

# A critical evaluation of research into accounting for biodiversity and ecosystems to inform future research pathways

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## Abstract

**Purpose** – The aim of this research is to critically review the research that discusses accounting for biodiversity and ecosystems in the broad business and economic field comprising accounting, business, management, economics, econometrics and finance journals.

**Design/methodology/approach** – We explore these works through a semi-systematic literature review grounded in Alvesson and Deetz's (2021) critical framework of insight, critique and transformative redefinition. Overall, we analyzed 239 articles retrieved from Scopus and the Web of Science databases under the categories accounting, business, management, economics, econometrics and finance. We then read and coded the articles to determine which accounting topics were present in the different research fields. The insights resulted in four transformative redefinitions.

**Findings** – Four topics pertaining to biodiversity and ecosystems are present in the corpus of research – biodiversity measurement, biodiversity offsetting, extinction accounting and biodiversity reporting. By critiquing these four accounting topics, we identified four transformative redefinitions that entail just as many avenues for further research: (1) the opportunities and pitfalls of biodiversity and ecosystem measurement, (2) the need to move on with biodiversity reporting, (3) accounting for conservation and rewilding and (4) accounting for the sixth mass extinction.

**Originality/value** – This literature review provides a critique of research emanating from business and economics studies at large and the way that these fields of knowledge have dealt with biodiversity and ecosystem accounting over the past few decades. Moreover, the review extends beyond mapping extant research to uncover ideas, thoughts, beliefs, the conditions of power and the dominant ideologies that are shaping the field of biodiversity accounting.

**Keywords** Biodiversity accounting, Natural capital, Ecosystem valuation, Biodiversity measurement, Biodiversity reporting, Extinction accounting

**Paper type** Research article

## 1. Introduction

Jones and Solomon's (2013) guest editorial problematized accounting for biodiversity into four broad categories: philosophical and scientific problems, accountability problems, technical accounting problems and problems of accounting practice. Fast forward 12 years, much more research on accounting for biodiversity and ecosystems has seen the light, but those four problems are far from being solved (Blanco-Zaitegi *et al.*, 2022; Schaltegger *et al.*, 2022; Maione *et al.*, 2023; Toukabri and Toukabri, 2025; Mateos *et al.*, 2025). Rather,

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researchers in accounting, business, management, economics, econometrics and finance fields are still wrapping their heads around whether it makes sense or not to value and monetize biodiversity (Arjaliès and Gibassier, 2023; Sullivan and Hannis, 2017), whether it is morally desirable to construct biodiversity offsetting markets (Ferreira, 2017), whether and how should organization account for extinctions (Atkins and Maroun, 2018; Gray and Milne, 2018) and report their impacts on and dependencies from ecosystems (Gaia and Jones, 2020; Zhao and Atkins, 2021), and how can accounting (and accountants) support conservation efforts (Boyd *et al.*, 2015; Horner and Davidson, 2021).

While research on accounting for biodiversity – the variety of life on planet Earth (Dasgupta, 2021) – and ecosystems has been growing in the past decade, it is still at its infancy if compared to other sustainability issues such as climate change, integrated thinking and circular economy, and natural resources (Di Vaio *et al.*, 2021; Maroun *et al.*, 2025). Moreover, said research tends to be centered on biodiversity reporting and overlooks other accounting topics such as risk management, performance management, management accounting and valuation (Schaltegger *et al.*, 2022; Maroun *et al.*, 2025). Furthermore, research published in accounting journals has evolved in silos from research that still deals with accounting topics, but it is published in other fields such as economic journals.

Hence, the purpose of this paper is to critically map the research on accounting for biodiversity and ecosystem services in the broad field of business and economic studies. More specifically, we undertook a semi-systematic literature review (SLR) on the research discussing biodiversity and ecosystem accounting across two fields: the accounting, business and management field, and the economics, econometrics and finance field. Differently from previous SLRs on biodiversity accounting, we chose to expand the search scope beyond accounting journals to capture how biodiversity accounting is developing in other fields close to accounting. Our analysis reveals the patterns of research conducted over the past few decades and identifies gaps in our knowledge that are yet to be filled (Massaro *et al.*, 2016).

We followed Alvesson and Deetz's (2021) critical framework to glean insights from the 239 articles identified in the Scopus and ISI Web of Science databases, uncovering four themes: biodiversity measurement, biodiversity offsetting, extinction accounting and biodiversity reporting. Last, we present four transformative redefinitions that entail just as many avenues for further research: (1) the opportunities and pitfalls of biodiversity and ecosystem measurement, (2) the need to move on with biodiversity reporting, (3) accounting for conservation and rewilding (4) accounting for the sixth mass extinction.

The remainder of the paper is structured as follows. Section 2 presents Alvesson and Deetz's (2021) critical framework around which the critical literature review is structured. Section 3 describes the methodology underpinning the literature review, while Section 4 shows the results emerging from the analysis of the selected papers. Section 5 critiques the results of the literature review and highlights four emerging themes. Section 6 proposes four transformative redefinitions grounded in a critical analysis of the generated insights. Last, Section 7 concludes the paper and discusses its main limitations.

## 2. Theoretical framework

Following Dumay *et al.* (2016) and Massaro *et al.* (2016), our SLR uses Alvesson and Deetz's (2021) critical framework, which spans insight, critique and transformative redefinition. Insight involves unravelling how objects and events are formed and sustained to interpret ambiguity (Alvesson and Deetz, 2021). By investigating local phenomena, insight produces meaning in the data, explains the conditions for seeing that meaning and adds practical knowledge (Alvesson and Deetz, 2021; de Villiers and Sharma, 2020). "Critique" was used to interrogate the discursive foundations of patterns in the data, connecting them to broader epistemic assumptions such as anthropocentrism, the monetization of nature and the reduction of ecological complexity into calculable metrics. Finally, "transformative redefinition" was mobilized to go beyond diagnosis and offer constructive alternatives.

However, researchers who stop at insight and critique fail to perform a crucial task, which is to point to possible ways forward that might enable change (Alvesson and Deetz, 2021). By performing “transformative redefinition”, researchers avoid the pitfalls of negativity and hyper-critique. Instead, they embrace critical pragmatism and positive action (Alvesson and Deetz, 2021). In fact, researchers should strive to create “a more positive future or, more cautiously, alternative routes towards engagement with the world” (Alvesson and Deetz, 2021, p. 152).

For a critical SLR to be good, it should not only map the field and synthesize what is known, but it should also offer an in-depth analysis of the body of literature with a review that uncovers goals, ideas, ideologies and discourses (Alvesson and Deetz, 2021; Massaro *et al.*, 2016). Moreover, along with the critique, a critical SLR should also formulate normative arguments about future research paths and questions with potential relevance for practice, education, policy and/or regulation (Massaro *et al.*, 2016). In practical terms, our critical SLR begins by systematizing and coding the body of literature to trace the evolution of the field up to the present day. Therefore, as in Massaro *et al.* (2016), we glean insights from the literature to answer the following research questions:

RQ1. How is research for inquiring into accounting for biodiversity and ecosystems developing?

After collecting insights on the evolution of the literature, we discuss the insights and critiques emerging from the identified research patterns in terms of location, research methods, research focus, settings and accounting topics, as well as the artefacts developed and used in the research on biodiversity and ecosystems accounting. Such a critique allows us to answer the second research question (Massaro *et al.*, 2016):

RQ2. What is the focus and critique of accounting for biodiversity and ecosystems?

Last, we build on the previous two steps to develop relevant knowledge and practical understandings of where accounting for biodiversity and ecosystems research is and should be going (Massaro *et al.*, 2016). This involves pointing out inconsistent results, the limitations of the dominant research approaches and gaps worth exploring. These avenues of enquiry answer the following research question:

RQ3. What is and should be the future of accounting for biodiversity and ecosystems research?

### 3. Methodology

#### 3.1 The literature review protocol

Conducting a literature review on biodiversity accounting is not novel. However, our literature review departs from previous ones for three fundamental reasons that, in our view, make this research relevant.

First, recent literature reviews deal with bibliometric analyses aimed at highlighting the historical patterns (Maione *et al.*, 2023) and thematic clusters (Maione *et al.*, 2024) found in the biodiversity accounting literature. Whilst these literature reviews are useful for returning a clear picture of how biodiversity accounting research has developed over the years, they do not provide a critical discussion of the field (de Villiers and Sharma, 2020; Alvesson and Deetz, 2021). This research is therefore designed around a SLR review methodology rather than us simply performing a bibliometric analysis of articles (Snyder, 2019; Massaro *et al.*, 2016; Alvesson and Deetz, 2021). According to Snyder (2019, p. 335), a semi-systematic review is “designed for topics that have been conceptualized differently and studied by various groups of researchers within diverse disciplines and that hinder a full systematic review process” and it is useful to “identify and understand all potentially relevant research traditions that have implications for the studied topic and to synthesize these using meta-narratives instead of by measuring effect size”.

Second, we did not find any literature reviews that considered economic and business studies in a broader sense. Yet the topic of accounting for biodiversity and ecosystems has been around for more than two decades not only in accounting journals but also in the economics literature, but it has been developing in silos. As we explored the topic, we began to realize that a deeper understanding was needed, and that this might shed some new light on biodiversity loss and ecosystem collapse in organizational contexts. Moreover, this new light might be useful for elucidating a more complete critique of both research and practice in this area. Therefore, unlike previous literature reviews (Roberts *et al.*, 2021), we undertook the methodological choice to expand the article search to accounting, business, management, economics, econometrics and finance journals.

Third, other literature reviews are narrower either in scope or in the methodological choices. For example, Blanco-Zaitegi *et al.* (2022), Toukabri and Toukabri (2025) and Mateos *et al.* (2025) focus only on a specific aspect of accounting such as reporting (Blanco-Zaitegi *et al.*, 2022; Toukabri and Toukabri, 2025) or the economic valuation of nature (Mateos *et al.*, 2025). On the contrary, we do not exclude other areas of accounting studies (e.g. risk management, performance management, management accounting) *a priori*, but we set to uncover whether accounting in the context of biodiversity and ecosystem is indeed present in accounting research strands of which reporting is just one of such strands (Schaltegger *et al.*, 2022). Moreover, differently from Grover *et al.* (2023) and Schaltegger (2020), our review is neither limited to a single biome type, such as forests, nor to a unique aspect of biodiversity. Moreover, Roberts *et al.* (2021) conducted a literature review that only considers a relatively small number of sample publications because either the literature search or the research question narrowed the scope of analyses. On the contrary, in our review, we broadened the scope of the analysis using keywords and research questions that embrace a variety of potential topics and authors – both core and emerging.

