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**Exploring the Historical Roots of Environmental and Ecological Accounting from the Dawn of Human Consciousness**

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# Exploring the Historical Roots of Environmental and Ecological Accounting from the Dawn of Human Consciousness

## ABSTRACT

**Purpose:** This paper seeks to broaden the agenda for environmental and ecological accounting research across several dimensions, extending the form of accounting in this field by encouraging research into its historical roots and developing a definition of accounting that can address the severe environmental and ecological challenges of the 21<sup>st</sup> century.

**Design/Methodology/Approach:** We explored environmental and ecological accounts from the dawn of human consciousness across a wide variety of media and in a broad range of forms. This theoretical approach reacts to the cold capitalist commodification of nature inherent in much environmental accounting practice, which documents, values and records usage of natural capital with little attempt to address depletion and loss.

**Findings:** By analysing the earliest ecological and environmental ‘accounts’ recorded by humans at the dawn of human consciousness, and considering a wide array of subsequent accounts, we demonstrate that rather than being a secondary, relatively recent development emerging from financial accounting and reporting, environmental and ecological accounting predated financial accounting by tens of thousands of years. This research also provides a wealth of perspectives on diversity, not only in forms of account but also in the diversity of accountants, as well as the broadness of the stakeholders to whom and to which the accounts are rendered.

**Research limitations/implications:** The paper can be placed at the intersection of accounting history, the alternative, interdisciplinary and critical accounts literature, and environmental and ecological accounting research.

**Originality/Value:** This study concludes with a new definition of accounting, fit for purpose in the 21<sup>st</sup> century, that integrates ecological, environmental concerns and is emancipatory, aiming to restore nature, revive biodiversity, conserve species and enhance ecosystems.

**Key words:** Accounting history; biodiversity accounting; Ecological accounting; Environmental accounting; Rock art accounts.

**Paper type:** Research paper

## 1. Introduction

This paper seeks to broaden the agenda for environmental and ecological accounting research across several dimensions, extending the definition and form of accounting in this field and encouraging research into its historical roots. We locate the paper at the intersection of academic research into accounting history, the alternative, interdisciplinary and critical accounts literature, and environmental and ecological accounting research. We observe that "environmental accounting" and "ecological accounting" are not necessarily synonymous. Environmental accounting research has been described as examining "how firms account for and disclose their environmental impacts" as well as investigating "the impact of environmental performance on firms' performance" (Marrone *et al.*, 2020, p. 2167). Despite the radical approaches of some early researchers in environmental accounting, much research in this field eschews a critical position regarding environmental accounting as just another strategy by which corporate entities are involved in the "financialisation of nature" (Ouma *et al.*, 2018). The term "ecological accounting" was first used by Birkin (1996, p. 231) to challenge not only what he referred to as "contemporary mainstream accounting" and its tendency to assimilate "environmental or sustainable development accounting" but also to encourage a holistic approach to accounting for nature. As environmental accounting moves further from being an analogue of conventional financial and managerial accounting, it becomes closer to ecological accounting.

The overarching aim of this paper is to explore ways of broadening environmental and ecological accounting, both in research and practice, in order to render this accounting more fit for the purpose of addressing the urgent challenges facing nature, the planet and humanity as we move through the 21<sup>st</sup> century (Carnegie *et al.*, 2021). Specifically, we aim to (i) explore the historical roots of environmental and ecological accounting; (ii) demonstrate that rather than being a secondary, relatively recent development that emerged from financial accounting and reporting, environmental and ecological accounting predated financial accounting by thousands of years; (iii) extend the form of environmental and ecological accounting to open new pathways for researchers; and (iv) demonstrate the diverse cultural and international roots of environmental and ecological accounting. Current approaches and the existing nature of accounting are failing to provide adequate solutions to heightening problems of ecological destruction, biodiversity loss, environmental degradation and species extinctions (Atkins and Atkins, 2019), "Given the looming and indeed already operative destruction of the natural world, accounting must certainly have more to say" (Lehman, 2017, p.39).

The majority of research into environmental and ecological reporting has tended to focus on contemporaneous data and practice, with researchers examining corporate (and other formal) reporting on the environment and biodiversity. Indeed, little research explores historical examples of environmental and ecological accounting, with only a handful of studies researching pre-20<sup>th</sup> century accounts. The current paper provides an introduction to a Special Issue of *Accounting, Auditing & Accountability Journal* which broadens the academic accounting literature by showcasing historical studies of environmental, ecological, biodiversity and extinction accounting. This paper and the seven contributions to the Special Issue widen the form of account studied by considering informal accounts produced by people who may be considered to act as "accountants", including diarists, nature writers, artists, poets, musicians, and others inspired to provide ecological and environmental accounts.

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4 This raises the question of what counts as an environmental or ecological "account". We note  
5 that dictionary definitions of "account" are pretty broad. The Oxford English Dictionary (2023)  
6 identifies five broad groups of senses for this word: "senses relating to counting, enumerating or  
7 calculating numerically", "senses relating to accounting for money paid and received", "a  
8 statement of money held, etc., and related senses", "estimation, consideration", and "narration,  
9 relation". Many of the accounts that we discuss in this paper fall into the final category, where  
10 the dictionary defines "account" as "a statement or narrative of an event or experience; a relation,  
11 report or description". Although the examples of "account" in this sense given by the dictionary  
12 all appear to be written statements of some form, in this paper we argue that any artefact that can  
13 provide a description, explanation or justification for some human phenomenon can be regarded  
14 as an account.  
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18 For many years, the academic accounting literature has acknowledged the 'ambiguity' of the term  
19 'accounting' and its dynamic nature (Miller *et al.*, 1991). Concerning 'form' of environmental and  
20 ecological account (which we define here as the manner/medium by which the accounting is  
21 expressed), since the 1960s, the focus has been primarily on reporting by business organisations  
22 (Gray *et al.*, 1996). This has, however, been criticised for being academically parochial and for  
23 "displac[ing] attention from other entities or activities, thus, potentially posing an obstacle to  
24 emancipatory work through social accounting in these other fields" (Gallhofer and Haslam,  
25 2003, p.106). Indeed, Carnegie (2022, pp. 620-621) asserted that the notion of accounting as the  
26 'language of business' was outdated and emphasized that,  
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30 Accounting is essentially not operable without having impacts, intended or unintended, on  
31 human behaviour, with implications for organisational and social functioning and  
32 development, as well as ramifications for nature and our natural environment, which  
33 sustains humans and non-humans alike.  
34

35 In this paper we explore alternative *forms* of environmental and ecological account, for example,  
36 reporting by external entities, or interested parties and individuals, such as accounts contained in  
37 historical scientific reports and related documents, diaries and journals. We also seek to broaden  
38 the acceptable *forms* of account studied by considering a variety of media, including art, music,  
39 poetry, literature produced as accounts of nature and the environment by 'accountants' such as  
40 artists, musicians, poets, writers and others. This allows and encourages accounting research to  
41 adopt an interdisciplinary approach and allows us to respond to calls in the accounting literature  
42 for "accounting to have more regard for beauty and nature. This is important to emancipating  
43 accountability thereby creating a richer, encompassing role for the lexicon and practice of  
44 accounting" (Lehman, 2017, p.31).  
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48 In terms of historical context and development, there seems to be a general acceptance among  
49 practitioners and within the academic accounting community that environmental and ecological  
50 accounting developed many decades after traditional financial reporting models to complement  
51 or accompany, a reporting framework centred around 'financials'. This is certainly implied by the  
52 definition of environmental accounting research provided by Marrone *et al.* (2020) quoted  
53 earlier. In this paper we explore the possibility that environmental and ecological accounting,  
54 including accounting for biodiversity and extinction accounting, predates the development of  
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3 financial accounting by many thousands of years, if not tens of thousands of years. This is  
4 demonstrated by a study of (primarily) ecological accounts from the dawn of human  
5 consciousness.  
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8 This paper also seeks to extend research across other dimensions, namely exploring alternative  
9 forms of account and different international and cultural contexts. Therefore, we focus on  
10 environmental and ecological accounting and reporting in this *Accounting, Auditing &*  
11 *Accountability Journal* Special Issue from a historical perspective to extend and broaden the  
12 reporting forms and provide illustrative examples of environmental and ecological accounting  
13 across earlier points of time and in different international and cultural contexts. We show that the  
14 roots of environmental and ecological account arise from all parts of the world and from all early  
15 human societies. In this way, our paper decolonises accounting, emphasising the multicultural  
16 and diverse geographic development of environmental and ecological accounts rather than the  
17 traditional view that accounting arose from a Western, European context, with social and  
18 environmental accounting following on from 19<sup>th</sup> century formalised financial accounting.  
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22 In the Call for Papers for this Special Issue of *Accounting, Auditing & Accountability Journal*,  
23 we provided a non-exhaustive list of potential areas for researchers to consider, including  
24 alternative forms of environmental and ecological accounting and auditing, such as nature  
25 diaries, travel journals, letters, reports, reviews; aesthetic and creative historical accounts of  
26 nature, wildlife, the natural environment and ecology such as literature, poetry, historical reports,  
27 etchings, illustrations; comparative accounts across time: the 'then and now' of environmental  
28 and ecological accounting and implications for the future of accounting and auditing practice;  
29 exploration of historical environmental/ecological accounts around the world, such as  
30 international illustrations of accounting for biodiversity, or extinction accounting, from the past.  
31 We also stressed to potential contributors that we would welcome research applying a wide range  
32 of methodological approaches, including qualitative, quantitative, interpretive, archival and  
33 theoretical. The seven papers included in the Special Issue make substantial contributions to the  
34 environmental and ecological accounting literature and break new ground in accounting history  
35 research. They are discussed in detail in section four.  
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39 The current paper proceeds as follows. In section two, we outline the prior environmental and  
40 ecological accounting research, focusing on the extant literature on historical research in this  
41 area. The section ends with a discussion of recent efforts to expand the definition and aim of  
42 accounting as outlined in the existing literature to develop a new definition of accounting from  
43 the discussion in this paper. Section three seeks to broaden our understanding of form concerning  
44 environmental and ecological accounting by considering a wide range of media, from diverse  
45 disciplines interpreted as 'accounts', including illustrative examples from art; diaries, personal  
46 records and letters, correspondence, travel writings; artefacts, fabrics and textiles; scientific  
47 reports; literature and poetry; and music. In section four, we discuss the papers collated for this  
48 AAAJ Special Issue, and the paper concludes with a discussion in section five.  
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## 51 **2. Environmental and Ecological Accounting Research: Towards a Historical** 52 **Perspective** 53 54 55 56

In this section, we attempt firstly to distinguish between environmental and ecological accounting from a theoretical perspective and demonstrate how these two areas of the academic literature cross over and are also differentiated.

