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Multi-level natural capital implementation within planetary boundaries

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Abstract

In this conceptual paper, we examine current theories of natural capital approach implementation and identify areas where further research is needed to help humanity live within planetary boundaries. Natural capital and ecosystem service approaches offer an advanced understanding of Earth's life-support systems and their interaction with human well-being at multiple scales, particularly organizations. The insights they offer are present in conservation and accounting literature but are not yet reflected in corporate environmental sustainability literature, a gap this paper seeks to bridge. Without considering scale, it is difficult to understand how micro (individual) and meso (organizational or national) actions contribute to global goals (planetary boundaries). We suggest a multi-level natural capital implementation framework for corporate environmental sustainability and explain how it can advance natural capital implementation by including scoping and monitoring phases and increasing awareness of natural resource dependencies and how it advances multi-level environmental management theory.

KEYWORDS
corporate environmental sustainability, ecosystem services, multi-level organizational theory, natural capital, planetary boundaries

1 | INTRODUCTION

Safeguarding Earth's life-support systems on which the welfare of current and future generations depend, is the greatest challenge of the 21st century (Griggs et al., 2013). Organizations play a key role in using and protecting these life-support systems as intermediaries that convert natural resources into usable products and services (Bansal, 2002; Figge & Hahn, 2020), but organizations operate at a much smaller scale than planetary boundaries. The development of sustainable organizations is steered, in part, by the concept of corporate environmental sustainability (CES) (Stead, 2015) which views the humanity–nature nexus from an organizational perspective. While CES has existed for decades and efforts have been made to bridge disciplinary silos there "is still a long way to go" (Guimarães-Costa et al., 2021, p. 8), particularly in understanding the boundary between humanity and nature at multiple levels from a systems perspective (Reimsbach & Braam, 2022). We contribute to this literature by proposing how natural capital (NC) approaches can be implemented in CES, building on multi-level systems theory. We ask the question: how can NC and ecosystem service approaches be used in CES practice, from a multi-level perspective, to improve understanding of the organization–nature nexus?

Abbreviations: CBD, Convention on Biological Diversity; CEO, Chief Executive Officer; CES, Corporate Environmental Sustainability; ES, Ecosystem Services; GHG, Green House Gas; IPBES, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services; MA, Millennium Ecosystem Assessment; NC, Natural Capital; SDGs, Sustainable Development Goals; SEEA, System of Environmental Economic Accounting; SNA, System of Environmental Economic Accounting; UNFCCC, United Nations (UN) Framework Convention on Climate Change.

While many definitions of CES exist, we define it as how business organizations manage their interaction with the natural environment to preserve and maintain the Earth's ecosystem. NC (and ecosystem service) approaches analyze in detail the benefits and services that the ecosystem provides, offering a fine grained understanding of nature. To date, limited volume of resource has focused on bridging the divide between organizations and the ecosystem both in theory and practice (Hahn et al., 2017; Small et al., 2022; Williams et al., 2021) termed the corporate-ecological disconnect (Ahlström et al., 2020). We depict each stage of the NC implementation process and the scales to be considered in CES, strengthening the connection between CES theory and practice without the supposition of wider transformational organizational change in terms of accounting practices. We do this using a hypothetical case of a water utility company to illustrate how multi-level NC approaches can advance CES practice.

Ecosystem services and NC are fundamentally intertwined (Potschin & Haines-Young, 2016). NC is the stock providing ecosystem functions and services: "ecosystem services are the benefits people derive from ecosystems; they are provided by natural capital in combination with built, social, and human capital" (Hernández-Blanco & Costanza, 2018, p. 261). Analyzing NC requires different techniques to analyzing the flows of benefits (ecosystem services) although they are but two sides of the same coin. For this reason, we research them together as one topic for analysis in line with Dickson et al. (2017) and van den Belt and Blake (2015).