### 3.2 Literature search

We decided to search the Scopus and ISI Web of Science databases because they are the largest database of peer-reviewed literature and have been used widely in SLRs (Dumay *et al.*, 2016; Donthu *et al.*, 2021; Snyder, 2019; Ecim and Maroun, 2023). Moreover, given that the debate on which database perform best is not conclusive (Maione *et al.*, 2023, 2024), we decided to use both to triangulate the search results. Our search strategy for the two databases was designed to capture articles published up to 30 June 2025 that discuss topics related to accounting, biodiversity and ecosystems. The search strategy for Scopus comprised the search string “TITLE-ABS-KEY ((account\* AND biodiversity) OR “ecosystem account\*”) AND (LIMIT-TO (SUBJAREA, “ECON”) OR LIMIT-TO (SUBJAREA, “BUSI”))”. For Web of Science, the search string was: (account\* AND biodiversity) OR (“ecosystem account\*”) (Title) OR (account\* AND biodiversity) OR (“ecosystem account\*”) (Abstract) OR (account\* AND biodiversity) OR (“ecosystem account\*”) (Author Keywords) and Economics or Management or Business Finance or Business (Web of Science Categories)”. The asterisk “\*” stems the relevant keywords.

These searches returned 1,063 articles, out of which we eliminated 165 books, book sections or conference proceedings; 264 duplicates, 3 book reviews, 1 corrigendum and 8 non-English articles. Thus, our final sample included 622 papers.

### 3.3 Coding strategy, validity, reliability and analytical framework

The coding strategy followed two main steps: initial skimming and open coding.

The first step, initial skimming, involved a round of content analysis to identify those articles that were coherent with the purpose of the research and, therefore, ensured construct validity (Massaro *et al.*, 2016). To ensure reliability, the abstracts of the 622 articles were read by at least two researchers and independently labelled as “coherent”, “no accounting”, “out of scope”, or “broad focus on sustainability” (Table 1).

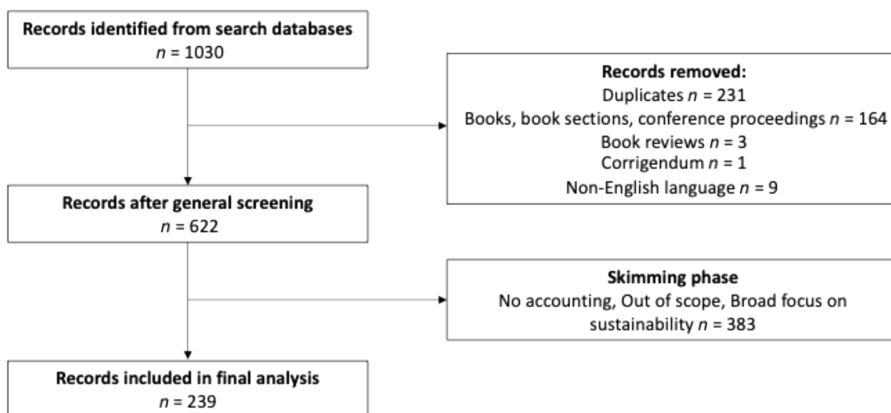
**Table 1.** Description of labels employed in the skimming phase

Label	Description	Example
Coherent	The abstract of the paper fits with the scope of the research	Feger, C. & Mermet, L. (2017). A blueprint towards accounting for the management of ecosystems, <i>Accounting, Auditing and Accountability Journal</i> , 30(7), 1511–1536
No accounting	The abstract does not explicitly reference an accounting topic such as controlling, accountability, reporting or valuation	Russel, C. & Downs, C. T. (2012). Effect of land use on anuran species composition in north-eastern KwaZulu-Natal, South Africa, <i>Applied Geography</i> , 35(1–2), 247–256
Out of scope	Accounting is not used in an economic/business sense, but rather in a naturalistic one (e.g. number of trees in an area)	Groeneveld, R. A. (2010). Species-specific spatial characteristics in reserve site selection, <i>Ecological Economics</i> , 69(12), 2307–2314
Broad focus on sustainability	Biodiversity and ecosystems are not central topics, but they are cited as part of broader sustainability issues	Qian, W., Tilt, C. & Belal, A. (2021). Social and environmental accounting in developing countries: contextual challenges and insights, <i>Accounting, Auditing and Accountability Journal</i> , 34 (5), 1021–1050

**Source(s):** Authors' own work

Those abstracts receiving different labels from the two researchers were openly discussed with the other two researchers until a consensus was reached. During this phase, 383 articles were discarded because they fell into one of the three excluded categories. The remaining 239 articles were coded in NVivo 20 software. For eight articles, it was not possible to access the full text and only their abstracts were included in the sample. Figure 1 summarizes the exclusion criteria employed throughout the literature search.

In the second step, two researchers undertook a first round of coding in which the articles were associated with descriptive information, such as the article's authors, year of publication and publication outlet. Furthermore, we coded the articles using common and acknowledged coding categories, including the geographic location where the study had been carried out and/or the economic sectors involved following the one- and two-digit NACE Rev.2 sector classification (Eurostat, 2008).

**Figure 1.** Exclusion criteria of the literature search. **Source(s):** Authors' own work

Then, we employed open coding to extract relevant concepts from reading the selected articles (Wolfswinkel *et al.*, 2011). Open coding allowed us to define some coding categories related to the articles' methodologies and accounting topics while reading the full articles. In practical terms, two researchers would independently read the abstract of the paper to identify the paper's methodology and the accounting topic(s) the paper discussed. If, after reading the abstract, the researchers did not have a sufficiently clear picture of the paper's content, they read the full paper. The coding unit of analysis was single sentences. Each time a new accounting topic piqued the interest of one of the researchers (e.g. ecosystem accounting, biodiversity reporting, extinction accounting, monetization), both researchers would go back to the already coded papers to make sure the new topic was not already present in those papers. After the two researchers ended this iterative open coding, the outstanding differences were discussed until a consensus was reached. In case of continued disagreement, the other two researchers got involved in the discussion to settle the dispute. Eventually, all the articles were checked an additional time by the first two researchers to ensure coherence. The internal validity check was conducted on all the articles. In addition, we run additional queries with keywords emerging from the coding strategy (e.g. "biodiversity reporting", "extinction accounting") to double-check the validity of our literature search and understand whether we missed relevant papers on biodiversity and ecosystem accounting or whether we under-represented some clusters of papers. The results of these tests confirmed the validity of our initial search and returned only 12 articles (5% of the final sample) not included in our sample.

Open coding was essential in this phase to derive categories from the database, given the fact that we did not find an official classification of accounting methodologies and accounting topics that suited our research objective (Wolfswinkel *et al.*, 2011). Both the codes obtained from common and acknowledged coding categories and the ones generated through open coding form the basis of the results presented in the next section.

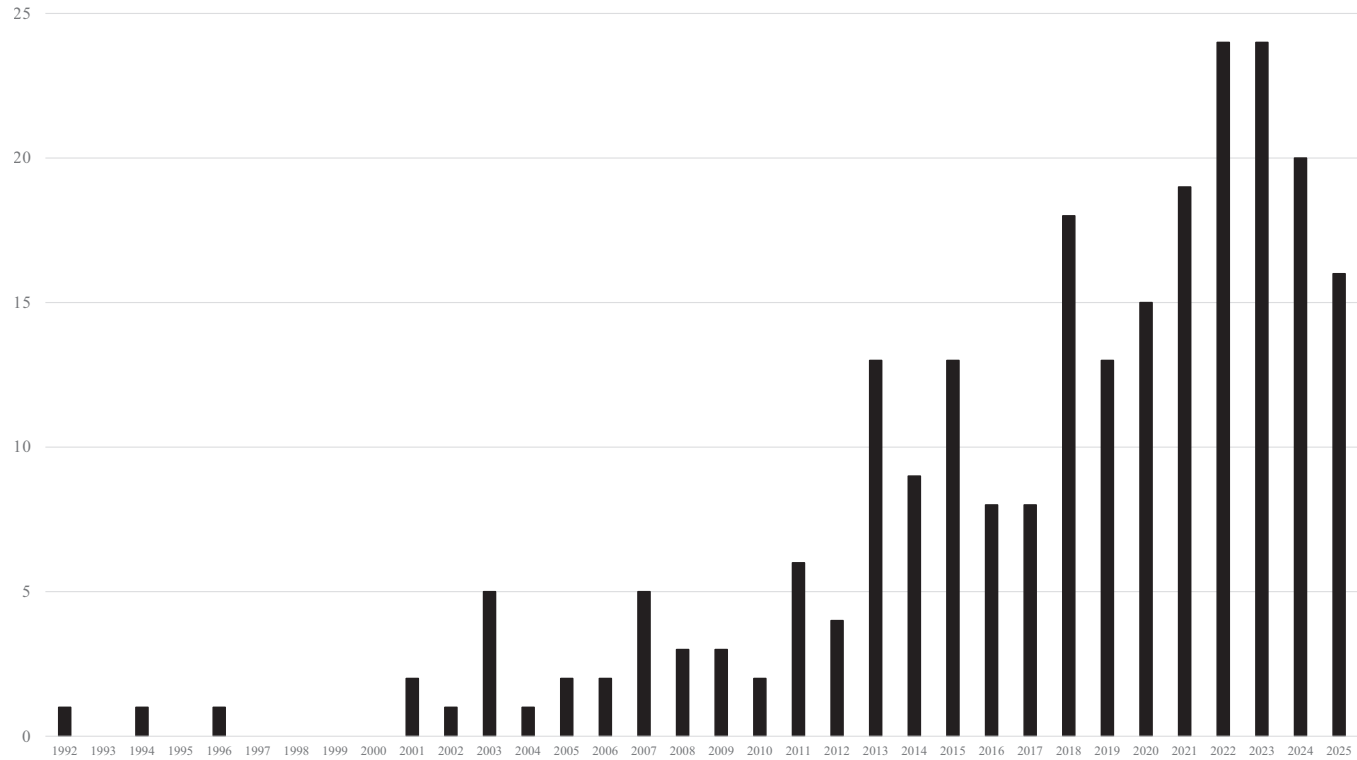
#### 4. Insights developed from the empirical findings

##### 4.1 Number of articles per year

Figure 2 shows the number of articles published on accounting for biodiversity and ecosystems from 1 January 1992 to 30 June 2025. The number of articles published over time is clearly increasing but, within this, four different time frames emerge. During the 1990s, accounting for biodiversity and ecosystems was a marginal topic researched by very few scholars. From 2001 to 2012, we observe a consolidation of the topic. In 2013, we start to see the topic take off, and from 2018 onwards, scholars are publishing articles more consistently. Given that the interest in accounting for biodiversity and ecosystems is growing but still far from becoming mainstream (Roberts *et al.*, 2021), it is too early to conclude whether the pattern we observe is a passing fad or a trend destined to last (Burritt and Schaltegger, 2010).