### ***Environmental accounting and ecological accounting***

Although it is beyond the scope of this paper to provide a full review of environmental and ecological accounting literature, we summarise several studies and seek to demonstrate where and how they intersect and what the main differences are. Environmental accounting has grown meteorically over the last decades. Spanning the last 25 years, there have been many studies summarising the state of environmental and ecological accounting at specific points in time, including Mathews (1997); Gray (2002, 2010a, b); Thomson (2007); Owen (2008); Gray and Laughlin (2012); Milne and Gray (2013); Gray *et al.*, (2014); Bebbington *et al.*, (2014); Deegan (2017); Parker (2005, 2011) and Marrone *et al.* (2020). Several of these contributions aim to summarise the literature in the years preceding their study, for example, 20 years (Gray and Laughlin, 2012), 21 years (Parker, 2011), and 25 years (Mathews, 1997) of environmental accounting research, which by extrapolation takes us back to around the early 1970s. As Thomson (2007, p.28) notes "The literature [on sustainable accounting] has flourished from a trickle of articles in the 1970s and 1980s into a rich and diverse field". Over time there has also been an increase in studies that focus on specific areas of environmental/ecological accounting, such as climate change and greenhouse gas accounting (Milne and Grubnic, 2011), accounting for biodiversity (Jones and Solomon, 2013) and accounting for extinction (Atkins and Maroun, 2018).

It is no mean feat to unpick the concepts of environmental and ecological accounting, as there are cross-overs in philosophical approach, theoretical frameworks, academic research and practice, which are far too complex to cover comprehensively in this paper. Therefore, we attempt a brief overview here, showing their differences and indicating where there are similarities in approach. A 'negative' account for environmental issues may be viewed as an accounting for negative externalities such as pollution, effluents, and deleterious impacts of industrial processes on water, air and nature. The concept of negative externalities derives chiefly from economics. Other forms of accounting for the environment that have emerged over the years include full-cost accounting (Bebbington *at al.*, 2001; Antheaume, 2004) and triple bottom line (Elkington, 1997). There is an ongoing tension, even dichotomy, between the perspectives of academics (and practitioners) researching environmental accounting and ecological accounting, as Richards (2023, p.99f) illustrated nicely in the following,

On the one hand, there are "environmental" economists and accountants who are armed with the neoclassical theory of externalities and who want to value natural capital by taking into account the costs of damages caused to third parties by the activity of polluters. In this vision, the goal, most often, is not to stop pollution in order to conserve natural capital, but to give compensation to those who suffer from the degradation of natural capital by starting from a system of subjective evaluation of their suffering....On the other hand, there are economists and "green" accountants who are looking for new monetary accounts capable of ensuring the conservation, in the strongest sense, of natural capital. (Richards, 2023, p.99f).

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4 From the literature, environmental and ecological accounting derive essentially from different  
5 worldviews and perceptions of the capitalist system, financial markets, businesses and the  
6 economy. Traditional, neo-classical, environmental accounting chiefly incorporates negative  
7 externalities into accounting frameworks to record and report on them. In contrast, ecological  
8 accounting is concerned with restoring the natural environment and ecological systems, such as  
9 biodiversity and ecosystems, in an emancipatory manner. However, ecological accounting may  
10 be seen as a subset of environmental accounting as it focuses on one part of the environment:  
11 natural capital, that is flora, fauna, and biodiversity. However, as we can see above, the  
12 theoretical and philosophical underpinnings of ecological accounting as it is evolving differ  
13 considerably (and in some ways are diametrically opposite) from the basis of environmental  
14 accounting, especially if we consider environmental accounting to be linked more closely with  
15 an economics/capitalist perspective. There are exceptions to this trend however, such as the  
16 academic development of 'environmental accounting' through the Centre for Social and  
17 Environmental Accounting Research (CSEAR) and the early work of Gray, which are far more  
18 closely aligned with the philosophical approach of more recent ecological accounting research.  
19 Nevertheless, despite many efforts to explore an alternative approach to environmental and  
20 ecological research, "environmental accounting research remains firmly anchored in the  
21 accounting model as information production and dissemination by economic entities" (Russell *et*  
22 *al.*, 2017, p.1443).

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27 There is a need for an ecological accounting that readdresses the incumbent business 'as usual',  
28 profit-focused approach. Lehman (2017, p.39) integrates diverse dimensions and alternative  
29 forms:  
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32 "Closed world thinking dovetails with a dominant scientific view which makes it quite  
33 difficult to explore how beliefs, feelings and intuitions shape the evaluative frameworks  
34 used to interpret the world. If the reform agenda in accounting developed concepts of  
35 beauty and truth and departed from closed-world thinking, it would be motivated less by  
36 corporate and instrumental logic and be driven more to enact meaningful environmental  
37 change. As a result, corporate and instrumental logic would be judged regarding its present  
38 contribution to the common good rather than to private profits. Concepts of beauty and  
39 truth would form part of a transformation in how we understand the connections among  
40 economics, culture, humanity and nature."  
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44 There has, however, been a recent upsurge in interest in the concept and practice of ecological  
45 accounting as more traditional environmental accounting has increasingly focused on corporate  
46 reporting around the environment. This upsurge has been spurred on by increasing awareness of  
47 ecological collapse, species loss and depleting biodiversity (Atkins and Atkins, 2019; Atkins and  
48 Macpherson, 2022). Increasing attention has been devoted to ecological accounting and  
49 frameworks, theoretical bases for ecological accounts emerging from the academic accounting  
50 literature. The difficulties in assigning monetary values to ecology and natural capital are  
51 addressed by Sullivan and Hannis (2017). Rambaud and Feger (2020) seek to provide an  
52 ecologically-centred framework for accounting. The recent literature has also explored an  
53 emerging planetary public-value accounting for ecological restoration (Vollmer, 2020).  
54 Theoretical frameworks on and research into ecological accounting have been pioneered in  
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3 Western countries, but their development has lagged in developing economies (Zhou *et al.*,  
4 2016). Our view is that ecological accounting includes a broad spectrum of frameworks and  
5 theoretical writings that range from a perspective grounded in deep ecology (for example,  
6 Russell *et al.*, 2017) towards a more 'in-system' approach such as extinction accounting (Atkins  
7 and Maroun, 2018; Maroun and Atkins, 2018). Gallhofer (2018) explored ecological accounts of  
8 nature from a feminist theoretical perspective, emphasising the importance of integrating  
9 different genders into accounting and alternative forms.  
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12 In essence, we argue that the rise of the ecological accounting literature is primarily motivated by  
13 a reaction to the capitalist commodification of nature inherent in much environmental accounting  
14 practice, which documents, perhaps values, and records usage of natural capital and nature with  
15 no attempt to address depletion and loss. Accounting within a capitalist context is inconsistent  
16 and inadequate for any accounting for the environment and ecological accounting (Maunder and  
17 Burritt, 1991; Jones, 2014). An ecological accounting instead is focused on change, and  
18 transformation, an emancipatory form of accounting that at its core aims to restore nature, revive  
19 biodiversity, conserve species and enhance ecological systems. Ecological accounts research  
20 frequently draws on deep ecology thought (Naess, 1984; Naess and Sessions, 1984), a systems-  
21 thinking approach (Meadows *et al.*, 2016) and even the notion of Gaia (Lovelock, 2000).  
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25 There have been various attempts in the academic accounting literature to explore ways of  
26 incorporating ecological issues, biodiversity and species into accounting in theory and practice  
27 (Jones, 2014), and a Special Issue of *AAAJ* published in 2017 began unpacking the meaning of  
28 environmental accounting and its (in)adequacy in addressing ecological and nature collapse. The  
29 Special Issue "welcomed work that explored, examined and critiqued efforts to make (in)visible  
30 the impacts and interconnections of humans, their organisations and non-human worlds" (Russell  
31 *et al.*, 2017, p.1428). Specifically, Russell *et al.* (2017) opened a pathway for researchers to  
32 focus on new and alternative forms of ecological accounts and accounts of nature, which could  
33 come from diverse origins, including literary writings. The current Special Issue derives  
34 inspiration from this earlier Special Issue by encouraging further exploration of alternative forms  
35 of ecological accounts and delving into the historical roots of ecological accounting through the  
36 study of alternative historical accounts of nature and biodiversity. We also encouraged the  
37 exploration of historical environmental accounts that adopt different perspectives, thereby  
38 bringing together research at the intersection of ecological/environmental accounting with  
39 accounting history research.  
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### 43 ***Historical research into environmental and ecological accounting***

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45 The substantial recent growth in research into environmental and ecological accounting has been  
46 accompanied by some examinations of the historical roots of these approaches to accounting,  
47 with researchers exploring "how earlier individuals and organisations used accounting to enable,  
48 or in some cases ignore, sustainability, and to hold the powerful accountable for their impact on  
49 nature" (Carnegie and Napier, 2017a, p. 85). Nevertheless, the body of historical research into  
50 environmental accounting remains relatively small, and there have been calls for further  
51 exploration of environmental accounting in a historical context (Parker, 2015; Carnegie and  
52 Napier, 2017a). Also, an investigation into different forms of accounting from a historical  
53 perspective has been called for (Carnegie and Napier, 2017b). Research has emphasised a need  
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3 to widen the notion of the 'archive' beyond the traditional 'obviously accounting-based source  
4 materials' (Carnegie and Napier, 1996, p.31) such as original accounts, business records and  
5 financial statements. Broadening the definition of 'archival evidence' could extend into  
6 alternative accounting research, considering forms of environmental and ecological accounts  
7 produced by stakeholders other than business organisations. The importance of researching  
8 environmental accounting in the past has been emphasized by, for example, Carnegie and Napier  
9 (2012, pp. 353-354), who stated,

