A Sand County Almanac*; Oxford University Press: New York, NY, USA, 1949.
37. Carson, R. *Silent Spring*; Houghton Mifflin: New York, NY, USA, 1962.
38. Stone, C. Should trees have standing?—Toward legal rights for natural objects. *South. Calif. Law Rev.* **1972**, *45*, 450–501.
39. Naess, A. The shallow and the deep, long-range ecology movement. *Inquiry* **1973**, *16*, 95–100. [[CrossRef](#)]
40. Singer, P. *Animal Liberation: The Definitive Classic of the Animal Movement*; Open Road Integrated Media: New York, NY, USA, 1975.
41. Regan, T. *The Case for Animal Rights*; University of California Press: Washington, DC, USA, 1983.
42. Taylor, P. *Respect for Nature: A Theory of Environmental Ethic*; Princeton University Press: Princeton, NJ, USA, 1986.
43. Rolston, H., III. *Environmental Ethics: Duties to and Values in the Natural World*; Temple University Press: New Haven, CT, USA, 1988.
44. Callicott, J.B. *Beyond the Land Ethic: More Essays in Environmental Philosophy*; State University of New York Press: New York, NY, USA, 1999.
45. Norton, B. *Sustainability: A Philosophy of Adaptive Ecosystem Management*; University of Chicago Press: Chicago, IL, USA, 2005.

46. Palmer, C. *Animal Ethics in Context*; Columbia University Press: New York, NY, USA, 2010.
47. Gardiner, S. *Perfect Moral Storm: The Ethical Tragedy of Climate Change*; Oxford University Press: New York, NY, USA, 2011.
48. Bekoff, M. *Ignoring Nature No More: The Case for Compassionate Conservation*; University of Chicago Press: Chicago, IL, USA, 2013. [[CrossRef](#)]
49. Thompson, P. *From Field to Fork: Food Ethics for Everyone*; Oxford University Press: New York, NY, USA, 2015.
50. Quinn, F.; Castéra, J.; Clément, P. Teachers' conceptions of the environment: Anthropocentrism, nonanthropocentrism, anthropomorphism and the place of nature. *Environ. Educ. Res.* **2016**, *22*, 893–917. [[CrossRef](#)]
51. Jonas, H. *Princípio Responsabilidade: Ensaio de Uma Ética para a Civilização Tecnológica*; de Marijane, L., Luiz, B.M.T., Eds.; Contraponto Editora PUC RIO: Rio de Janeiro, Brasil, 1979.
52. Simmons, F. What Christian environmental ethics can learn from stewardship's critics and competitors. *Stud. Christ. Ethics* **2020**, *33*, 529–548. [[CrossRef](#)]
53. Littledyke, M. Science education for environmental awareness: Approaches to integrating cognitive and affective domains. *Environ. Educ. Res.* **2008**, *14*, 1–17. [[CrossRef](#)]
54. Gardiner, S.; Thompson, A. *The Oxford Handbook of Environmental Ethics*; Oxford University Press: New York, NY, USA, 2017.
55. DesJardins, J. *Environmental Ethics: An Introduction to Environmental Philosophy*, 5th ed.; Cengage Learning: Belmont, CA, USA, 2013.
56. Harlen, W. *Trabajando con las Grandes Ideas de la Educación en Ciencias*; Programa de Educación en Ciencias (SEP), IAP: Trieste, Italy, 2015.
57. Baker, M.; Grundy, M.; Junmookda, K.; Macer, D.; Manzanero, L.; Reyes, D.; Tuyen, N.; Waller, A. *Environmental Ethics Education*; Eubios Ethics Institute: Christchurch, New Zealand, 2019.
58. Wals, A.; Brody, M.; Dillon, J.; Stevenson, R. Convergence between science and environmental education. *Science* **2014**, *344*, 583–584. [[CrossRef](#)]
59. Harlen, W. *Principles and Big Ideas of Science Education*; Ashford Colour Press: Gosport, UK, 2010.
60. Kim, M.; Roth, W.-M. Rethinking the ethics of scientific knowledge: A case study of teaching the environment in science classrooms. *Asia Pac. Educ. Rev.* **2008**, *9*, 516–528. [[CrossRef](#)]
61. Gayford, C. Environmental literacy: Towards a shared understanding for science teachers. *Res. Sci. Technol. Educ.* **2002**, *20*, 99–110. [[CrossRef](#)]
62. Parreira, M. *Ética Ambiental-Uma Emergência Social. Contributo para a Formação de Professores*. Ph.D. Thesis, Universidade do Minho, Braga, Portugal, 2003.
63. Hadjichambis, A.; Reis, P.; Paraskeva-Hadjichambi, D.; Činčera, J.; Boeve-de Pauw, J.; Gericke, N.; Knippels, M.-C. *Conceptualizing Environmental Citizenship for 21st Century Education*; Springer Open: Cham, Switzerland, 2020.
64. Spitzer, D. What is a concept? *Educ. Technol.* **1975**, *15*, 36–39.
65. Poole, A.; Hargrove, E.; Day, P.; Forbes, W.; Berkowitz, A.; Feinsinger, P.; Rozzi, R. A call for ethics literacy in environmental education. In *Linking Ecology and Ethics for a Changing World: Values, Philosophy, and Action, Ecology and Ethics*; Rozzi, R., Pickett, S., Palmer, C., Armesto, J., Callicott, J., Eds.; Springer Science+Business Media: Dordrecht, The Netherlands, 2013; pp. 349–371.
66. Matos, D.; Jardimino, J. Os conceitos de concepção, percepção, representação e crença no campo educacional: Similaridades, diferenças e implicações para a pesquisa. *Educ. Formação* **2016**, *1*, 20–31. [[CrossRef](#)]
67. Guimarães, H. Concepções, crenças e conhecimento-afinidades e distinções essenciais. *Quadrante* **2010**, *XIX*, 81–101.
68. Temel, S. Prospective teachers' understanding of environmental ethics approach: A qualitative study. *ERPA SHS Web Conf.* **2019**, *66*, 01010. [[CrossRef](#)]
69. Çatak, M.; Kahyaoglu, M. Examining the cognitive structures of teacher candidates on the environmental ethics concept. *Int. J. Eurasia Soc. Sci.* **2019**, *10*, 163–176.
70. Nyberg, E.; Castéra, J.; Mc Ewen, B.; Gericke, N.; Clément, P. Teachers' and student teachers' attitudes towards nature and the environment—A comparative study between Sweden and France. *Scand. J. Educ. Res.* **2020**, *64*, 1090–1104. [[CrossRef](#)]
71. Yumuşak, A.; Özbaş, S.; Sargin, S.; Baltacı, F. An investigation for the future educators' attitudes towards the environmental issues in the context of ecocentrism and anthropocentrism. *Int. J. Environ. Sci. Educ.* **2016**, *11*, 603–612.
72. Pereira, R. *Educação Ambiental No Ensino Básico e Secundário: Concepções de Professores e Análise de Manuais Escolares*. Ph.D. Thesis, Universidade do Minho, Braga, Portugal, 2009.
73. Tracana, R.; Ferreira, E.; Carvalho, G. Concepções de professores sobre Educação Ambiental: Identificação de dimensões “ecocêntrica”, “antropocêntrica” e “sentimental”. In *Actas do Vº Seminário Internacional/IIº Ibero Americano de Educação Física, Lazer e Saúde*; Pereira, B., Condessa, I., Carvalho, G., Camilo, C., Pereira, V., Coord, Eds.; Universidade dos Açores: Ponta Delgada, Portugal, 2009; pp. 1–17.
74. Almeida, A.; Vasconcelos, C. Teachers' perspectives on the human-nature relationship: Implications for environmental education. *Res. Sci. Educ.* **2013**, *43*, 299–316. [[CrossRef](#)]
75. Creswell, J.; Crewell, J. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 5th ed.; SAGE Publications, Inc.: Thousand Oaks, CA, USA, 2018.
76. Direção-Geral de Estatísticas da Educação e Ciência (DGEEC). *Perfil do Docente 2021/2022. Análise Sectorial*; DGEEC: Lisboa, Portugal, 2023.
77. McMillan, J.; Schumacher, S. *Research in Education: Evidence-Based Inquiry*, 7th ed.; Pearson: Harlow, UK, 2014.