##### 4.2 Journal outlet, ABS-AJG ranking and category

Table 2 lists the most recurrent journal outlets publishing articles on accounting for biodiversity and ecosystems. According to the Academic Journal Guide 2024, produced by the Chartered Association of Business Schools, these outlets belong to different fields of knowledge. It is interesting to note that a considerable number of articles are published in economics journals, rather than in accounting journals. Therefore, we find that the topic crosses the boundaries of accounting research and involves broader consideration of micro-, meso-, and macro-economic issues. It is worth noting that two journal outlets alone – *Ecological Economics* and *Accounting, Auditing and Accountability Journal (AAAJ)* – account for 36% of all the articles analyzed. Moreover, both outlets are of high quality in their respective fields, with a rank of 3 out of 4 in the Association of Business Schools - Academic Journal Guide (ABS-AJG) ranking system. We could therefore argue that the topic of accounting for biodiversity and ecosystems has been pushed forward by a few influential journals in the accounting, business, management, econometrics, finance and economics fields, but it has not yet become mainstream.



**Figure 2.** Number of articles on accounting for biodiversity and ecosystems published by year. **Source(s):** Authors' own work

**Table 2.** Number of articles published into the ten most recurring journal outlets with ABS-AJG category and rank

Name of the journal outlet	Number of articles	ABS-AJG (2024) category	ABS-AJG (2024) rank
<i>Ecological Economics</i>	58	Economics	3
<i>Accounting, Auditing and Accountability Journal</i>	28	Accounting	3
<i>Journal of Cleaner Production</i>	11	Sector	1
<i>Business Strategy and the Environment</i>	9	Social Sciences	3
<i>Social and Environmental Accountability Journal</i>	9	Accounting	1
<i>Marine Policy</i>	9	Sector	2
<i>Sustainability Accounting, Management and Policy Journal</i>	8	Accounting	2
<i>Corporate Social Responsibility and Environmental Management</i>	6	Regional Studies, Planning and Environment	1
<i>Environmental and Resource Economics</i>	6	Economics	3
<i>Forest Policy and Economics</i>	5	Not applicable	Not applicable

**Source(s):** Authors' own work

#### 4.3 Geographical location and sector of research

Notably, we coded the country in which the research was conducted, finding that 61% of the articles (146 out of 239) focus on a specific country. The UK features the highest number of studies (18), followed by Australia (13), the USA (9), China (9) and then South Africa (8). It is also worth noting that, taken together, countries belonging to the European Union (EU) form the setting for 47 studies.

In coding the articles with a sector focus, we mainly followed the NACE classifications (Eurostat, 2008). Specifically, we grouped the 99 articles with a sector focus into 17 groups. Apart from the groups “conservation” and “public sector”, the other 15 groups reflect the NACE classifications either at the section, one- or two-digit levels. Table 3 provides the list of the sectors with their corresponding NACE codes (Table 3). Moreover, we introduced a new classification called “conservation sector” to group all the articles referring to protecting or conserving biodiversity by establishing or managing a protected area (e.g. Cabral *et al.*, 2015; Kim *et al.*, 2014) or through a conservation/restoration project (e.g. Cuckston, 2013, 2017).

We also decided to create a specific group for the “public sector” to include those papers that analyze accounting for biodiversity and ecosystems in public organizations such as municipalities, local councils, regional and territorial authorities, and governments (Gaia and Jones, 2020; Sobkowiak *et al.*, 2020; Weir, 2018).

The agricultural sector is the most represented with 23 articles plus 2 articles that analyze agroforestry systems in which agriculture and forestry activities coexist. The conservation sector follows closely with 22 articles. The third most represented sector is the public sector, which reflects research in accounting for biodiversity and ecosystems in public organizations. It is worth highlighting that research on sectors comprising the agri-food value chain (i.e. crop and animal production, hunting and related activities; fishing and aquaculture; manufacture of food products; wholesale of agricultural raw materials and live animals) accounts for 38 out of the 99 sector-based articles.

Sectoral studies started to emerge already in the early 2000s, but it is after 2012 that we see a consistent presence of sectoral studies in accounting for biodiversity and ecosystems (Figure 3). After 2012, research articles on the agri-food, conservation, recreation, forestry and public sectors have become common practice.

**Table 3.** Number of articles containing sectoral research following NACE rev.2 classification

Sector name	NACE rev.2 code	Number of articles
Crop and animal production, hunting and related service activities	A.01	23
Conservation	Not applicable	22
Public sector	Not applicable	11
Libraries, archives, museums and other cultural activities	R.91	8
Fishing and aquaculture	A.03	7
Forestry and logging	A.02	4
Mining and quarrying	B	4
Manufacture of food products	C.10	3
Financial and insurance activities	K	3
Crop and animal production, hunting and related service activities + forestry and logging	A.01 and A.02	2
Wholesale of agricultural raw materials and live animals	G.46.2	2
Manufacture of textiles, wearing apparel, leather and related products	C.13, C.14, C.15	2
Electricity, gas, steam and air conditioning supply	D.35	2
Construction	F	2
Manufacture of basic pharmaceutical products and pharmaceutical preparations	C.21	1
Water collection, treatment and supply	E.36	1
Mining and quarrying + manufacture of food products	B and C.10	1
Waste collection, treatment and disposal activities; materials recovery	E.38	1
Electricity, gas, steam and air conditioning supply + water supply; sewerage, waste management and remediation activities	D.35 and E	1

**Source(s):** Own elaboration from NACE rev.2 classification (Eurostat, 2008)

#### 4.4 Methodologies and methods

Quantitative studies were the most recurring methodology. This group accounted for 70 papers, most of which attempt to quantify ecosystem services and/or biodiversity using statistical methods applied to physical, economic and financial data (e.g. Kim *et al.*, 2014; Hougner *et al.*, 2006). Forty-nine studies relied on qualitative methods – generally single or multiple case studies as well as studies based on interviews and discourse analysis (e.g. Fleming *et al.*, 2022). In terms of the case studies, the unit of analysis was usually a single entity with either a micro, meso or macro setting (e.g. a company, a state, an organization) (e.g. Cuckston, 2013; Ferreira, 2017). It is worth noting that we classified studies monetizing a region's ecosystem services as quantitative (e.g. Campos *et al.*, 2022). Further, 49 studies were theoretical since they contain research developing or studying models, tools and frameworks (e.g. Atkins *et al.*, 2018; Cuckston, 2018; De Valck *et al.*, 2023). Thirty papers comprised a content analysis of corporate reports (e.g. Corvino *et al.*, 2021; van Liempd and Busch, 2013) or other written documents (e.g. Atkins and Maroun, 2020). There were 16 literature reviews comprising studies either reviewing academic literature (e.g. Boyd *et al.*, 2015; Maione *et al.*, 2023, 2024) or policies and frameworks (e.g. Cummings *et al.*, 2023). Ten papers adopted a mixed-methods approach, combining methods such as content analysis with interviews (e.g. Rimmel and Jonäll, 2013) or satellite imaging and interviews (e.g. Vihervaara *et al.*, 2012). There were also nine commentaries – these being papers commenting on regulations (e.g. Burritt, 2002; Weber, 2007), books or other papers (e.g. Droste and Bartkowski, 2018). Only three papers were editorials (Jones and Solomon, 2013; Cuckston, 2021), two were interventionist studies (Feger and Mermet, 2020; Horner and Davidson, 2021) and only one, Greiner *et al.* (2014), followed an experimental methodology.

It is worth noting how the methodologies used in accounting for biodiversity and ecosystems have evolved over time (Figure 4). The three articles from the 1990 were mainly