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12 If we ignore the historical perspective, current accounting practice and ideas appear  
13 rootless, evanescent and arbitrary.  
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16 The Special Issue of AAAJ in 2017, mentioned above, was inspired by a "curiosity about the  
17 parameters of environmental accounting and the types of 'accounts' and 'natures' that are deemed  
18 worthy of research" (Russell *et al.*, 2017, p.1428). This 'curiosity' led the authors to explore  
19 nature writing and environmental campaigns as potentially viable 'archives' for ecological  
20 accounting research. Similarly, earlier work has considered historical forms of environmental  
21 and ecological accounts that do not arise from more traditional business entities or even public  
22 sector 'accounting' practices. For example, researchers have analysed a 19<sup>th</sup>-century engineer's  
23 report on river pollution as an early form of external environmental account (Solomon and  
24 Thomson, 2009). Letters written by the artist, writer and social activist William Morris  
25 concerning woodland conservation have been interpreted as an early form of environmental audit  
26 (Atkins and Thomson, 2014) and were identified as an isolated exploration of early accounts  
27 from a sustainability perspective (Carnegie and Napier, 2017). Short emancipatory reports from  
28 17<sup>th</sup>-century writers and accounts of nature and wildlife encapsulated in 18<sup>th</sup>-century travel  
29 writings and naturalists' journals have been cited as illustrations of early forms of accounting for  
30 biodiversity, wildlife and landscape (Atkins and Atkins, 2019) and pamphlets as illustrations of  
31 emancipatory pollution accounting (Atkins and McBride, 2022). Indeed, Carnegie and Napier  
32 (1996) suggest that using diaries and other sources represents an extension of traditional  
33 accounting and accountability research.  
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38 Despite this, the historical study of environmental and ecological accounting is still emerging.  
39 The most recent edition of *The Routledge Companion to Accounting History* (Edwards and  
40 Walker, 2020) has just a single mention of environmental accounting. Relevant themes appear in  
41 other chapters, such as Jack's review of historical agricultural accounting research (2020).  
42 However, accounting historians know that the oldest forms of accounting typically record  
43 particular events, transactions or assets relating to agriculture. Therefore, they may be regarded  
44 as early forms of environmental accounting because they provided ways to exercise power over  
45 the natural world. Thus, in Mesopotamia, there was a system of token accounting (see, for  
46 example, Schmandt-Basserat, 1988a, 1988b). In this particular system that existed in Sumeria  
47 between around 7,500 and 3,000 BCE, tokens (counters modelled into clay in multiple shapes)  
48 were used to record items such as cereals or animals. "The token system was an archaic device  
49 for collecting, manipulating, organising, storing, and retrieving data conveying economic  
50 products" (Schmandt-Basserat, 1988a, p.125). Similarly, ancient Egyptian accounting can be  
51 seen as the practice of preparing in a visible format a record of items and activities (Ezzamel and  
52 Hoskin, 2002).  
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The paper follows a path of environmental and ecological accounting through time and across media, specifically focusing on 'accounting' for species as forms of biodiversity and extinction accounting. We begin by considering pictorial, artistic accounts of nature and wildlife, representing the earliest recorded 'accounts' of flora and fauna produced by humans. We adopt an interdisciplinary approach, crossing boundaries between art, social science, natural science, anthropology, archaeology and humanities, primarily broadening the concept and definition of environmental and ecological 'accounting'. As mentioned above, earlier research has adopted a similar approach in considering early 'accounts' such as the tokens in Mesopotamia or the recordings by ancient Egyptians, often in artistic and calligraphic form. Earlier work, such as the Dadaist movement, has also turned to art to derive accounting meaning (Gallhofer and Haslam, 1997). Further, Gallhofer and Haslam (1997) pointed out that accounting research focused heavily on accounting *content* whilst paying relatively less attention to accounting *form*. Our focus on the form of historical roots of environmental and ecological accounting seeks to address this point. We build on this prior literature to lay the way for researchers to explore accounting in various forms, disciplines, media and dimensions.

### ***Towards a new definition of accounting***

This paper attempts to redefine environmental and ecological accounting to ensure it addresses the severe challenges of the 21<sup>st</sup> century. Over time there has been a gradual expansion of the definition of accounting from a focus on financial information being provided in a technical and standardised form for shareholders to a broader array of definitions covering financial and non-financial information provided for stakeholders. Indeed, there is a tradition of academic accounting research building on the work of accounting scholars since the 1980s that recognises accounting as a social and moral practice rather than merely an objective, technical, financial, and calculative practice.<sup>1</sup> By exploring the historical roots of environmental, ecological and extinction accounting, this paper provides us with new ways of looking at accounting and new ways of defining accounting (Carnegie *et al.*, 2021, p.68):

Morgan (1988) for instance, views accounting as an interpretive art based on the perspective assumed and calls on accountants to relinquish claims asserting objectivity and truth in their practice. Instead, professional accountants should appreciate the multiple dimensions of the realities they attempt to 'account for' (p. 484) and offer their insights and statements as elements for dialogue.

There is widespread dissatisfaction across the academic literature regarding the current state of accounting for the environment, which leads to a current tide of work that seeks to define and propose new, more genuinely ecologically accountable forms. Tregidga *et al.* (2019, p.314). acknowledged that, indeed, for corporate reporting in this area, "rather than alleviating social and environmental crises and the likelihood of ecological collapse, corporate discourse on sustainable development continues to mask and thus perpetuate them."

A recently proposed definition of accounting seeks to incorporate ecological accountability through the inclusion of 'nature' in how we should see accounting. Carnegie *et al.* (2021, p.69, emphasis added) state :

Accounting is a technical, social and moral practice concerned with the sustainable utilisation of resources and proper accountability to stakeholders to enable the flourishing of organisations, people and *nature*.

This is developed by Carnegie *et al.* (2023, p.4) which:

recognises accounting in any organisational and social context as being a multi-faceted technical, social and moral practice. Therefore, it is essential to understand its full capabilities and potential for the betterment of all people, the social and natural environment from which we gain sustenance, all other life forms and for the Planet to support and nurture liveability.

These agendas inspire our paper to broaden the understanding, aim and definition of accounting by considering a diversity of accounting 'forms' drawn from various disciplines, embedding the discussion in a historical and multicultural context. We hope to extend the above definition further, rendering more aspects of a 'utopian' environmental and ecological account visible and explicit. We seek in this paper, as in this AAAJ Special Issue, to respond to a call from an earlier Special Issue, Russell *et al.* (2017, p.1444),

[T]o break open the very much limited notion of "environmental" accounting in which our scholarship has become so ensnared. We seek to promote and generate a wider, wilder, more vivid interdisciplinary mosaic that is fully representative of the political and moral concerns at play in "accounts" of "nature" and which may also prove more enchanting to our scholarship, to our lives, and to the lives and relations we have with the non-human entities that make up our planet.

In addition to breaking open the notion and form of environmental and ecological accounts, we also seek to push the exploration of such accounts back in historical time and across geographical areas.

### 3. Exploring the Historical Roots of Environmental and Ecological Accounting

This paper begins at the dawn of human consciousness by drawing on rock art as representing the source of the earliest 'accounts' recorded by humans at the dawn of human consciousness. We also interpret as environmental and ecological accounts a wide array of media, including art, modelling, sculpture, watercolour and oil paintings, lithographs, etchings, and the applied arts such as mosaics, stained glass, lacquer, embroidery, carpets, weaving, and tapestry. The form is relatively rigid when we think of accounting in the traditional sense of financial accounts. Media for keeping financial accounts have changed throughout accounting history, such as Mesopotamian tokens, the abacus and Egyptian hieroglyphs. Similarly, the media are again important in art, a form appropriate for social and environmental accounting (Gallhofer and Haslam, 1997). As well as discussing the various media used to communicate accounts of prehistoric animals, we also draw attention to the chronological development of the media used in artwork concerning their geographic development. There is an attempt to draw on examples

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3 from countries in every corner of the earth showing the international and cross-cultural origins of  
4 this environmental and ecological accounting.  
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### 6 ***Environmental and ecological rock art accounts from the dawn of human consciousness***

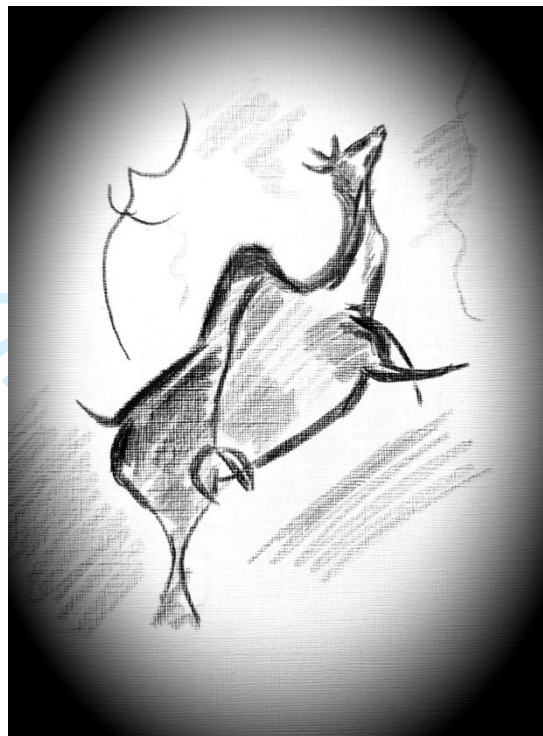
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9 To begin our discussion of the historical roots of environmental and ecological accounting, we  
10 delve into the earliest forms of expression at the dawn of human consciousness: rock art  
11 depicting animal species.<sup>ii</sup> Speaking of Sumerian token accounting Mattessich (1987, p.81)  
12 commented that "the long tradition of accounting must either inspire some awe or reinforce the  
13 view that accounting is a dusty discipline indeed — one that literally arose out of the clay or dust  
14 of the earth."  
15