78. Dhakal, K. Nvivo. *J. Med. Libr. Assoc.* **2022**, *110*, 270–272. [[CrossRef](#)] [[PubMed](#)]
79. Boyd, D. *The Environmental Rights Revolution: Constitutions, Human Rights, and the Environment*; University of British Columbia: Vancouver, BC, Canada, 2010.
80. Williston, B. *The Ethics of Climate Change: An Introduction*; Routledge: London, UK, 2018.
81. Direção-Geral da Educação (DGE). *Referencial de Educação Ambiental para a Sustentabilidade para a Educação Pré-Escolar, o Ensino Básico e o Ensino Secundário*; Ministério da Educação Português: Lisboa, Portugal, 2018.
82. Oliveira, A.; Obara, A.; Rodrigues, M. Educação ambiental: Concepções e práticas de professores de ciências do ensino fundamental. *Rev. Electrón. Enseñanza Cienc.* **2007**, *6*, 471–495.
83. Sarivaara, E.; Keskitalo, P.; Ratinen, I. Finnish student teachers' conceptions and experiences of nature. *J. Adventure Educ. Outdoor Learn.* **2021**, *21*, 151–161. [[CrossRef](#)]
84. Karpudewan, M.; Ismail, Z.; Roth, W.-M. The efficacy of a green chemistry laboratory-based pedagogy: Changes in environmental values of Malaysia pre-service teachers. *Int. J. Sci. Math. Educ.* **2012**, *10*, 497–529. [[CrossRef](#)]
85. Almeida, A. *Educação Ambiental: A Importância da Dimensão Ética*; Livros Horizonte: Lisboa, Portugal, 2007.

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