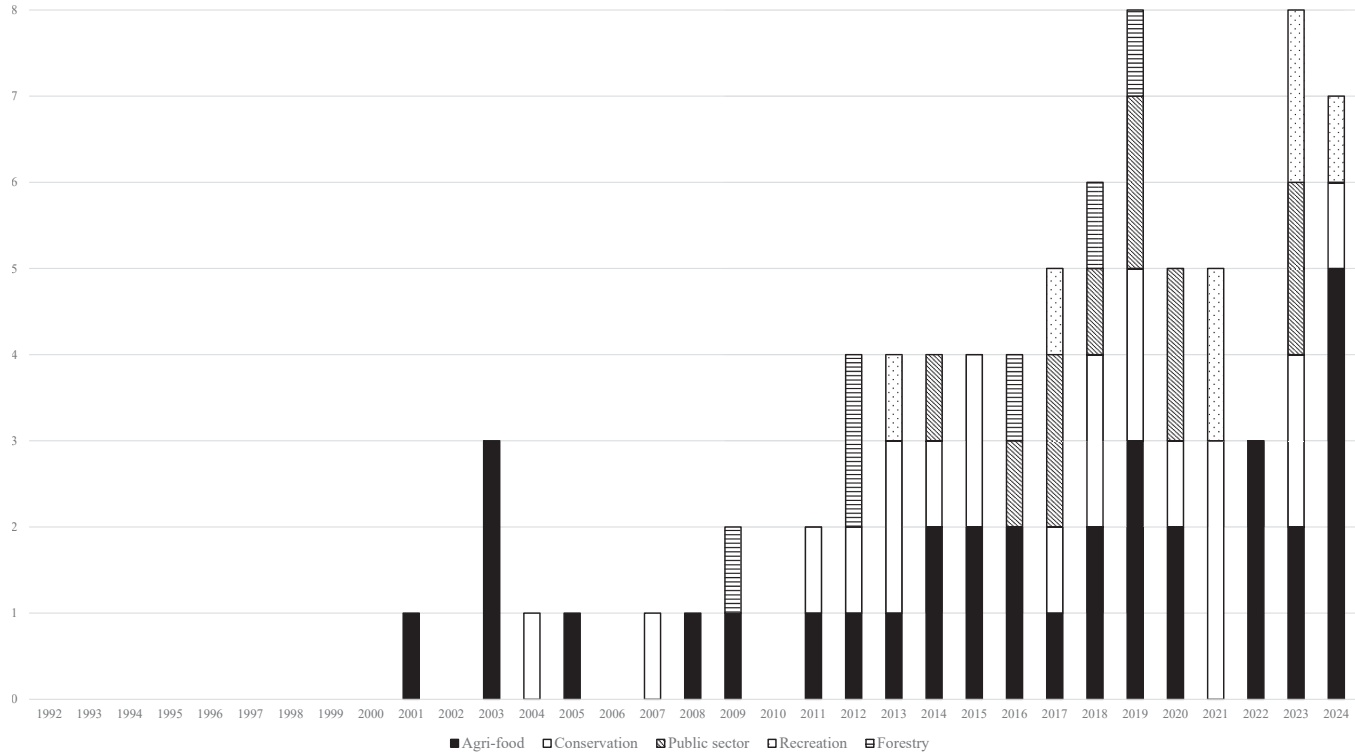
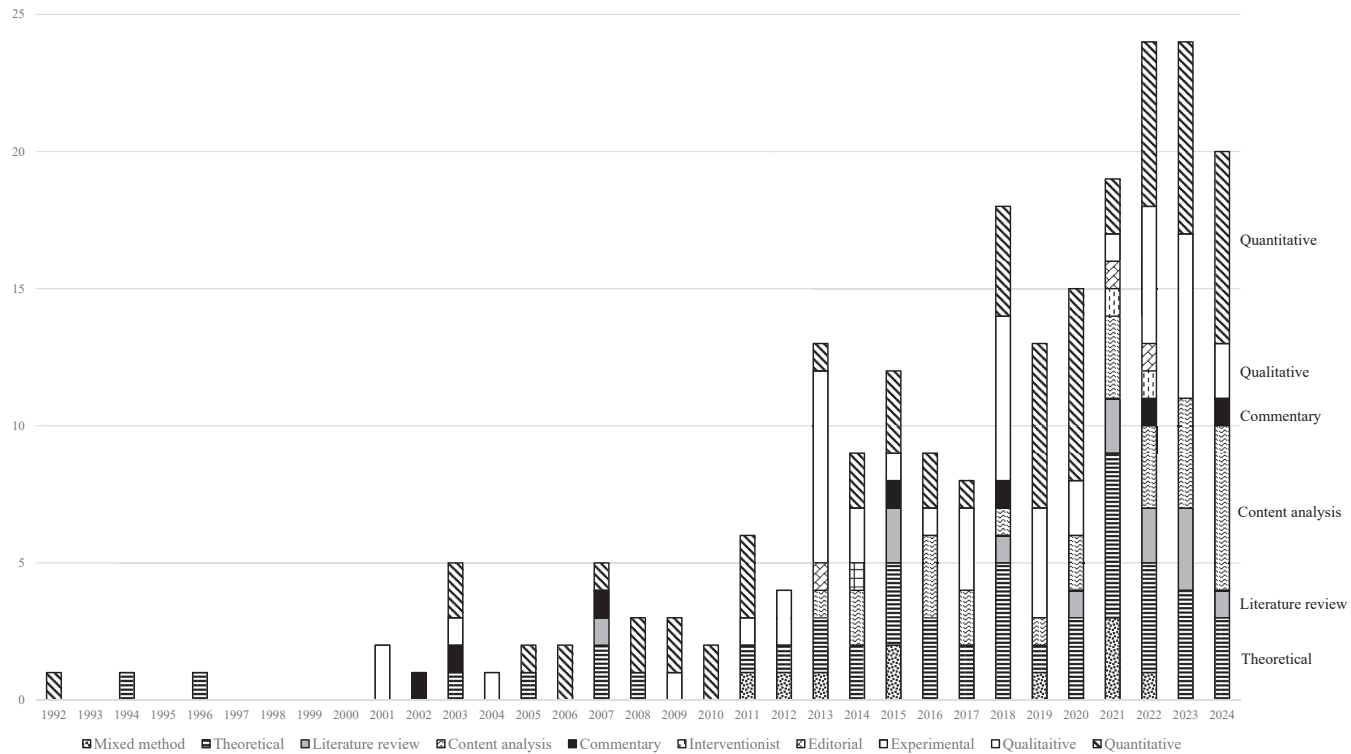


Figure 3. Number of sectoral articles published by year. Source(s): Authors' own work



**Figure 4.** Number of articles by methodology per year. **Source(s):** Authors' own work

worried about creating models both theoretical and practical for measuring and valuing ecosystem services and biodiversity from both economic (Hultkrantz, 1992; Common and Norton, 1994) and accounting (Jones, 1996) perspectives. Interestingly, already at the outset of the biodiversity accounting movement, we find *in nuce* the same tensions among ecological and economic valuations that will characterize the accounting for biodiversity field in the following decades and that will be deepened in the remainder of this paper.

From an ecological economics perspective, Hultkrantz (1992) offers a quantitative model that integrates ecosystem services into the System of National Accounts. Using Swedish forest data, he estimates the economic value of both marketed and non-marketed forest goods and services, including recreation, carbon sequestration and biodiversity preservation. His modified net national product framework accounts for changes in environmental stocks and demonstrates that conventional gross national product significantly underestimates the contribution of natural capital. Moreover, Common and Norton (1994) critique the limitations of conventional economic valuation methods, particularly cost-benefit analysis, in capturing the complexity and irreversibility of biodiversity loss. They argue that the biosphere should be monitored through ecological indicators rather than monetized proxies, emphasizing the importance of maintaining critical natural capital and minimizing the probability of biodiversity loss. Their capital-theoretic model introduced the notion of ecological thresholds and irreversible change, challenging the static assumptions of neoclassical economics.

In the accounting discipline, the first article of our sample is Jones' (1996) natural inventory model. Natural inventory consists in a three-stage process involving the identification, valuation and reporting of wildlife habitats and species. Drawing on ecological classifications and valuation techniques, Jones (1996) distinguishes between critical and sustainable natural capital and argues for the non-valuation of irreplaceable ecological assets. Furthermore, Jones (1996) applies the natural inventory model to a pilot study at Cosmeston Lakes Country Park demonstrating the feasibility of integrating ecological data into organizational reporting and highlighting the role of accountants in designing information systems and communicating environmental performance. Therefore, Jones's (1996) framework is groundbreaking in its attempt to operationalize biodiversity accounting within existing organizational structures and bridge ecological theory and accounting practice.

During the 2000s we observe a diversification in methodology, with the 2013 special issue of AAJ giving a boost to qualitative research in accounting for biodiversity. Among these qualitative studies, Cuckston (2013) examines how a biodiversity conservation project in Kenya was brought into financial accounting calculations by constructing a greenhouse gas emissions offset product from the conserved tropical forest. Also, Freeman and Groom (2013) apply conventional environmental accounting approaches to two forestry case studies in the UK to demonstrate how the estimation of long-term discount rates results in the undervaluation of projects that are sensitive to biodiversity conservation. Siddiqui (2013) applies Jones' (1996) natural inventory model on the Sundarbans (Bangladesh), the world's largest Mangrove forest, highlighting the potential for the model to be adopted in developing countries. Last, Tregidga (2013) explores, through a Foucauldian governmentality lens, how accounting practices actively construct and legitimize biodiversity offsetting as a rational, calculable solution and simplify complex ecological relationships into measurable units, ultimately enabling continued environmental harm under the guise of accountability and balance.

It is worth noting that quantitative studies are present from the outset of the accounting for biodiversity and ecosystems movement. In the past two decades, quantitative research has gradually strengthened mainly in non-accounting journals such as *Ecological Economics* (26/70 quantitative studies belong to said journal). These studies tend to fall into two groups. The first comprises articles proposing econometric and mathematical models to assess biodiversity and ecosystems that are then tested using available data and databases (see e.g. Mouysset *et al.*, 2011). The second group contains studies that value natural capital using different valuation techniques (see e.g. Campos *et al.*, 2019, 2022).

Last, in the past 5 years, we see a boom in content analyses. Articles adopting content analysis methodologies come nearly all from accounting journals of the likes of *AAAJ* (e.g. [McBride et al., 2023](#)), *Meditari Accountancy Research* (e.g. [Pujiningsih and Utami, 2024](#)), *Social and Environmental Accountability Journal* (e.g. [Zhao and Atkins, 2021](#)) and *Sustainability Accounting, Management and Policy Journal* (e.g. [Schneider et al., 2014](#)). These studies assess reporting practices of governmental organizations ([Gaia and Jones, 2017, 2020](#)), private corporations ([Corvino et al., 2021](#); [McBride et al., 2023](#); [Di Vaio et al., 2025](#)) and conservationists ([Büchling and Maroun, 2021, 2023](#)).

## 5. Critique of the main biodiversity-and-ecosystem-accounting topics

[Table 4](#) presents the main themes emerging from the open coding ([Wolfswinkel et al., 2011](#)). The themes are organized into two groups. Specific topics are those unique labels present in the articles we coded. General topics are groups of specific topics that we can trace back to similar concepts. “Natural capital accounting” is the only topic that is evenly present across the accounting and economic outlets ([Table 5](#)). In fact, both economic and accounting research refers to accounting as a practice useful for measuring stocks and flows of natural capital at times in an anthropocentric manner and, at times, to preserve and restore nature in an ecocentric manner ([Atkins et al., 2023](#); [Sullivan and Hannis, 2017](#); [Fleming et al., 2022](#)).

What strikes the most, however, are the differences in the extent and the way in which the other topics (i.e. measuring and valuing ecosystems, biodiversity offsetting, biodiversity reporting and extinction accounting) are treated – if at all – by accounting and economics journals. In the next sections, we will critique these topics, which form the backbone of the transformative redefinitions that conclude this research.

### 5.1 *Measuring ecosystems and giving nature a price*

Looking at how biodiversity accounting topics have evolved over time ([Figure 5](#)), we find that research valuing ecosystems and biodiversity has been present since the early 2000s, mostly in economic journals. The near absence of valuation studies from accounting journals is not surprising if we consider that articles in accounting journals tend to focus primarily on “reporting” as demonstrated by [Blanco-Zaitegi et al. \(2022\)](#) and [Toukabri and Toukabri \(2025\)](#).