16  
17 We suggest that the representations of animals, and specific species, in rock art, emerging from  
18 the dawn of human consciousness, may be interpreted as the earliest form of 'accounting', in the  
19 sense of representing number (or at least relative abundance) and a form of 'naming', that is,  
20 naming and counting. Again this earliest form of environmental and ecological account arose  
21 from the earth, from the rocks and caves used by our ancestors. Exploring the foundations of  
22 language, Mattessich (1987) drew from Wittgenstein (1922) to illustrate that writing is a form of  
23 pictorial representation, "although a sentence cannot say its meaning ..., it can show its meaning.  
24 And if it can show this, then it must be some kind of picture of reality" (Mattessich, 1987, p.82).  
25 Mattessich (1987, p.84) does, however, pour cold water on the notion that rock art may be  
26 interpreted as accounts:  
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30 One might argue that the much older paleolithic cave paintings ..... constitute earlier  
31 evidence for a correspondence theory of representation. But in these caves only objects  
32 (e.g. animals and hunters) are clearly represented while the relationships are, at best,  
33 merely implied. Certainly, the systematics necessary for a representational system, and the  
34 evidence afforded by the clay envelopes and string aggregates of the token accounting  
35 systems, is nowhere found in paleolithic art. In other words, paleolithic art represented  
36 mainly objects while neolithic record keeping represented objects as well as facts in  
37 Wittgenstein's sense (i.e. relations between objects). However, this hypothesis may founder  
38 if Margulis and Sagan's [1986, p. 222] guess is correct that "hunter-gatherers were  
39 sketching maps and plotting the movement of planets and stars as early as 40,000 years  
40 ago.  
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43  
44 Mattessich leaves it open for researchers to build a case that rock art equates to an early form of  
45 accounting. Concerning rock art research, mainly arising since Mattessich's work, we are led to  
46 believe that rock art animal accounts may demonstrate characteristics of accounting hitherto  
47 unrealised: representation of abundance (rather than specific numbers), economic significance,  
48 and effectively naming species via pictorial representation. In the last sentence, Mattessich  
49 suggests that hunter-gatherers could have been doing more than merely producing artwork that  
50 allows us to readdress this idea. Rock art researchers have concluded in recent years that there  
51 are various motivations for rock art, including cultural, societal and economic significance. We  
52 only need to look at one of the earliest examples of species recorded in rock art to see how  
53 prehistoric man (or woman) provided an account of a specific animal for others, for the  
54 community, in order to discharge accountability in some way, maybe to a deity, or to mother  
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3 nature, we will never know. The detailed pictorial representation allows the identification of  
4 specific species, making these rock art images informative and accurate recordings (and  
5 therefore accounts) of animals of the time, sometimes now extinct (and therefore also a form of  
6 extinction account). The figure below is an artistic reproduction of an elk species that dates back  
7 almost 40,000 years.<sup>iii</sup>  
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33 Academic rock art research, with suggested motivations underlying its production, are discussed  
34 more fully in Atkins and Maroun (2023). Indeed, interviews with 'informants' from the South  
35 African Khoisan tribe suggest that rock art had meanings more in tune with 'accounting' than  
36 mere art, such as leaving important information on herds and species for other visitors to the area  
37 (Atkins and Maroun, 2023). Research has indicated that rock art and other artistic forms in South  
38 Africa can be traced back further than 70,000 years, with ecological accounts through rock art  
39 representing the first expressions of human consciousness (Botha and Everaert, 2013). Indeed,  
40 the ancient remains of a 'paint-making workshop' has been discovered at Blombos Cave in South  
41 Africa and dated to around 100,000 years ago,  
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45 Archaeologists have unearthed two paint-mixing palettes made of shell, mineral ochres that  
46 had been rubbed to produce powders for the making of paint pastes, and tools used to  
47 process those pigments (David, 2017, p.119).  
48

49  
50 Research into the First Nation people in Australia has shown that Aboriginal culture dates back  
51 more than 60,000 years, with a focus on their relationship with nature.<sup>iv</sup> Rock art from 27,000  
52 years ago has been discovered at Nawarla Gabarnmang (David, 2017). Indeed, Australian  
53 aboriginal art is part of the oldest continuous living culture in world history. Again, such art and  
54 narrative provide ecological and environmental accounts from the dawn of human  
55 consciousness.<sup>v</sup>  
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4 It is beyond this paper's scope to delve further into rock art as a form of ecological and  
5 environmental accounts. In any event, although it is impossible to go back in time and discover  
6 once and for all the purpose of rock art, some of the latest academic rock art research suggests  
7 economic and numeric representational meaning in rock art animals that render them in our  
8 view, the earliest accounts of species, ecology and the environment. This provides a rich area for  
9 further academic research that links academic research into rock art with accounting,  
10 communication and language. This approach also builds on contemporary research in accounting  
11 that seeks to draw inspiration and improvements to practice from ancient communities, for  
12 example,  
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16 First Nations perspectives should be instructive for the global sustainability agenda and for  
17 re-thinking the balance between profit, people and the planet (Guthrie *et al.*, 2022, p.45).  
18

19 By delving into historical forms of accounting and accountability within ancient and prehistoric  
20 communities, we can inform the development of more inclusive and holistic practices that  
21 integrate people more closely with the natural world and non-human species.  
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### 24 ***Environmental and ecological accounts through diverse media***

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26 If we interpret rock art's first surviving human visual communication as the earliest form of  
27 ecological accounting, then art and pictorial representation predate any form of purely numerical  
28 or financial account. Tracing back in time, there are many examples of early ecological accounts  
29 of flora and fauna. Considering a wide array of ecological and environmental accounts from  
30 diverse media, including artistic representation and other forms of recording, allows us to build  
31 on earlier academic accounting calls for social and environmental accounting research and  
32 practice, to adopt alternative and more holistic views arising from a critique, Lehman (2017,  
33 p.32, emphasis added) stated that:  
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37 Economic modernity has created a social and business world which focuses (overly) on  
38 efficiency, effectiveness and instrumental reasoning. Instrumental thinking, however, has  
39 the potential to ignore beauty just as it ignores environmental and other objects of value.  
40 These *largely ignored values all shape and nurture the spirit of humanity to inspire better*  
41 *ways to live in the world.*  
42

43 We consider it is only by expanding the role and definition of ecological and environmental  
44 accounting that nature and society can be enhanced through an emancipatory and more holistic  
45 approach to business, finance, accounting and society.  
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### 48 ***Ecological Accounts of Animals through Art***

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50 As discussed above, rock art accounts may be seen as the earliest form of artwork and the earliest  
51 recording of species and ecology. Here, we explore subsequent artistic ecological accounts  
52 through history and across different geographic regions and cultures. Throughout history, many  
53 artistic movements have focused on the representation of flora and fauna. Tracing back in time,  
54 there are many examples of early ecological accounts of flora and fauna in pictorial form. The  
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3 form may include various physical materials and media. Weaving, for example, provides a  
4 means of communicating artistic representations of flora and fauna that evolved in the Far East  
5 thousands of years ago. Embroidery, the decoration of material by needlework, is an art as old as  
6 the history of civilisation (Belves and Mathey, 1968). Carpets often provide accounts of wildlife  
7 and nature, originating in Asia thousands of years ago. Mosaics were developed as a form of  
8 artistic communication in the early Greek and Minoan times. A salient example is the Mosaic in  
9 the lapidary of the Archaeological Museum of Delphi, depicting dogs, fish, wild boar, chickens  
10 and other animals.<sup>vi</sup>  
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14 In the Pacific Islands, artistic accounts of flora and fauna were made on tapa cloth from the bark  
15 of paper mulberry trees. Indeed, Tongan, Samoan, and Fijian tapa tended to depict geometric  
16 patterns with fish and plants.<sup>vii</sup> African depictions of animals and the environment tended to be  
17 primarily in wood carvings. Drawings, such as pencil drawings, are a means by which an artist  
18 may express an object while simultaneously interpreting it through their own personality, in the  
19 same way as everyone's handwriting is different. Indeed, writing developed from drawing  
20 (Belves and Mathey, 1968). Pencils were only invented in Cumberland, a UK county, in 1564,  
21 and drawing employed earlier media such as lead paint, silverpoint and charcoal. In the early 19<sup>th</sup>  
22 century, Japanese prints that frequently depicted animals, birds and nature became popular, for  
23 example, at the end of the 19<sup>th</sup> century, Hiroshige's 'The Eagle'.<sup>viii</sup>  
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27 The 19<sup>th</sup> century French 'animalier' movement, for example, involved artists producing detailed  
28 animal sculptures. Antoine-Louis Barye (1795-1875) painted and sculpted animals in the zoo in  
29 Paris, his Reclining Tiger being a startling and unnerving illustration.<sup>ix</sup> These artists captured the  
30 spirit and the visual characteristics of species well before they could be recorded through  
31 photography. In our view, such images go beyond providing a simple record as they are intended  
32 to stimulate feelings and reactions on the part of those viewing them, and because of this the  
33 images can be regarded as a pictorial form of ecological account. Throughout history, we can  
34 find a myriad examples of artistic ecological and environmental accounts, again far too many to  
35 mention in this paper.  
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### 38 *Nature Diaries as Ecological Accounts of Flora and Fauna*

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41 Diaries represent a relatively under-researched account (Carnegie and Napier, 1996). Atkins and  
42 Maroun (2020) analysed the nature diaries of the Rev. Gilbert White as ecological accounts of  
43 biodiversity and even extinction accounting. The nature diaries of Edith Holden (1871-1920)  
44 provide an account from a female perspective of flora and fauna observed by the writer. The  
45 nature diary for 1906 was published as *Country Diary of an Edwardian Lady* (Holden, 1977).  
46 This work is a fine example of a nature diary, which identifies the plants and animals that Holden  
47 observed when walking near her home on the outskirts of Birmingham, UK, and it also contains  
48 her own botanical paintings and excerpts from poems she felt were relevant to her observations.  
49 Nature diaries such as that of Holden are vital as they provide a contemporary account (in the  
50 sense of a record) of nature for the nature diarist's use and allow subsequent readers to analyse  
51 the diary as a source of data on plant and animal species. Moreover, as Holden provided  
52 illustrations and references to poetry and other literature, subsequent readers can assess how  
53 these different elements reinforce or qualify the more specific information provided textually.  
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3 She also included another dimension to her account, the pictorial representation of species  
4 through her botanical paintings.  
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6  
7 Potentially, Holden's diaries may demonstrate a 'feminine' way of accounting for the  
8 environment as opposed to the more 'masculine' accounting of White, relying entirely on textual  
9 narrative. Moreover, her multidimensional ecological account contained in her *Country Diary*  
10 provides a springboard for exploring other forms of, and dimensions of, environmental and  
11 ecological accounts produced by external accountants or other interested parties to record and  
12 account for nature, species, the natural environment and ecology.  
13