Half of the valuation studies convert biodiversity and ecosystems to monetary quantities. Methods range from valuing specific services, for example pharmaceutical provision ([Erwine et al., 2010](#)) or individual species like lions ([Jacobsen et al., 2022](#)), to choice experiments ([Scarpa et al., 2003](#)), acquisition costs ([Kim et al., 2014](#)) and hedonic pricing ([Belcher and Chisholm, 2018](#)). These primarily gauge stakeholders’ willingness to pay for conservation, though some adopt multi-criteria approaches integrating non-monetary values, such as combining cost–utility analysis with threat reduction assessment for UK Species Action Plans ([Laycock et al., 2011](#)), helping decision-makers assess complex trade-offs ([Yousefpoor and Hanewinkel, 2009](#)).

The accounting articles that do focus on valuation highlight the limits of anthropocentric framings that reduce nature to accounting numbers and favor ecological on economic valuation ([Cuckston, 2019](#); [Sullivan and Hannis, 2017](#)). In fact, research on ecosystem valuation is spanning debates on the tension between anthropocentrism, which values ecosystems for human benefit and economic utility ([O’Neill et al., 2008](#)), and ecocentrism, which sees intrinsic value in nature, independent of human use ([Dempsey, 2016](#); [Atkins et al., 2023](#)). Critics note that even sophisticated methods can commodify nature ([Costanza, 2006](#); [Ferreira, 2017](#); [Robertson, 2006](#); [Atkins and Maroun, 2018](#)), reducing complex ecological relations to transactions and perpetuating exploitative dynamics ([Sullivan and Hannis, 2017](#); [Melathopoulos and Stoner, 2015](#); [Dempsey, 2016](#)). Inclusive valuation methods face challenges too: powerful interests may dominate, marginalizing vulnerable groups and

**Table 4.** Accounting topics identified from the open coding and corresponding working definitions

General topic (# of articles)	Specific topic	Number of articles	Definition	Examples
Natural capital accounting (85)	Agroecology accounting	2	Agroecology is “the science that provides the ecological principles and concepts for the design and management of productive agricultural ecosystems that conserve natural resources” (Lanka <i>et al.</i> , 2017, p. 1592) <i>Agroecology accounting</i> explores the use of ecological principles in the management of agricultural ecosystems where biodiversity is used to generate value for farms	Lanka <i>et al.</i> (2017)
	Biodiversity accounting	25	<i>Biodiversity accounting</i> includes research on both the accounting of life forms (biodiversity as <i>an asset</i> to be accounted for and enhanced; biodiversity as <i>an accounting entity</i> ) and research into how <i>accounting</i> (also at the level of individual organizations) can contribute to preserving biodiversity	Maione <i>et al.</i> (2024), Atkins and Maroun (2020)
	Ecological accounting	4	“An ecological accounting [...] is focused on change, and transformation, an emancipatory form of accounting that at its core aims to restore nature, revive biodiversity, conserve species and enhance ecological systems” (Atkins <i>et al.</i> , 2023, p. 1478) Ecological systems are accounting <i>entities</i> . The goal is to use different forms of <i>accounting</i> to restore the natural environment and ecological systems	Atkins <i>et al.</i> (2023), Sullivan and Hannis (2017)
	Ecosystem accounting	32	A set of official statistics that measure the value and inter-connections between ecosystems and human well-being to support decisions and planning at national and international levels. Ecosystem accounting tends to have a macro-level characterization	Bordt (2018), Feger and Mermet (2020)
	Environmental accounting	9	“Traditional, neo-classical, environmental accounting chiefly incorporates negative externalities into accounting frameworks to record and report on them. In contrast, ecological accounting is concerned with restoring the natural environment and ecological systems, such as biodiversity and ecosystems, in an emancipatory manner” (Atkins <i>et al.</i> , 2023, p. 1477) <i>Environmental accounting</i> has to do with the measurement and reporting of the (negative) externalities of economic activities and is, therefore, a sort of extension to traditional <i>accounting</i> to incorporate issues that would otherwise remain outside the <i>accountability</i> of economic activities	Atkins <i>et al.</i> (2023), Freeman and Groom (2013)
	Extended accounts	1	Very similar to the concept of <i>ecosystem accounting</i> , <i>extended accounts</i> are designed to complement national accounts with the valorization of ecosystem services	Campos <i>et al.</i> (2019)
	Marine resource accounting	3	A subset of <i>ecosystem accounting</i> and <i>biodiversity accounting</i> specific to marine ecosystems	Cabral <i>et al.</i> (2015)
	Natural capital accounting	17	Natural capital accounting is “the process of identifying the stocks of natural assets, assessing their condition, and estimating, in physical and/or monetary terms the flow(s) of services that they produce over time” (Fleming <i>et al.</i> , 2022, p. 2) Natural capital accounting focuses on measuring and valuing nature as stocks and flows	Fleming <i>et al.</i> (2022), Maione <i>et al.</i> (2024)
	Ocean accounting	4	Subset of <i>ecosystem accounting</i> and <i>biodiversity accounting</i> specific to the ocean ecosystem	Cummings <i>et al.</i> (2023)

(continued)

**Table 4.** Continued

General topic (# of articles)	Specific topic	Number of articles	Definition	Examples
Biodiversity and ecosystem valuation (70)	Valuation	65	Economic and/or ecological valuation of biodiversity and ecosystems	Cuckston (2019)
	Monetization	36	Conversion in monetary terms of biodiversity and ecosystems	Jacobsen <i>et al.</i> (2022), Yousefpour and Hanewinkel (2009) Dedeurwaerdere (2005)
	Bioprospecting	1	Exploration of biodiversity for commercial purposes	
	Pricing	2	Development of a price on biodiversity or ecosystem services	Kim <i>et al.</i> (2014)
	Costing	8	Allocation of direct and/or indirect costs to biodiversity conservation services	Kim <i>et al.</i> (2014)
Extinction accounting		17	Refers to studies on the role of <i>accounting</i> in measuring, reporting and combating biodiversity loss	McBride <i>et al.</i> (2023), Atkins and Maroun (2018)
Reporting		51	Organizational reporting on biodiversity and ecosystems	Gaia and Jones (2017, 2020)
Biodiversity offsetting		6	The development and implementation of biodiversity compensation systems	Cuckston (2017), Ferreira (2017)

**Source(s):** Authors' own work

**Table 5.** Frequency of accounting topics in economics and in accounting outlets

ABS-AJG category Number of articles		Economics <sup>a</sup> 64	Accounting <sup>b</sup> 46
Natural capital accounting	Agroecology accounting	–	1
	Biodiversity accounting	2	9
	Ecology accounting	–	3
	Ecosystem accounting	12	3
	Environmental accounting	1	3
	Extended accounts	1	–
	Marine resources accounting	1	–
	Natural capital accounting	3	4
	Ocean accounting	–	–
Biodiversity and ecosystem valuation	Bioprospecting	1	–
	Costing	3	–
	Pricing	1	–
	Valuation	32	3
	Monetization	14	1
Biodiversity offsetting		–	5
Extinction accounting		–	11
Reporting		–	19

**Note(s)** <sup>a</sup>The category “economics” comprises articles from *Ecological Economics* and *Environmental and Resource Economics*, <sup>b</sup>The category “accounting” comprises articles from *Accounting, Auditing and Accountability Journal*, *Sustainability Accounting, Management and Policy Journal* and *Social and Environmental Accountability Journal*

**Source(s):** Authors' own work

leaving unresolved conflicts between cultural, ethical and economic priorities (Dempsey, 2016; O'Neill *et al.*, 2008).

Twenty-three valuation articles refer to the UN (2021) System of Environmental-Economic Accounting (SEEA) as a framework for measuring and valuing ecosystems. The SEEA is an internationally recognized statistical framework that integrates environmental and economic data to assess ecosystem conditions, services and their contributions to human well-being.

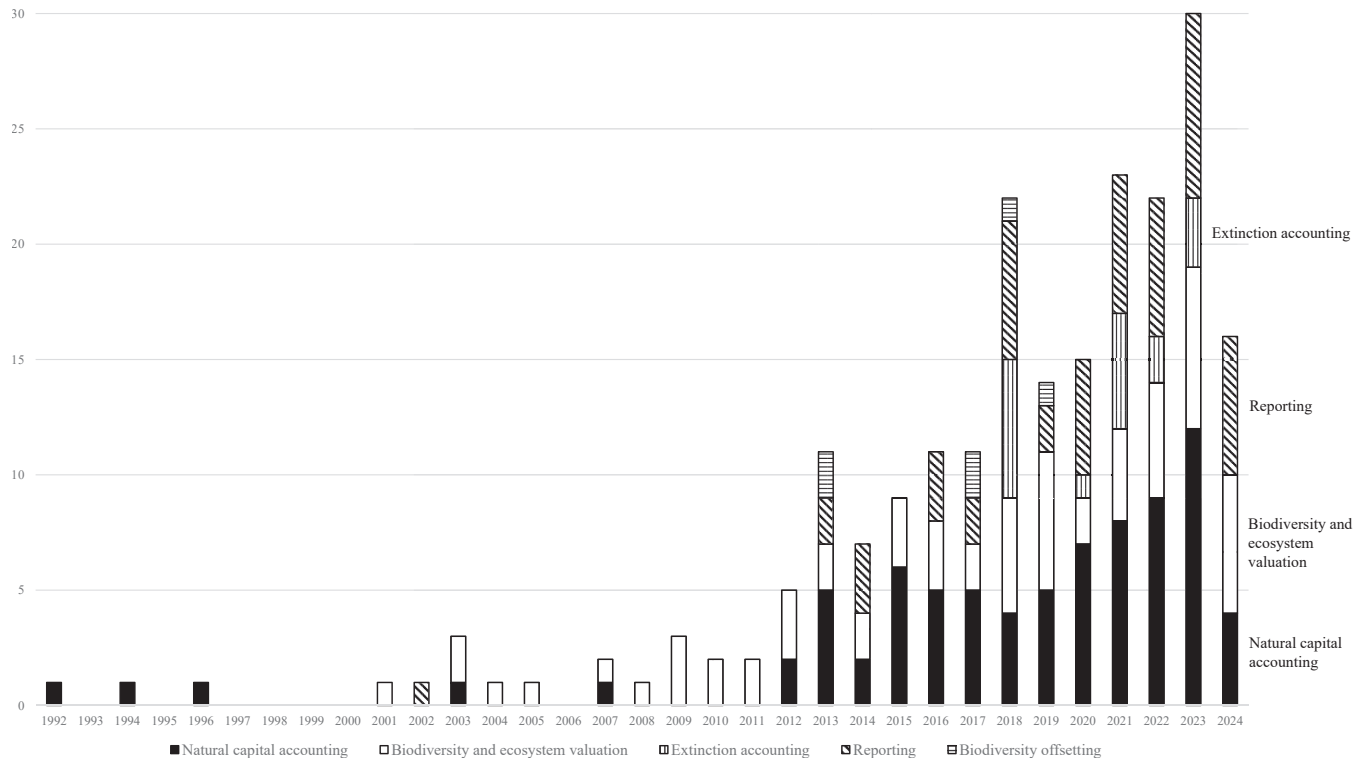


Figure 5. Number of articles by accounting topic per year. Source(s): Authors' own work

Through the use of spatially explicit data on ecosystem extent and condition, the SEEA supports policy-making by linking ecological data with national accounts, enabling informed decisions on biodiversity conservation, land use and sustainable development. The objective of the SEEA monetary accounts is to determine the exchange value of ecosystems and their services (i.e. the sums of money payable to asset owners for the assets themselves or for the use of their services; [Mateos et al., 2025](#)).

### 5.2 Biodiversity offsetting

Biodiversity offsetting appears in our sample during the 2010s mainly thanks to the 2013 AAAJ special issue. Biodiversity offsetting is a policy mechanism that seeks to reconcile environmental degradation with economic development by ensuring “no net loss” of biodiversity ([Tregidga, 2013](#)). It operates by compensating for ecological harm in one location through restoration or conservation efforts elsewhere.

[Cuckston \(2013\)](#) explores biodiversity offsetting through financial accounting, focusing on a forest preservation project in Kenya. He illustrates how biodiversity is successfully rendered calculable via carbon metrics, enabling its integration into financial systems. This process simplifies complex ecological phenomena into standardized units, which are then monetized and traded. On a similar note, [Tregidga \(2013\)](#) critiques offsetting from a governmentality perspective and analyses how accounting technologies shape environmental governance. Her case study of Solid Energy in New Zealand shows how biodiversity offsetting is legitimized through visual metrics and scoring systems that reduce ecological complexity to manageable figures.

Both [Cuckston \(2013\)](#) and [Tregidga \(2013\)](#), however, argue that biodiversity-offsetting accounting practices can obscure ecological uncertainties and ethical dilemmas, risk transforming conservation into a transactional exercise, where habitats and species are treated as interchangeable commodities, and marginalize cultural and relational values. These dilemmas are further investigated by [Sullivan and Hannis \(2017\)](#) and [Ferreira \(2017\)](#). By examining the failed attempt to establish a biodiversity offset market in the UK, [Ferreira \(2017, p. 1581\)](#) highlights the resistance posed by ecological realities, arriving to describe biodiversity as an “uncooperative commodity: an entity whose biophysical, spatial and sociocultural characteristics make it resistant to commodification”. [Sullivan and Hannis \(2017\)](#) go even deeper into the ontological and ethical foundations of ecological accounting that (should) underpin biodiversity offsetting. They contrast arithmetical approaches – used in natural capital accounting and offsetting – with relational understandings of nature. Their analysis reveals how numerical-economic values are constructed to facilitate appropriation, often marginalizing non-monetary and non-quantifiable values. If biodiversity-offsetting accounting challenges dominant neoliberal logics, however, there could be a more interdisciplinary and ethically grounded pathway for sustainable development ([Cuckston, 2019](#)).

### 5.3 Biodiversity reporting

Paralleling the rise of content analysis methodology, since 2013 we observe a surge of biodiversity reporting driven predominantly by accounting journals. Biodiversity reporting – disclosing corporate impacts, dependencies and conservation efforts – is the most widely discussed biodiversity-related topic in accounting journals, reflecting the broader rise of non-financial reporting ([Burritt and Schaltegger, 2010](#); [Pigatto et al., 2022](#); [Pigatto, 2025](#)).

We find that research on biodiversity reporting often falls into one of three categories: (1) in-depth analysis of disclosures of single organizations, (2) content analyses of a large sample of organizations or (3) conceptual articles. In the first group, we find studies that focus on organizations to unpack unique characteristics of their biodiversity reporting (e.g. [Sobkowiak et al., 2020](#); [McBride et al., 2023](#); [Sun and Lange, 2023](#)).

The second group contains articles adopting quantitative methods to map both the state of the art and underlying motives behind biodiversity reporting practices (e.g. [Blanco-Zaitegi et al., 2022](#);

Boiral, 2016; Gaia and Jones, 2017, 2020; van Liempd and Busch, 2013; Pujiningsih and Utami, 2024; Rimmel and Jonäll, 2013; Solimene *et al.*, 2024; Zhao and Atkins, 2021) and unravel whether reporting on biodiversity is related with financial performance (Elsayed, 2023), corporate governance characteristics (Hambali and Adhariani, 2024; Haque and Jones, 2020), engagement with conservationists (Ackers and Adebayo, 2024), environmental performance (Dutta and Dutta, 2024) and country-level differences (Robert and Elamer, 2025).

Studies belonging to the third group conceptualize new frameworks for biodiversity reporting. They propose extinction accounting as an emancipatory framework that company might embed in integrated or sustainability reporting to help organizations becoming more accountable toward biodiversity-related risks, preventing the loss of species and driving positive change (Atkins and Maroun, 2018; Buchling and Maroun, 2021; Maroun and Atkins, 2021).

It is worth mentioning that, in our sample, research adopting content analyses of large samples (i.e. strand 2) almost doubles in-depth analyses of single organizations (i.e. strand 1). Moreover, only a residual of articles deals with proposing novel theoretical and conceptual approaches to biodiversity reporting.

#### 5.4 Extinction accounting

Extinction accounting is an emerging area in accounting research that documents, measures and reports species loss from human activities and environmental degradation (Atkins and Maroun, 2018; Atkins and Macpherson, 2022). In contrast to natural capital accounting, it focuses explicitly on biodiversity loss and species extinction, addressing ethical, ecological and long-term economic implications. Its purpose is to render extinction a visible, quantifiable concern in corporate, governmental and societal decision-making (Cuckston, 2018; Atkins *et al.*, 2018; McBride *et al.*, 2023).

Atkins and Maroun (2018) propose an integrated extinction accounting framework to hold corporations accountable for preventing species extinction. Emphasizing collaboration with NGOs and governments, they position businesses as key actors in combating mass extinction through transparent, science-aligned strategies. The aim is to integrate ecological and financial data following an integrated thinking perspective (Maroun *et al.*, 2025), embed extinction risks into corporate reports and heighten investor and stakeholder awareness (Atkins and Maroun, 2018; Weir, 2018).

Gray and Milne (2018) extend the concept by urging researchers to consider human extinction alongside species loss. They propose using species accounts to explore threats to humanity's survival, highlighting three possible trajectories: "devastation of the human species through existential threats manifest through western ways of organizing; selective exterminations through which those societies less in thrall to modernity may survive in some form or other; and the erosion of the quality of 'humanity' – the loss of what it is to be human" (p. 834). They argue that without comprehensive accounts of human–nature relations, existential threats will remain unaddressed. At root, the challenge lies in the organization of global financial capitalism, driven by "growth, profit, consumption, individualism and the pursuit of more" (p. 839).

## 6. Transformative redefinition: a critical agenda for biodiversity and ecosystem accounting research

### 6.1 The opportunities (and pitfalls) of biodiversity and ecosystem measurement

We anticipate that the more frameworks and tools for measuring and valuing biodiversity and ecosystems evolve, the more accounting (and accountants) will play an important role. It is not the first time that accounting has had to deal with complex phenomena, which elude clear measurements. Think for example, at climate change and carbon accounting, accounting for sustainable development or even the challenges posed by measuring and valuing intellectual

capital. Yet, through research, practical experimentation and policy interventions, frameworks and standards have been produced such as the greenhouse gas (GHG) Protocol, the SDGs (Laine *et al.*, 2022) and intellectual capital valuation models (Sydler *et al.*, 2014). In the biodiversity and ecosystem measurement context, we are already seeing measurement standards being developed and updated; the SEEA is an example of that.

Based on the literature analyzed in this paper, we identify four issues that accounting researchers and practitioners should address as they are preparatory to measuring and valuing nature: (1) ecological complexity, (2) commodification and reductionist traps, (3) ethical challenges and (4) measurand and measurements. The first three have already been discussed in previous SLRs at length (Blanco-Zaitegi *et al.*, 2022; Schaltegger *et al.*, 2022), so we won't discuss them here. The latter has received scant attention but needs to be addressed fully before practically tackling biodiversity loss and ecosystem collapse.

For organizations, measuring and valuing biodiversity and ecosystems first implies deciding what to measure – the “properties” of the “objects” under measurement (i.e. the measurand” as per Micheli and Mari, 2014). The relationship between business and nature is tripartite: there are impact, dependency and state of nature. And for each of the three objects, there can be different measurand, which imply different measurements, different interests and different actors (Nørreklit and Cinquini, 2024).

Reasoning in terms of impacts means understanding an organization's direct and indirect effect on land/sea use change, pollution, introduction of invasive alien, species, over-exploitation of natural resources and climate change, because these are all direct impact drivers of biodiversity loss (Jaureguiberry *et al.*, 2022; IPBES, 2019). Inside a company, data on these impact drivers might come from multiple sources such as operations, logistics, procurement, R&D and sustainability functions and are relevant for a range of stakeholders such as customers, suppliers, local communities and public institutions.

Reasoning in terms of dependencies means understanding which ecosystem services an organization uses and what would happen if said ecosystem service deteriorates or ceases to exist. Inside a company, this means involving risk management and accounting departments to assess the exposure of business activities and the financial consequences of biodiversity loss and ecosystem collapse. Shareholders, banks and financial institutions are becoming sensible to these type of nature-related risks as demonstrated by the development of the Taskforce on Nature-related Financial Disclosures (TNFD), which supports organizations in assessing and reporting the financial impacts of biodiversity loss, and the inclusion of ecosystem collapse among the most material risks for the economy in the mid-term (World Economic Forum, 2025). Also, the SEEA is in the realm of dependencies, since it is mainly about measuring and valuing natural stocks and ecosystem services.

Last, reasoning in terms of state of nature implies measuring the health of ecosystems and species. Because of a scale problem, such a measurand is possibly the least important from a business point of view. In fact, ecosystems and species extend and move far beyond the boundary of a single organization and are usually measured at a regional, national and international level. Is it truly a company the one in charge – or that should be in charge – of measuring how many species of birds fly over its roof or how in good health is the neighboring wood? This question is not rhetoric, but the answer calls for a re-thinking of the business responsibility in monitoring natural stocks and flow that are not entirely under its control.