#### 14 15 *Nature writings, poetry and literature as ecological and environmental accounts* 16

17 Nature writings have been used to illustrate an alternative form of environmental and ecological  
18 account when Russell *et al.* (2017) allude to the 'value creation story' provided in Potton's  
19 (2016) written account of his experiences of nature. The paper also discusses the nature writings  
20 of Muir (1915/2017), Thoreau (1854/2004) and Leopold (1949) as potential ecological accounts  
21 worthy of study as ecological and environmental accounting archives. We build on these  
22 suggestions by providing illustrations of such accounts from nature writings and a handful of  
23 poems, literature and music. Our exploration builds on prior literature that investigates  
24 environmental and ecological accounting as forms of narrative and storytelling (Dillard and  
25 Reynolds, 2008; Morrison and Lowe, 2021) and aesthetic and even emotional accounts. Our  
26 approach also builds on the notion of shadow accounts (Dey, 2007; Dey *et al.*, 2011; Tregidga,  
27 2017), which may include multiple forms of accounts provided by external parties (Solomon and  
28 Thomson, 2009) and may be informal, rather than provided as a formal and structured account  
29 and which may exist, "as an ununified array of accounts from others external to the traditional  
30 boundaries of the organization" (Morrison and Lowe, 2021, p.821). Although there are a myriad  
31 examples across poetry, literature and music, we have selected a small sample of those that  
32 illustrate species accounting, ecological accounting, and accounts of nature and the environment.  
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36 An interesting contrast between 'positive' and 'negative' ecological accounts is provided by two  
37 poems by Gerard Manley Hopkins SJ, "The Windhover" and "The Caged Skylark" (for text, see  
38 Hopkins, 1985). Hopkins was born in 1844 and died in 1889; and is one of the most celebrated  
39 British poets of the Victorian era and a Jesuit priest. The contrast between these two poems  
40 reflects two opposing environmental and ecological account forms. Hopkin's poem "The  
41 Windhover" uses uplifting and inspiring language to reflect a species' beauty and place in nature.  
42 On the other hand, "The Caged Skylark" is written using much 'harder' and negative language,  
43 demonstrating the deleterious impact of human actions on species, in this case, capturing and  
44 imprisoning a wild bird. Hopkins encompasses multiple dimensions, including artistic writing,  
45 rhyme and rhythm, love of nature, a religious motivation for accounting for nature, and  
46 emotional content (Stanca, 2018).  
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50 In terms of nature writing, we have selected the works of Muir, drawing inspiration from Russell  
51 *et al.*'s (2017) assertion that his narrative, to them, represents a form of ecological accounting. In  
52 terms of an ecological account of a specific species, Muir's (2017, p.288) description of the  
53 water ouzel is quite remarkable:  
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3 The waterfalls of the Sierra are frequented by only one bird, - the Ouzel or Water Thrush  
4 (Cinclus mexicanus, Sw). He is a singularly joyous and lovable little fellow, about the size  
5 of a robin, clad in a plain waterproof suit of bluish grey, with a tinge of chocolate on the  
6 head and shoulders. In form he is about as smoothly plump and compact as a pebble that  
7 has been whirled in a pot-hole, the flowing contour of his body being interrupted only by  
8 his strong feet and bill, the crisp wing-tips, and the up-slanted wren-like tail.  
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11 This ecological account combines beauty, emotion, colour, and personification with poetic prose,  
12 leaving the reader with an exacting image of the bird, allowing identification. His accounts are  
13 also likely to be intentionally emancipatory, as “His voice, often rhapsodic and, at times, ecstatic,  
14 was urgent in his resounding call for wilderness protection” (Williams, 2017, p.xv).  
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17 As an artistic, aesthetic medium, music represents another means for nature to be accounted for.  
18 Again, the amount of music composed inspired by nature is far beyond the scope of this paper,  
19 so we have selected one of the most well-known from the genre of Western classical music. For  
20 example, Smetana’s *Ma Vlast* provides musical representations of several features of the Czech  
21 countryside. The work includes “Vltava”, which tracks the course of a river, painting a picture  
22 through the orchestral score of nature abounding on the river’s journey through the countryside.  
23 Smetana wrote *Ma Vlast* to encourage Czech nationalism through his love of the countryside,  
24 and in a sense, the music represents a discharge of the accountability that Smetana accepted for  
25 his support for Czech independence. As Helfert (1924, p. 153) observed, Smetana was, “actuated  
26 by a sense of moral responsibility and [was] at one with his native soil and home atmosphere”.  
27 Again, we would welcome explorations of music from other cultures and other parts of the world  
28 but are limited by the scope of the current paper and call for other researchers to turn to such  
29 sources of environmental and ecological accounts.  
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### 33 *Accounting for plants through botanical illustrations, records, and commercial catalogues*

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35 The impact of human activity and especially business activity on plants, trees and all forms of  
36 ‘flora’ is at least as significant as their impact on animals, insects, birds, fish and other ‘fauna’.  
37 Accounting for plants has increasing relevance as we move through the 21<sup>st</sup> century. Medicinal  
38 plants present an excellent illustration of why plant accounting is increasingly essential. The  
39 latest reports into the state of biodiversity loss globally identify species depletion of tropical flora  
40 as a threat to the pharmaceutical industry. The recent IPBES (2019) highlights the impacts of  
41 biodiversity loss and species extinctions on medicinal plants as a severe issue. Companies that  
42 practice deforestation are actively destroying plants that are used in medicines. The natural  
43 abundance of medicinal plants represents an important ecosystem service. Recognition of the  
44 importance of particular plant species for medicines involves identifying and auditing  
45 populations and communicating their importance. At least 28,000 plant species are recorded for  
46 medicinal use (Allkin *et al.*, 2017). Indeed, more than 25 per cent of new drugs are derived from  
47 natural products, with more than 70 per cent of drugs to treat cancers derived directly from  
48 natural medicinal products (Newman and Cragg, 2012; Newman *et al.*, 2003) with growing  
49 evidence of extinctions among medicinal plant species (Klein *et al.*, 2014; Mapfumo *et al.*,  
50 2016). Habitat loss, habitat conversion, habitat degradation and excessive harvesting are the  
51 leading causes of decline in threatened plant species, including medicinal plants (Newbold *et al.*,  
52 2014; Brummitt *et al.*, 2015; Fernández Llamazares *et al.*, 2016). The latest scientific research  
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has found that 21% of known medicinal plants are threatened (Schippmann *et al.*, 2006). As known medicinal species decline in abundance and become extinct, the potential for new medicinal drugs from plant species is also declining (Richerzhagen, 2010).

The purpose of constructing an account for plants and the practice of plant accounting is not a 21<sup>st</sup> century phenomenon. Indeed, accounting for medicinal plants through documenting and recording species, reporting on how they may be used in medicines, and stating their importance, dates back hundreds of years. Early historical examples of such ecological audits and accounts of plant species go back centuries. Such accounting for medicinal plants may be interpreted as accounting with the aim of enhancing societal welfare, given their role in healing the sick.

Plants and especially medicinal herbs that were deemed helpful to humans were recorded and described as early as the fourth century BC by Theophrastus, known as the 'Father of Botany', as well as by various Greek and Roman naturalists such as Dioscorides in first century AD (Harvey, 1972). As we know from the accounting history literature above, naming and counting are crucial characteristics of early accounts such as the Sumerian tablets. "Theophrastus was the first person to devote serious attention to naming plant names for flora. He was the first person to gather information about plants and to ask the big questions: 'What have we got?' 'How do we differentiate between these things?'" (Pavord, 2005, p.21). The commercial and economic connections to this early ecological plant account are evident from their focus on medicinal and dietetic characteristics and use.

As well as naming, a description in the form of a botanical illustration or picture can also be interpreted as an early form of 'account' of a plant, in the same way that rock art represents the earliest account of animal species. There are innumerable examples of artistic plant species accounts through history, from an Anglo-Saxon herbal from around 1050 (Pavord, 2005, p. 119) to William Roxburgh's "*Plants of the Coast of Coromandel*" from the end of the 18<sup>th</sup> century (Desmond, 2003, p. 54), even before we enter more recent periods.

One of the earliest attempts to commercialise trade in plants in Britain was in fruit trees such as apples and pears, with early traders being Gerard 'le fruter' and Philip 'le fruter de London' being involved in importing trees and seeds in the early 14<sup>th</sup> century (Harvey, 1972). The 'best' plant account in the UK was that of Master John Bray, physician to Edward III, in the 14<sup>th</sup> century, which focused again on medicinal herbs but also plants imported as drugs (Harvey, 1972). The 'Fromond' List of Plants, produced around 1500 in the UK, is seen as the "ancestor of the lists made for commercial purposes by nurserymen and seedsmen" (Harvey, 1972, p.4). The list included herbs for many purposes, including 'herbys necessary for a gardyn', 'herbes for savour and beaute', again emphasising the commercial and economic motivations underlying the production of these accounts. Cardinal Wolsey's and Henry VIII's accounts include payments for seeds and plants, with Wolsey paying 13s.2d. for hyssop and germander plants in 1515.

The recording of plants, especially those with medicinal properties, was a serious preoccupation of the earliest explorers, with detailed notes and records being frequently accompanied by pictorial representation in the form of botanical drawings and artwork. Early systematic inventories of animals and plants arose from European explorers 'discovering' the 'New World' (Desmond, 2003). The first of these plant 'audits' was published in 1569 and written by

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3 Monardes. These early biodiversity botanical ‘accountants’ were effectively called to account for  
4 plants and animals, often by Royal decree. For example, Hernandez, a physician to Philip II of  
5 Spain, was sent to the Americas with a team of artists and observers to produce detailed  
6 drawings and records of flora and fauna. The outcome was the first survey, or ecological  
7 account, of the ‘New World’, conducted between 1571 and 1577. There were various attempts to  
8 publish these accounts, but the focus was on medicinal data, with one notable edition being  
9 published in Rome in 1651, entitled, “*Rerum medicarum Novae Hispaniae Thesaurus, seu*  
10 *Plantarum, Animalium, Mineralium Mexicanorum Historia ex Francisci Hernandez*”. As well as  
11 royalty, patrons also played a significant role in calling for these ecological accounts, providing  
12 moral support and motivation to the ‘accountants’ and financial backing for the projects.  
13 Examples include John Hill’s ‘*British Herbal*’ published in 1756, and the “*Plants of the Coast of*  
14 *Covomandel*”, 1795-1820.  
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18 In the mid-18<sup>th</sup> century, natural history was still seen as mainly a recreational activity for the  
19 leisure class and academics, but its appeal started to spread more broadly to gardeners, clergy  
20 and other groups of society (Desmond, 2003). Indeed, the publication of natural history books in  
21 the UK accelerated significantly in the 18<sup>th</sup> century, growing from 12 books published in the  
22 16<sup>th</sup> century to 97 in the 17<sup>th</sup> century, with 376 published in the 18<sup>th</sup> century (Freeman, 1980).  
23 Indeed, history is littered with examples of interested parties, scientists and non-corporates  
24 accounting for plants for various reasons. In addition to his nature diaries that have been  
25 interpreted as early accounts of biodiversity, Gilbert White also produced detailed ecological  
26 accounts and audits of flora in his “*Flora selborensis*” and “*Garden calendar*” (Atkins and  
27 Maroun, 2021).  
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31 Ecological and biodiversity accounts of flora and fauna in the Far East, for instance, were  
32 collated by physicians *inter alia* employed by the trading bodies of the time, namely the British  
33 East India Company and the Dutch East India Company during the 17<sup>th</sup> and 18<sup>th</sup> centuries. These  
34 include the “*Hortus Indicus Malabaricus*” by Hendrik Adriaan Van Reede Drakenstein in 1678.  
35 This publication describes 729 plants providing details of their foliage, flowers, fruit and seeds,  
36 trunk/stem, roots, usage in agriculture, and their usage in the commerce of medicine. This  
37 account, commissioned by a trading company, highlights plants’ commercial and economic uses,  
38 documenting them for the first time with pictorial illustrations. Indeed, Van Reede was clearly  
39 ‘called to account’ by the East India Company as the accounts were commissioned by the Dutch  
40 officials, “To investigate the vegetation of the Company’s overseas possessions” (Desmond,  
41 2003, p.38). From a contemporary perspective, this activity reflects corporate efforts to provide  
42 audits of natural capital in the habitats they own and are impacted by their business activity.  
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46 In the 18<sup>th</sup> century, the British East India Company employed artists such as William Roxburgh  
47 (mentioned above) but also engaged Indian artists to produce detailed drawings of plants. This  
48 artwork has been interpreted as ‘colonial’. However, it merges Indian and Western artistic styles  
49 in a hybrid form of art, as the Indian artists altered their style from, “... fastidious miniatures  
50 associated with traditional Indian art and learn[ed] how to paint flowers, usually life-size, in a  
51 European idiom acceptable to botanists” (Desmond, 2003, p.51).  
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54 As gardening began to take off as a commercial activity, what was referred to as ‘Nurserymen’s  
55 Catalogues’ began to be produced. These catalogues were effective accounts of plants sold and  
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exchanged from the Tudor period onwards in the UK. Each plant would be available for customers to purchase from these early nurseries and, therefore, was a record of their commercial, ecological, and aesthetic value. One aim of, for example, the “*Catalogus Plantarum*” of 1730 was to standardise plant names. The catalogue consisted of a list of English and Latin names, including cultivation notes and engravings of the flowers. Every plant included was available for purchase and had a code relating to its specific financial value. The East India Company was again influential in these developments as they represented the means of sourcing and transporting plants for botanic gardens and embryonic nurseries.

The diverse ways in which ‘accounts’ of the natural world can be generated through rock art, diaries, paintings, music, plant listings and catalogues allow us to suggest that historical studies of ecological accounting should seek to find a wide range of different forms of archival and other evidence. Such evidence will probably not reflect a monetarised approach to nature (though mercantile plant catalogues give an idea of monetary value through the prices they quote). However, they may still be regarded as ‘accounts’ through their provision of detailed records that in some cases were used by their preparers or contemporaries to ‘hold nature to account’ and also to hold individuals and society to account for how the environment was exploited. In the next section of the paper, we consider how the contributions to this Special Issue demonstrate the historical dimension of environmental and ecological accounting.

#### 4. The Papers in this Special Issue: Broadening the Agenda for Environmental and Ecological Accounting Research

The contributions to this Special Issue are diverse and provide research into a variety of forms of accounting through history in a wide range of geographic locations and in diverse cultural contexts. Further, the papers in this Special Issue demonstrate cutting edge academic accounting research that contributes to interdisciplinary perspectives in accounting research as well as to the fields of alternative accounting research, accounting history and of course environmental and ecological research. We discuss the contributions to this Special Issue in chronological order, in other words taking them in order according to the time period when the accounts studied were produced. Table 1 below summarises characteristics of the contributions in chronological order across several dimensions: their geographic focus; the time period when the accounts were produced, the form the account took and lastly, the disciplines incorporated into, and represented by, the account.

**Table 1: Contributions to the Special Issue**

Special Issue Paper	Geographic Focus	Time Period	Form of Account
Bigoni, Lazzini, Occhipinti and Verona	Italy	1537-1621	Primary sources located at the State Archive of Pisa, including laws, statutes, regulations, rescripts and accounting reports
Lehner and Kyriacou	Germany	1769–1859	Humboldt’s <i>Naturgemälde</i>
Wang and Hu	China	C18 <sup>th</sup> /19 <sup>th</sup>	Qingshui River Contracts
McBride, Sagitova and Cam	Russia	1840-1863	Accounts of the Russian American Company
Quinn, Moreno and	Ireland	1935-1993	Reporting by Irish state-owned energy company, the

Bhatla			Electricity Supply Board of Ireland
Lauwo, Ossamuyimen, Denedo and Ejiogu	Nigeria	Late 20 <sup>th</sup> century	Books, diaries, letters and poems written by Ken Saro-Wiwa, as well as books, reports and audio recordings of panel discussions which capture the Ogoni struggle, Ken Saro-Wiwa's activism and its impacts
Maione, Currurullo and Tommasetti	International	1767-2022	Accounting for biodiversity literature in a wide variety of forms

Bigoni *et al.* have explored the accounts of the Grand Duchy of Tuscany from 1537 to 1621, interpreting them as an early historical form of environmental accounting. This Tuscan region of what is modern day Italy was ruled by the Medici family during this specific historical period. The paper is especially interesting in its contribution to interdisciplinary perspectives in accounting as not only does it provide research into an early form of environmental accounting but also the authors study environmental accounting, accounting history and hydrogeology using a Foucauldian theoretical framework. Hydrogeology is the generic term for the investigation of groundwater with the term being used for the first time in 1802 by Jean-Baptiste de Lamarck (Hölting and Coldewey, 2019). Bringing environmental accounting research into the study of 16<sup>th</sup> and 17<sup>th</sup> century groundwater systems is novel in itself. Bigoni *et al.*'s paper explores an early form of environmental accounting rather than ecological accounting, although the issues arising in the paper have ecological implications. The research is enveloped within Foucauldian theory applying the notion of *raison d'État* as well as accounting as a technology of government, to investigate the ways in which accounting reports enabled the Grand Dukes to implement an environmental strategy that would improve air and water quality with the aim of improving societal health. The collected, broadly defined, accounts analysed are primary sources located at the State Archive of Pisa, including laws, statutes, regulations, rescripts and accounting reports. The paper demonstrates how governing and accounting, in a variety of forms informed and managed environmental practices that impacted the hydrogeological stability of the territory in order to ameliorate local environmental and ecological conditions with a view to increasing the population as well as their health and quality of life. Consistent with the rationality of *raison d'État*, protecting the population and enabling it to grow was a means of increasing the power and prestige of the Grand Duchy.

The second contribution to this Special Issue is a study of Humboldt's *Naturgemälde* ('picture of nature'). As well as being an early example of environmental and ecological accounting, this work may also be interpreted as an early integrated report, as Humboldt perceived everything in nature being interconnected, and named this concept, '*Naturgemälde*' (see, Editorial, 2019). Furthermore, his ideas may have established the groundwork for more recent scientific theories such as Lovelock's (1979; 2009; 2014) concept of Gaia. In terms of being an ecological accountant, Lehner and Kyriacou note that more flora and fauna species have been named after Humboldt than after anyone else: quite an astounding fact which demonstrates his influence as an early accountant (and effectively auditor) of species. In terms of 'form of account', which is an important focus of this Special Issue, the research demonstrates the importance of the aesthetic role of accounting, highlighting artistic representation as environmental and ecological account. Indeed, by recording environmental and ecological data in artistic (infographic) form Humboldt asserted that, "...visual arrangements of data can uncover the complex relations found in nature", (as quoted in Lehner and Kyriacou) which, we feel, shows how important ecological accounting is in developing an intrinsic understanding of nature and our relationship and

connectedness with the same. Humboldt's preoccupation with measurement, as evidenced by the multitude of tools for measuring that he took on expeditions, is shared by other early ecological and environmental accountants, such as the nature diarist, the Revd. Gilbert White (Atkins and Maroun, 2020). Further, the concept of a hybrid ecological (and extinction) accounting is core to earlier research, and the multifaceted, integrated nature of Humboldt's environmental and ecological accounts is paramount, as they combine artistic representation with detailed measurements and more scientific data, with Lehner and Kyriacou highlighting the way such forms of account thus have the ability to reach different audiences. This paper also highlights the interdisciplinary nature of the contributions to this Special Issue, as Humboldt's environmental and ecological account draws together disciplines of ecology, global change and geoscience (Editorial, 2019) with infographics and art, and from our perspective, with accounting, reporting, recording, auditing and measuring.

The third paper in this Special Issue is Wang and Hu's study of accounting for community forests which analyses records from the Qingshui River Society spanning the 18<sup>th</sup> and 19<sup>th</sup> centuries, namely the Qingshui River Manuscripts (清水江文书). The paper focuses specifically on a series of written contracts, referred to as 'folk contracts'. These are defined by the authors as predominantly unofficial contracts established between the local people for the sustainable governing of the community forests. The contracts sought to prevent decimation of the forests via unauthorized logging with the aim of regulating the timber industry in the region. This paper also provides an example of species accounting, as the primary species involved in the contracts was the cunninghamia tree (a variety of cypress native to China). Wang and Hu's research is illustrative of interdisciplinary research in the way it weaves together ecological and environmental accounting with emancipatory accounting concepts, accounting history and economic anthropology. Incorporating anthropology into this study of early environmental and ecological accounting also shows the embeddedness of culture and societal issues in accounting.

McBride *et al.*'s paper on the accounts of the Russian American Company between 1840 and 1863 explores an early form of extinction accounting, and specifically an early form of species accounting. Motivated by financial risk management considerations for preserving species and biodiversity<sup>1</sup> rather than any moral or ethical intention, the company developed strategies for protecting the populations of fur seals and fur otters in order to prevent their local extinction, so as to protect the fur trade's future cash flows. Indeed, the authors assert that the company's profits were falling from the early 19<sup>th</sup> century as a direct result of their target animals' declining populations and that this was the cause for their extinction prevention measures. Researching the Russian American Company's accounts, translated into English by the authors, employs an inductive top-down analytical approach combined with the extant extinction accounting framework, which builds on emancipatory accounting theory. An interesting outcome from the analysis was identification of emancipatory accounting involving stakeholder consultation, where the company engaged with local communities of indigenous peoples to assist them in species preservation. The extensive species accounting includes reporting on populations and management of blue, black and white polar fox, sea otter, river beavers, walrus, Eurasian lynx, bear, sable, and fur seals. Another emancipatory extinction strategy reported by the company

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<sup>1</sup> Atkins, Gräbsch and Jones (2014) provide a diagrammatic framework outlining a system of biodiversity risk management within a company's system of internal control.