At an international level, there are some efforts that are going in this direction. One example is the Nature Positive Initiative, an international initiative set in motion by 27 of the world's largest nature conservation organizations, institutes, business and finance coalitions that are proposing a set of metrics for organizations to measure the state of nature and span ecosystem extent, ecosystem condition and species metrics (Nature Positive Initiative, 2025). The underlying rationale is that if every organization were to measure the state of its own territory, we would be able to construct a detailed, granular map of ecosystems in which they operate. Therefore, monitoring the evolution of ecosystems and species would become much simpler.

Also in the case of nature positive, the measurand and measurement issues are far from being solved. What does a company mean when it calls itself nature-positive? And how do we even measure biodiversity? The richness of life forms? Species heterogeneity? Species distribution evenness? Ecosystem fragmentation? Ecosystem extent? Extinction rates? Or a mix of all of these? (Cuckston, 2019; Dasgupta, 2021; Gray and Milne, 2018; McBride *et al.*, 2023; Jones, 2003; Jones and Solomon, 2013). There is room – and necessity – of accounting and economics researchers and practitioners to engage with one another as well as with researchers from other disciplines, such as biology, ecology, agronomy, chemistry and conservation. Only through a multi-disciplinary approach, there could be a chance to get at the bottom of the measurement problem.

Such collaboration is necessary because the objects and properties to be measured – ranging from ecosystem health and species richness to business impacts and dependencies – are inherently complex and cannot be fully captured by the tools and concepts of any single discipline (Dasgupta, 2021). For example, while accounting provides the infrastructure for recording, classifying and managing data, it is ecological and biological expertise that defines what constitutes a meaningful ecological baseline or a relevant indicator of biodiversity. Similarly, advances in remote sensing, eDNA analysis and global biodiversity databases require data science and technological input to be effectively integrated into accounting systems. This convergence of disciplines allows for the development of more robust, context-sensitive measurement frameworks that reflect both ecological realities and organizational needs.

A promising example of said multi-disciplinary collaboration is the integration of ecological data and accounting systems for natural capital accounting at the national or regional level. Projects implementing the SEEA often require close cooperation between statisticians, ecologists, economists and accountants. For instance, compiling ecosystem accounts for forests or wetlands involves ecologists defining ecosystem types and health indicators, data scientists processing remote sensing and field data, and accountants translating these into standardized reporting formats that can inform policy and business decisions (Hultkrantz, 1992; Campos *et al.*, 2019, 2022). Another example is the TNFD. In fact, mapping business dependencies and impacts on nature brings together sustainability managers, financial controllers, risk analysts and external experts in ecology or conservation. For example, a food retailer might work with ecologists to identify critical ecosystem services in its supply chain, with data scientists to analyze satellite imagery for land use change and with accountants to quantify and disclose these risks in annual reports.

However, multi-disciplinary collaboration is not without its challenges. Differences in epistemologies, terminologies and methodological preferences can create friction and misunderstandings among researchers. For instance, the reductionist and utilitarian tendencies of accounting and economics may clash with more holistic, relational perspectives of ecology and conservation science, which emphasize intrinsic values and ecosystem interdependencies (Atkins *et al.*, 2023; Sullivan and Hannis, 2017). Achieving a productive nexus requires ongoing dialogue to negotiate these differences and co-create shared frameworks. Successful collaboration often hinges on the willingness of all parties to engage in critical reflection, embrace methodological pluralism and remain open to alternative forms of value and evidence. When such a nexus is achieved, it can yield innovative approaches to measurement that are both scientifically rigorous and practically relevant, providing future researchers with a foundation for addressing the measurement problem in ways that are both credible and transformative.

### 6.2 Time to move on with research on biodiversity reporting?

Research on biodiversity reporting published in accounting journals, however, seems on a path to become subject to the same sickness affecting research on voluntary reporting such as integrated reporting and sustainability reporting. Voluntary reporting research has been

criticized in the past years for failing to be innovative in terms of theoretical and methodological approaches adopted, with limited contributions to practice, and subject to passing fads (Adams, 2002; Burritt and Schaltegger, 2010; Dumay *et al.*, 2018; Pigatto *et al.*, 2022; Vinnari and Laine, 2013). Biodiversity reporting research runs the risk of falling into the same pitfalls of broader voluntary disclosure research.

Debates over voluntary biodiversity reporting, in fact, exactly mirror broader voluntary reporting tensions between economic and socio-political paradigms (Pigatto *et al.*, 2022; Buhr *et al.*, 2014). From an economic perspective, it reduces information asymmetry, signals commitment to biodiversity (Gaia and Jones, 2020), promotes accountability (Khan, 2014) and may support emancipatory extinction accounting (Zhao and Atkins, 2021). From a socio-political view, it is shaped by institutional pressures and legitimacy concerns, potentially functioning as impression management or “greenwashing” (Rimmel and Jonäll, 2013; Gaia and Jones, 2020).

An antidote to the lack-of-innovation sickness might come from two sources: (1) the *mandatorization* trend biodiversity reporting is experiencing and (2) the focus on the peculiar aspects of biodiversity and ecosystems vis-à-vis other sustainability issues.

The voluntary reporting landscape is ongoing a process of *mandatorization* – a “slow, yet steady, process of codification and regulation” (Pigatto, 2025, p. 93) – and biodiversity reporting is experiencing the same. For example, the EU’s Corporate Sustainability Reporting Directive (CSRD) and European Sustainability Reporting Standards (ESRS) ask certain companies to assess biodiversity and ecosystems under the double materiality approach. If biodiversity and ecosystems are deemed material, firms must follow ESRS E4: biodiversity and ecosystems, disclosing transition plans, strategies, policies, actions, targets and metrics (European Parliament and Council, 2022; European Commission, 2023). In addition to the CSRD, it is worth following the developments of the International Sustainability Standards Board (ISSB). After issuing the first two standards on “General Requirements for Disclosure of Sustainability-related Financial Information” (ISSB S1) and “Climate-related Disclosures” (ISSB S2), the ISSB is now considering the adoption of a standard on biodiversity, ecosystems and ecosystem services. In the second half of 2025, the ISSB is expected to come to a decision (IFRS, 2025) [1]. Other recent developments in biodiversity-reporting codification include the 2024 revision of Global Reporting Initiative (GRI) 101: biodiversity, effective from January 2026, requiring disclosure of biodiversity policies, impact management and alignment with the Kunming-Montreal Global Biodiversity Framework. Alongside this, the already mentioned TNFD supports organizations in assessing and reporting the financial impacts of biodiversity loss. While many voluntary standards exist, GRI 101 and TNFD uniquely focus on biodiversity metrics.

Biodiversity reporting faces persistent challenges due to measurement complexity specific to biodiversity and ecosystems. In fact, the same measurement challenges, described in the previous section, also affect biodiversity reporting. Depending on whether a company wants to report its impact on biodiversity, its dependencies from ecosystem services and/or the state of nature where it operates, the company will likely have to resort to different disclosures. Research on these aspects is still scant, yet promising. For example, Sobkowiak *et al.*’s (2020) analysis of UK government biodiversity report implicitly tackles the problem of collecting and organizing data on the state of nature. McBride *et al.* (2023) is an example of deepening how Russian American Company reports on a key impact driver of biodiversity loss: over-exploitation of natural resources.

Unsurprisingly, our sample does not contain studies analyzing biodiversity reporting from a dependency perspective. While research on the dependencies of entire sectors, regions and economies is flourishing (O’Neill *et al.*, 2008; World Economic Forum, 2020; Vysna *et al.*, 2021; UN, 2021), business dependencies have received less attention from researchers and practitioners (Carvalho *et al.*, 2022; UNEP-WCMC *et al.*, 2022). However, the new ESRS E4 (biodiversity and ecosystems) reporting standard (European Commission, 2023) will require companies to report on their ecosystem dependencies – a disclosure requirement that is not

present in the updated version of the GRI 101. An effective way to help companies reason about these dependencies is to think in terms of business risks. For example, it may be that the ability of an ecosystem to continue to generate useful, if not fundamental, offerings to a company is also a source of risk since that ecosystem could collapse or deteriorate ([Carvalho et al., 2022](#)).

While accounting research on dependency-related biodiversity reporting is lacking, however, practice is going ahead. For example, the French Elo group – owner of Auchan Retail, New Immo Holding and possessing the 49.9% of Oney – showcased a matrix of dependencies from biodiversity in its 2023 Annual financial report and non-financial performance statement ([ELO, 2024](#)). The matrix mapped the ecosystem services relevant for the company’s value chain and identified which dependencies affected direct and indirect segments of the value chain. We expect more of such examples in the near future as the effect of the CSRD and TNFD start to kick in.

We call for more qualitative and quantitative accounting research to understand how companies are approaching the identification and reporting of dependencies and whether information constructed for external reporting obligations is then used inside the companies for decision-making and risk management.

### 6.3 Accounting for conservation and rewilding

The growing integration of accounting into biodiversity conservation reflects the need to financially value ecological outcomes to attract investment and assess efficiency. Conservation finance mechanisms, such as conservation impact bonds, align ecological goals with financial incentives to address chronic underfunding ([Arjaliès and Gibassier, 2023](#)). While tools like cost-utility analysis compare intervention costs with ecological benefits, such approaches risk oversimplifying biodiversity into monetizable outputs, reducing its intrinsic value ([Sullivan and Hammis, 2017](#)). Evaluating conservation cost-effectiveness remains challenging due to the complexity of measuring ecological success ([Laycock et al., 2011](#)).

Biodiversity conservation accounting also underpins biodiversity offsetting, which seeks to demonstrate “no net loss” or “no net gain” of biodiversity ([Cuckston, 2013](#)). Offsetting treats nature as a quantifiable, tradable asset, enabling biodiversity losses in one location to be “balanced” by gains elsewhere, often via credits or restoration projects ([Arjaliès and Gibassier, 2023](#)). However, the absence of standardized methods for integrating ecosystem services and processes ([Egoh et al., 2007](#)) results in inconsistent calculations. Metrics often prioritize easily measurable attributes, such as carbon sequestration or species counts, over less tangible elements like ecosystem resilience, potentially undermining ecological integrity. However, we expect that as standards and frameworks for measuring and valuing conservation efforts evolve, biodiversity offsetting will likely gain new traction as an easy, yet problematic, way for organizations to compensate their negative impacts.