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3 included banning the killing of pregnant sea otters. This historical study allows us to see how  
4 corporate extinction accounting (and accounting for biodiversity and species) was initially rooted  
5 in financial risk concerns but in response to 21<sup>st</sup> century challenges of mass extinction and  
6 biodiversity collapse is now being increasingly motivated by a need for organisational  
7 accountability and moral, deep ecology perspectives.  
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10 The study by Quinn *et al.* explores an early form of environmental accounting, with some  
11 elements of ecological accounting in relation to fish, over 56 years of the 20<sup>th</sup> century. They  
12 focus their analysis on the reports published by the Irish state-owned energy company, the  
13 Electricity Supply Board of Ireland. Reporting on activities around fisheries by the Electricity  
14 Supply Board of Ireland was effectively mandated by the government due to the hydroelectric  
15 power station they constructed on the River Shannon, and it is this section of the organization's  
16 report that is the focus of Quinn *et al.*'s analysis. However, the authors highlight the lack of  
17 specificity required in the fisheries reporting. Species accounting was a feature, with salmon  
18 regularly reported on, which links to Irish culture as well as the fish farming and fisheries  
19 industries. The authors also comment that the reporting demonstrates attempts to preserve  
20 biodiversity in the River Shannon, via protection of fish stocks, suggestive of an early form of  
21 extinction prevention accounting which also has emancipatory elements as the company is active  
22 in preserving fish species. The paper is couched in a framework identifying legitimacy  
23 relationships.  
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27 Lauwo *et al.* provide an analysis of the writer Kenule Beeson Saro-Wiwa's books, diaries and  
28 poems as an illustration of early calls for environmental accountability from oil multinationals  
29 for severe, deleterious impacts on the Niger Delta region in Nigeria. The authors also analyse  
30 other books and reports as well as audio recordings of panel discussions relating to the struggles  
31 of the indigenous Ogoni people. This paper seeks to address a relative lack of academic  
32 environmental accounting research into African countries as well as to deal with a paucity of  
33 research into how indigenous, marginalised peoples have sought to demand environmental and  
34 ecological accountability from the perpetrators of damage. The paper is framed around  
35 Foucault's theory of counter-conduct, where counter-conduct refers to subtle forms of resistance,  
36 and dissent, against hegemonic power in order to elicit new and improved ways of being  
37 governed. This study contributes to recently evolving literature exploring how accounting, linked  
38 to struggle and resistance, can assist in the emergence of alternative ways of governing. As well  
39 as providing an in-depth study of 20<sup>th</sup> century calls for environmental and ecological  
40 accountability, the authors highlight the severe negative impacts of what we may see as neo-  
41 colonialism, with a Western multinational effectively taking control of the Niger Delta region, as  
42 if they were the owners of the land but exercising no stewardship, or duty of care over the  
43 indigenous peoples, the environment or non-human species. By focusing on a historic African  
44 case, Lauwo *et al.* decolonise the environmental and ecological accounting literature, paving new  
45 avenues for research into historical environmental and ecological accounting and accountability,  
46 at the same time placing alternative forms of 'account' (such as poetry) at the heart of the study.  
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51 The final paper in our Special Issue by Maione *et al.* provides an algorithmic historiography of  
52 biodiversity accounting literature. Specifically, the authors apply the Bibliometrix R-package,  
53 which they describe as a unique approach to bibliometric analysis, allowing academics to  
54 identify and examine historical patterns in scientific literature. In addition to reviewing a vast  
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array of accounting for biodiversity literature including various forms of account (such as Barrington's 1767 "*Naturalist's Journal*", discussed in Atkins and Maroun, 2020) the paper also emphasises the critically important role that accounting can (and should) potentially play in saving species and protecting biodiversity. One outcome of the research is to provide a schematic of four 'periods' of the progression of discourse around accounting for biodiversity, namely: Origins (1767-1864), Awareness (1865-1961), Consolidation (1962-1995), and Acceleration (1996-2021). The novel approach and the broad coverage in Maione *et al.*'s paper ensure that this provides a substantial contribution to the literature on accounting for biodiversity by delving into historical literature and demonstrating the recent acceleration on research interest in this area which is acknowledged as a necessary shift if we are to address one of the most significant challenges of the 21<sup>st</sup> century, the imminent collapse of nature.

## 5. Extending the Definition of Environmental and Ecological Accounting

In the Special Issue to which the current paper presents an introduction, some interesting general observations can be made regarding the papers included. They all provide interdisciplinary insights into environmental and ecological accounting, with the papers integrating environmental and ecological accounting, reporting and recording with a whole range of diverse disciplines including hydrogeology, economic anthropology, historiography, infographics and aesthetics. In terms of motivation underlying these early forms of environmental and/or ecological accounting, the driving force behind attempts to preserve the environment and nature is to ensure a steady and healthy flow of natural capital for the industry concerned: trees for the Chinese forestry industry (Wang and Hu); fish stocks for the fisheries industry (Quinn *et al.*); animals for the fur trade industry (McBride *et al.*). In the case of the amelioration of air and water (Bigoni *et al.*) the intention is to improve societal health and welfare, with an aim of growing the population, again deriving from a recognition that humans could not thrive where groundwater and air were contaminated. These observations are consistent with Maione *et al.*'s classification of the earliest illustrations of accounting for biodiversity as 'Origins' which recognises the nascent and emergent character of these early accounts and reports. Indeed, it is the emerging realisation over time of people's reliance on natural ecosystems services and the species within those ecosystems that drove them to develop strategies to ensure their protection and consequently report on, or audit, those strategies in some manner, demonstrating emergent environmental and ecological accountabilities. In the current paper, however, we delve into prehistoric history, recognising that earliest human societies felt a need to demonstrate an accountability for the environment and ecology which led them to produce the earliest accounts of species and nature in the form of rock art: the earliest 'origins' of environmental and ecological accounting.

This paper seeks to break open the notion of what constitutes an environmental and ecological account by considering, from a historical perspective, different forms of account produced by various accountants employing various media. It seems from our analysis that since the dawn of human consciousness, humans have attempted to account for nature and species using whatever forms of the communicative language they had at their fingertips, from rock art to botanical drawings to monastic scripts, to sculpture, weaving, tapestry, lists, catalogues, diaries, artwork, poetry, literature, and music. Why? We can only conjecture and guess at the motivation. Perhaps it is simply that people have consistently recognised the value of species and nature: not merely

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3 some sense of commercial or economic value but the broader understanding of value, albeit  
4 aesthetic, spiritual or cultural.  
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7 Furthermore, we can see evidence of spiritual value being expressed through rock art, as the  
8 current descendants of early rock artists explained that the depictions of animals represented a  
9 means for their ancestors to capture and represent the 'value' of the creature at the same time in  
10 some way discharging their stewardship, or accountability, for it to the creator, or higher being  
11 (Atkins and Maroun, 2023). Religious and aesthetic values are expressed in poetry, such as that  
12 discussed here. The aesthetic value of species and biodiversity is contained in the botanical  
13 accounts produced by East India companies. Emancipatory elements of environmental and  
14 ecological accounts are also present in music (for example, *Ma Vlast*), the diaries of White, and  
15 the nature writings of Thoreau.  
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19 In attempting to explain why an immense diversity of environmental and ecological accounts  
20 span human history, we ponder on possibilities. Perhaps species' fragility and transitory nature  
21 have motivated people from the earliest times to try and capture flora and fauna in some  
22 enduring form, to hold their beauty and give them permanency. Today we can easily take  
23 photographs using our ever-present mobile phones, but this was not the case in the past. Animals  
24 and birds that migrate appeared and disappeared in prehistoric landscapes for no apparent reason  
25 and the people at the time would have wanted somehow to capture the fauna for their  
26 communities of the time but also for future generations. In White's time, 250 years ago (Atkins  
27 and Maroun, 2020), people still had no understanding of migration and were convinced swallows  
28 hid over the winter. In earlier times, such arrivals and disappearances must have been great  
29 causes of consternation, as people must have wondered if they would ever see these creatures.  
30 The blossoming of a flower so beautiful but over so soon perhaps compelled people to record its  
31 beauty in whatever form they could. Accounting may have evolved from a deep human need to  
32 record flora and fauna and later to develop ways of enumerating and counting them, leading to  
33 early financial and environmental records.  
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37 If we think about it, the idea that environmental and ecological accounting preceded financial  
38 accounting by millennia does not seem surprising. Early human beings were embedded within  
39 nature, part of their natural environment and ecosystem, surviving by consuming animals and  
40 plants. The first 'stock' or 'assets' they would have wanted to count in some way would have been  
41 livestock or at least wild animals that they would have hunted as nomadic groups. The first  
42 recordings they would have made would have been of flora, fauna and their communities, as  
43 shown by the predominance of animals in rock art. The next question is to consider how this  
44 study of early, historical forms of environmental and ecological accounts can feed into the  
45 development of accounting today. What lessons can be learned from our study that can assist in  
46 rendering accounting today more effective in recording species, the environment and biodiversity  
47 and ensuring its transformational and emancipatory effects?  
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51 Considering environmental and ecological accounts from men and women throughout history,  
52 appreciating the gender differences in accounting form (as with Holden's multi-media ecological  
53 accounting) inspires accounting to demonstrate such different dimensions. New environmental  
54 and ecological accounting forms need to embrace all genders to become more holistic, inclusive,  
55 and emancipatory. By extending the form of accounting to create an ecological and  
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environmental accounting that is more holistic and integrated, that incorporates artistic representation, narrative, and even music, and may be produced by a wide range of external accountants or other interested parties accounting for nature, as well as for the impacts of humans on nature. We draw inspiration from earlier research, with Dillard and Reynolds (2008, p.573) calling also for accounting that incorporates the feminine as well as masculine characteristics and forms:

As a result of the transformation, the feminine is integrated with the other, completing and balancing the social reality of existence. ... By understanding the world differently, people can choose to live their lives differently, teach and research accounting differently. As a result, they will have an enlightening, enabling, and transforming effect on their world. One part of that world comprises those who study, practice, or will practice accounting and, therefore the possibility exists for changing the understanding and practice of accounting. The challenge, and that of any society, is to act based on a value set that increases the societal welfare rather than the interests of only a subset thereof.

A holistic ecological account needs to include all these dimensions of ecological value. Future accounting should, we propose, account holistically for nature, species and biodiversity across all of these dimensions and use various forms, including pictorial, narrative description, and other media such as poetry and music. Exploring the historical roots of environmental and ecological accounting provides us with a wealth of perspectives on the diversity not only of forms of account (diaries, reports, letters, art, literature, poetry, music) but also the diversity of accountants, as well as the broadness of the stakeholders, both human and non-human, to whom and to which the accounts are rendered. Furthermore, consideration of rock art as representing the earliest form of accounting for the environment and species, as well as for society, highlights the global roots of accounting, demonstrating that 'accounting' derived from the earliest human societies, with the earliest cave and rock art arising from Africa and the Far East: accounting was not created in the West!