Last, accounting for biodiversity conservation feeds into biodiversity reporting. There is a growing expectation from stakeholders and regulators for organizations to disclose their biodiversity impacts and conservation efforts. Biodiversity accounting enables organizations to meet these expectations by providing the necessary data for comprehensive reporting ([Rimmel and Jonäll, 2013](#); [Gaia and Jones, 2020](#)). Robust accounting practices provide the quantitative and qualitative data necessary for transparent and meaningful reporting, which in turn enhances corporate accountability, informs strategic decision-making and meets stakeholder expectations.

### 6.4 Accounting and the sixth mass extinction

Differently from [Blanco-Zaitegi et al. \(2022\)](#) who found that biodiversity reporting focuses mainly on single species and their extinction, our sample returns a different picture when expanding the analysis to fields beyond accounting. In *Economics and Econometrics* journal, in fact, there is a sizeable tradition of measuring and disclosing natural capital comprising

ecosystem extent, ecosystem condition and ecosystem services. We find this result as more in line with Gray and Milne's (2018, p. 828) request to consider that "any consideration of a specific species' endangerment must also seek to simultaneously recognize that any species extinction may hasten humanity's own extinction as a species". Stretching the concept of valuation, we could hypothesize that the more a species – or another element of natural capital – becomes critical for the survival of humankind, the more it will become valuable. However, what this line of reasoning misses is the analysis of the root cause of the current fates of the natural world, that is "humanity's ways of organizing are the root cause of such fates" (p. 828).

Extinction accounting's ecocentric perspective calls on organizations to accept moral responsibility for biodiversity loss and ecosystem collapse (Gray and Milne, 2018; McBride *et al.*, 2023). This requires moving beyond compliance-oriented environmental reporting toward assessing corporate contributions to species loss and making proactive changes to avert further harm (McBride, 2023; Atkins *et al.*, 2023). Achieving this entails linking conventional business data with ecological indicators – such as ecosystem health, species population trends and the functional roles of endangered species (Cuckston, 2018; Atkins and Maroun, 2020; Atkins *et al.*, 2018) – to embed biodiversity considerations into the core of organizational accountability.

It is worth noting, however, that some developments of the extinction accounting framework are based on the integrated reporting framework of the International Integrated Reporting Council (IIRC, since 2021 consolidated into the International Financial Reporting Standards (IFRS)) and on the GRI (Atkins and Maroun, 2018; Maroun and Atkins, 2021). The rationale is clear and understandable: use well-known frameworks to avoid additional reporting burdens and speak to businesses using a business language that makes clear the business case for biodiversity conservation and extinction prevention in terms of organizational strategy, risk exposure, operating environment and value creation (Maroun and Atkins, 2021). The use of the IIRC's framework for advancing extinction accounting, however, might prove problematic. The IIRC's framework and conceptualization of integrated thinking has been widely criticized as being an investor-centric, shareholder-first model based on financial materiality that prioritizes the interest of investors and providers of financial capital and marginalizes less vocal and powerful stakeholders (Dumay and Dai, 2017; Flower, 2015, 2020; Thompson, 2015; Pigatto *et al.*, 2023; Pigatto, 2025). And *Nature* has seldom voice and power. Therefore, the open question is whether relying on the IIRC's framework for advancing extinction accounting truly goes in the direction hoped for by Gray and Milne (2018) to go at the root of environmental degradation and offer accounts that challenge the way of organizing of modern businesses.

We, therefore, encourage accounting researchers to look for ways to strengthen the extinction accounting movement by, for example, looking to alternative models of reporting that favor a more balanced relationship between humans and nature. A good starting point could be moving to a double materiality approach as championed by the EU CSRD. Here, if an issue is relevant for a stakeholder – say, *Nature* – but not for the company, the company must account for and report on such an issue, nevertheless. We believe it could be an interesting starting point for research aimed to advance extinction accounting in the era of reporting mandatorization.

## 7. Conclusions

Previous SLRs on accounting for biodiversity and ecosystems have denoted a scarcity of company or industry case studies (Schaltegger *et al.*, 2022) and of quantitative studies (Blanco-Zaitegi *et al.*, 2022) and have called for more research along those methodological lines. We believe that these calls originate from the fact that previous SLRs have analyzed research published in accounting journals only. However, expanding the analysis to research fields near the accounting field (i.e. economics, econometrics and finance) returns a different picture. In fact, while accounting journals tend to be dominated by research on biodiversity

reporting, economics journals are populated with a plethora of industry-specific case studies, especially in agricultural and agro-forestry (see [Ranjan, 2019](#); [Ovando et al., 2016](#)), fishery ([Martinet and Blanchard, 2009](#); [Frésard and Ropars-Collet, 2014](#)) and conservation sectors ([Trousdale and Gregory, 2004](#)). Moreover, quantitative studies abound in economics journals, predominantly with a focus on translating bio-physical data and intangible aspects in an economic, quantified valuation ([Mateos et al., 2025](#)). In line with [Schaltegger et al. \(2022\)](#), however, we too find a lack of studies addressing the indirect impacts and dependencies present in companies and industries which are “further away” from nature such as services and manufacturing.

This study has addressed the development of research in accounting for biodiversity and ecosystems ([RQ1, Section 4](#)), critiqued the main accounting topics contained in the literature ([RQ2, Section 5](#)) and offered ways forward for accounting research on biodiversity and ecosystems ([RQ3, Section 6](#)). Specifically, four main themes have been covered at length: biodiversity and ecosystem measurement, biodiversity reporting, accounting for conservation and extinction accounting.

Applying [Alvesson and Deetz’s \(2021\)](#) critical approach revealed how biodiversity accounting is shaped by a set of dominant theories and discourses. Chief among these is the anthropocentric framing of biodiversity as a resource for human utility and the financialization of ecosystems through accounting calculability. These assumptions permeate both economics and accounting research, structuring the boundaries of what counts as legitimate knowledge in the field.

Through the phase of “critique”, we interrogate these foundational assumptions and show how they limit the transformative potential of biodiversity accounting. In line with [Alvesson and Deetz’s \(2021\)](#) emphasis on “critical pragmatism”, the four transformative redefinitions we propose are not limited to critiquing the current state of biodiversity accounting but are aimed at reconfiguring its theoretical and methodological foundations. These include integrating ecocentric values, recognizing the intrinsic worth of biodiversity beyond economic metrics and building interdisciplinary bridges that connect accounting with ecological and conservation sciences.

By embedding ecological complexity and interdisciplinary dialogue into the accounting discourse, we move beyond existing critiques of financialization and commodification to articulate a more expansive vision for biodiversity accounting. This vision seeks to reposition accounting not only as a calculative technology but as a tool for ecological stewardship and collective care, bridging the gap between economics, critical accounting and conservation science. Responding to the call for transformative contributions, our approach demonstrates how critical accounting can be reconfigured when applied to biodiversity and ecosystem research. This reconfiguration both challenges and extends the scope of [Alvesson and Deetz’s \(2021\)](#) framework by embedding ecological complexity and proposing interdisciplinary avenues of inquiry. In doing so, the study offers a conceptual shift that we argue advances new knowledge rather than reproducing existing critical debates.

[Schaltegger et al. \(2022, p. 2548\)](#) identify three key functions accounting fulfils to support corporate biodiversity management: “identification, priority setting, monitoring and assessment”. Based on literature beyond accounting, we identify two additional functions: measurement and valuation. First, accounting contributes to measuring and collecting data on biodiversity and ecosystems by creating the infrastructure to record, classify and manage bio-physical data that measure ecological baselines (e.g. species population, habitat integrity) coming from on-site measurements with new technologies such as satellite imagery, eDNA, remote sensing or global databases such as the Exploring Natural Capital Opportunities, Risks and Exposure (ENCORE) platform, World Wildlife Fund (WWF) Biodiversity Risk Filter and the International Union for Conservation of Nature (IUCN) Red List. Of course, accounting alone is not enough to sustain the measurement effort, but it needs to work in tandem with ecology, conservation biology and data science. Second, accounting enables the quantification of biodiversity and ecosystem services in economic and in monetary terms. Especially with the

adoption of the updated version of SEEA (UN, 2021), there has been an increasing number of studies that compile natural capital accounts valuing the ecological and economic value of biodiversity and ecosystems.

Our study comes with limitations pertaining, mainly, to the methodological choices we made. First, we limit our literature search to articles published in business, management, accounting, economics, econometrics and finance journals. While this was a deliberate choice, we understand that the topic “accounting, biodiversity and ecosystems” could have been present also in other fields of knowledge such as environmental science, agricultural and biological sciences, and genetics, just to name a few. However, given that our research focused on uncovering patterns in the broad economics and business studies, we decided to leave other fields of knowledge out of the analysis. Further research could overcome this limitation by undertaking a comprehensive review of how accounting for biodiversity and ecosystems appears in different fields.

Second, we purposefully decided to implement a SLR methodology without resorting to bibliometric analysis. In fact, our choice rests upon Snyder’s (2019) and Donthu *et al.*’s (2021) considerations that below a sample of 300 articles, manual coding is preferable. Moreover, our interest was on the content of the articles more than on their performance measurement. However, we do acknowledge that our deliberate choice fails to inform the reader about the most cited articles and network analysis. However, we refer to the recent Maione *et al.*’s (2024) bibliometric analysis of biodiversity accounting that partially covers our second limitation.

A third key limitation of this study concerns the specificity of the search strategy used to identify relevant literature. Our search string was intentionally limited to the broad keywords “accounting”, “biodiversity” and “ecosystem” to maintain a general and neutral approach that would allow emergent themes and patterns to be inductively identified through coding. However, we acknowledge that this approach may have excluded relevant studies that use more specific terminology – such as “biodiversity reporting”, “natural capital disclosure”, “extinction accounting” or references to policy frameworks like the EU CSRD or TNFD. Including such targeted terms could have expanded the scope of the dataset and surfaced additional insights, particularly within sub-fields such as reporting or disclosure. That said, the exclusion of these terms was deliberate, as incorporating them into the initial search may have introduced bias by over-representing certain accounting subtopics. For instance, the overemphasis on reporting in biodiversity accounting literature emerged as a key insight in our analysis – an observation that may have been obscured had “reporting” been embedded in the original search terms. Nevertheless, future studies seeking broader coverage or narrower sub-field analysis may benefit from an expanded keyword set tailored to specific aspects of biodiversity accounting.

#### Note

1. We do not deepen ISSB’s S1 and S2 further, because these standards are focused on climate change and not on biodiversity and ecosystems. On the contrary, ESRS E4 and GRI 101 are explicitly centered on biodiversity and ecosystem reporting.

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