Imagining a utopian form of environmental and ecological accounting requires us to create an accounting that is inclusive of form, culture, gender, and species in order to discharge accountability for nature and our use/abuse of nature not only to each other but also to those other parties with whom we share the natural world. A utopian form of ecological and environmental account would also be one that should seek to and succeed in aligning the versions of reality portrayed by the accountant in the account with the ecological and environmental realities of our time (alluding to the seminal work of Hines, 1988).

Building on Carnegie *et al.*'s (2021) proposed definition of accounting cited earlier, as well as on the research for this paper and Lehman's notions of incorporating beauty and truth, and we suggest the following for discussion and in order to open up dialogue:

Accounting is a technical, social, *ecological, holistic, inclusive* and moral practice concerned with the sustainable utilisation of resources and proper accountability *to human and non-human* stakeholders to enable the flourishing of organisations, people and nature, *produced by a diversity of accountants and constituting multidimensional media and forms of expression, expressing beauty and truth.* (Our additions in italics)

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4 It is worth noting that this expanded definition may be useful to academic researchers to assist in  
5 developing broader and novel approaches to accounting research. For practitioners, this new  
6 definition may be pertinent to those seeking to incorporate biodiversity, for example, into current  
7 accounting frameworks (such as in ongoing corporate applications of the Biological Diversity  
8 Protocol, 2021, for example). This reworked definition is also consistent with the recent  
9 suggestion that environmental accountability is central to a holistic governance framework that  
10 discharges accountability to all stakeholders, human and non-human (Atkins and McBride,  
11 2023). Further, it builds on calls for social and environmental accounting to embrace  
12 participative democracy and neo-pluralism (Gray *et al.*, 1996; Dillard, 2007; Dillard and Vinnari,  
13 2019) and on calls for accounting to incorporate 'beauty and truth' (Lehman, 2017). Redefining  
14 definitions of accounting is critically important given the emancipatory nature of accounting, and  
15 hence its potential to improve nature and society, as well as our acknowledgment that 'the most  
16 prized and respected valuation in the world' is actually non-financial valuation (Carnegie, 2023).  
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20 We hope this AAAJ Special issue represents a call for accounting researchers and accountants to  
21 be imaginative and innovative in how they approach and treat nature and species. The  
22 contributions to this Special Issue provide illustrations of historical environmental and ecological  
23 accounts spanning several centuries and also many areas of the world from historic Russian  
24 territories, to China, Africa, and across Europe (Italy, Ireland and Germany). The diverse forms  
25 of account studied include artistic representation (infographics), ancient folk contracts, varied  
26 sources from the Grand Duchy of Tuscany, poetry and other writings, as well as more traditional  
27 company accounts. The current paper also extends geographic region to Australia and Africa (in  
28 the earliest forms of ecological account) and to a variety of forms from all around the world  
29 including artwork, music, poetry and other media.  
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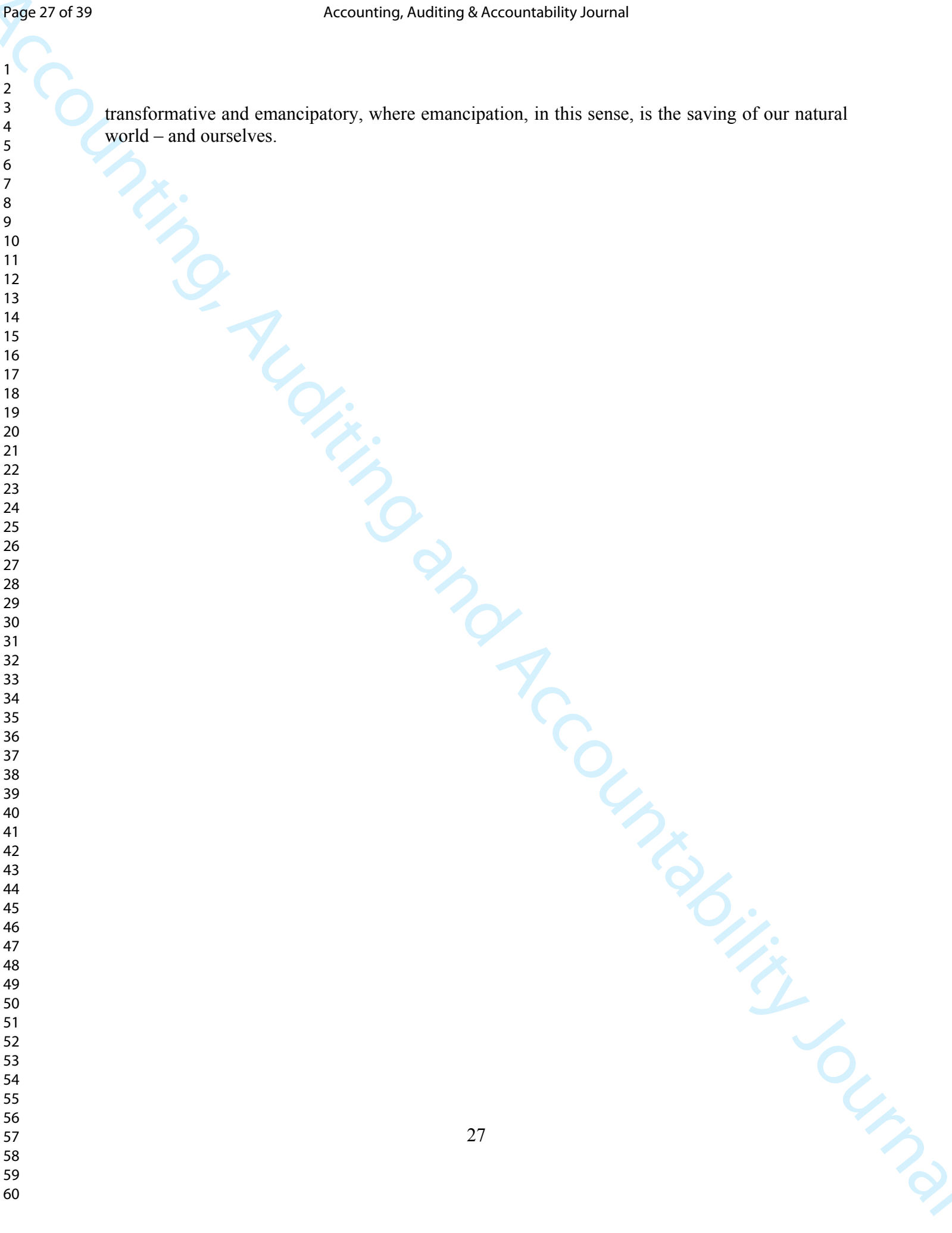
33 The current paper underlines the need for accounting to be a mechanism of emancipatory change  
34 that is ready to address the critical challenges of the 21st century, including biodiversity collapse,  
35 deforestation, ecological degradation, ecosystem destruction and mass species extinctions.  
36 Drawing on history and how early civilisations accounted for, and reported on nature, flora and  
37 fauna helps us reconnect with the ancient relationship between human and non-human species.  
38 The need for different media and a hybrid accounting in order to communicate with diverse  
39 stakeholders, different countries and cultures, and across different genders, is critical if we are to  
40 stem the current rate of destruction of nature in order to rediscover our ancient place within  
41 nature and find better ways of living and working that are in tune with, rather than against,  
42 nature. This picks up on earlier work that identifies a cultural separation between nature and  
43 people, exacerbated by language and terminology,  
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47 The English language speaks about nature and environments as if these concepts are  
48 separate from people, and the dichotomy between 'nature' and 'culture' is deeply rooted  
49 within the Western ontology (Guthrie *et al.*, 2022, p.41: also referring to Descola, 2013).  
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51 There is a need to redefine terms, definitions and language to progress towards a more  
52 integrated, holistic and ecologically inclusive way of living and accounting. In order to stem the  
53 current tide of species extinctions, ecological destruction and, ultimately, self-annihilation,  
54 accounting needs to be used as one of many mechanisms under our control that must be rendered  
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transformative and emancipatory, where emancipation, in this sense, is the saving of our natural world – and ourselves.



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39 <sup>i</sup> See for example: Burchell *et al.* (1980), Hopwood (1983, 1990), Tinker (1984, 1985), Chua (1986), Lehman and  
40 Tinker (1987), Hines (1988), Morgan (1988), Arrington and Francis (1989), Francis (1990), Miller (1994),  
41 Hopwood and Miller (1994); Gray *et al.* (1996), Power (1997), Christensen (2004), Amernic and Craig (2005),  
42 Tsahuridu and Carnegie (2018), Carnegie *et al.* (2020).

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47 <sup>ii</sup> These ideas, introduced here, are explored more fully in Atkins *et al.*, (2021).

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53 <sup>iii</sup> This is an artistic interpretation by one of the authors of a cave painting of an Irish elk (*Megaloceros giganteus*) at  
the Chauvet-Pont d'Arc Cave in Ardèche, France, dated to 36,000 years ago, possibly drawn over the earliest  
potential known depiction of a volcano, sourced from Wikimedia Commons. The interpretation was created so that  
it could be included in the journal as a black and white picture.

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57 <sup>iv</sup> See for example Uluru Statement from the Heart (2017), <https://antar.org.au/campaigns/un-declaration-rights>  
indigenous-peoples

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5 <sup>v</sup> We are grateful to our reviewer for raising this point.

6 <sup>vi</sup> This may be viewed on Wikimedia Commons at: [File:Mosaic, animals, AM Delphi, 060056.jpg](http://commons.wikimedia.org/wiki/File:Mosaic,_animals,_AM_Delphi,_060056.jpg) - Wikimedia  
7 [Commons](http://commons.wikimedia.org/wiki/File:Mosaic,_animals,_AM_Delphi,_060056.jpg)

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9 <sup>vii</sup> See: [http://en.wikipedia.org/wiki/Tapa\\_cloth](http://en.wikipedia.org/wiki/Tapa_cloth) for further information and references.

10 <sup>viii</sup> This may be viewed on Wikimedia Commons at:

11 [http://commons.wikimedia.org/wiki/Category:Utagawa\\_Hiroshige](http://commons.wikimedia.org/wiki/Category:Utagawa_Hiroshige).

12 <sup>ix</sup> This painting may be viewed on Wikimedia Commons at: [http://commons.wikimedia.org/wiki/File:Antoine-](http://commons.wikimedia.org/wiki/File:Antoine-Louis_Barye_-_Reclining_Tiger.jpeg)  
13 [Louis\\_Barye\\_-\\_Reclining\\_Tiger.jpeg](http://commons.wikimedia.org/wiki/File:Antoine-Louis_Barye_-_Reclining_Tiger.jpeg)