Framing the environment in this way offers the potential to assign financial value which can be a part of NC and ecosystem service concepts. The environmental value agenda is extensively debated in relation to NC approaches alongside normative concepts of value (Bateman & Mace, 2020; Costanza et al., 2017; Gómez-Baggethun et al., 2010; Hernández-Blanco & Costanza, 2018). Metrics to account for NC are needed (van den Belt & Blake, 2015), but they do not need be financial (Costanza et al., 2017). NC approaches highlight the value of nature, which can be quantified and then monetized for disciplines that mandate monetary value metrics offering an important boundary concept for transdisciplinary collaboration (Steger et al., 2018). We seek to contribute to literature outside the accounting domain, studying the concept from a socio-ecological systems perspective for CES. Further information on NC accounting and financialization can be found in the corporate accounting literature (Bartelmus, 2009; Bebbington & Unerman, 2020; Cuckston, 2019; Rhodes et al., 2018; Schaltegger et al., 2017; Simnett & Huggins, 2015; Unerman et al., 2018). This paper plugs the gap in the literature discussing how NC approaches can be implemented to improve environmental awareness from a multi-level social-ecological systems perspective, without requiring transformational change to integrated accounting.

In what follows, we first lay down the conceptual foundations of this paper, introducing the concepts of planetary boundaries, multi-level theory for sustainability management, and NC approaches. We bring these concepts together as a multi-level NC implementation framework for CES and explain how it offers an improved understanding of the humanity–nature nexus at multiple scales. Finally, we discuss the implications for management scholarship and identify future research needs to advance CES with the preservation of Earth's life-support systems within planetary boundaries.

2 | CONCEPTUAL FOUNDATIONS

2.1 | Planetary boundaries—The global scale

Planetary boundary theory (Rockström et al., 2009; Steffen et al., 2015) articulates quantifiable and measurable targets to monitor the health of Earth's life-support systems. Rockström et al. (2009) identify nine planetary boundaries, with climate and biodiversity boundaries as core support systems that all other planetary boundaries relate to. While climate change has received attention in management literature, the biodiversity boundary relating to ecosystem services remains less studied (Hahn et al., 2017). Although planetary boundary theory is not without its critics (Brook et al., 2013; Nordhaus et al., 2012), it still provides the most widely accepted approach to understanding the condition of the Earth's life-support systems (Dempsey, 2015).

Whiteman et al. (2013) suggested the importance of a multi-level planetary boundary approach for CES at local, regional, and planetary scale, and Winn and Pogutz (2013) envisioned a new horizon for biodiversity, ecosystem services, and management literature by conceptualizing organizational ecosystem embeddedness. We build on this work by focusing on implementation of NC concepts at multiple levels specifically for CES literature.

2.2 | Multi-level approaches— Global to local

Multi-level approaches have been developed for over 40 years from a range of perspectives (Bronfenbrenner, 1979; Rousseau, 1985). Starik and Rands (1995) proposed a multi-level, multi-system theory for understanding ecological sustainability in organizations. Recent applications of the multi-level, multi-system concept at the mesolevel (organizations) include Aguilera et al. (2007), Williams et al. (2017), Williams et al. (2021), Wood (2010) and Hahn et al. (2015). Starik and Kanashiro (2013) advanced multi-level theory for sustainability management by proposing a multi-level, multi-system perspective of a proto-theory of sustainability management (Starik & Kanashiro, 2013) and multi-level theory for sustainability management more broadly (Starik & Kanashiro, 2020). We focus on the environmental component of this sustainability management proto-theory. Starik and Kanashiro (2013) highlight the importance of understanding the values of each level. Values are deeply held beliefs, assumptions, and desires that are often the basis for voluntary human action (Joyner & Payne, 2002). Understanding the values of actors (Whiteman & Cooper, 2000) and feedbacks at each level has a bearing on the stages of NC assessment as we will explain below.

A multi-level theory for sustainability management often includes macrolevel, mesolevel, and microlevel (Cavagnaro & Curiel, 2017), but other combinations are possible. For example, Aguilera et al. (2007)

developed their multi-level theory of social change in organizations at the individual, organizational, national, and transnational levels. We recognize that implementing NC approaches at these levels varies depending on the context and application. We use "level" to refer to the scale of human social organization: micro, meso, and macro; not the "level" of ambition or sophistication related to sustainability (Starik & Kanashiro, 2020). An example of the complexities of implementing multi-level sustainability management systems is offered by Arogyaswamy (2018) who proposed a time based multi-level measurement framework in the United States.

It is widely considered that multi-level analysis of CES offers great potential to move the literature forward (Hahn et al., 2017; Starik & Kanashiro, 2020), but further research on multi-level theories in corporate sustainability is needed. Aguinis and Glavas (2012) suggested that only nine of the 181 reviewed corporate responsibility papers explored organizational sustainability at multiple levels. Dyllick and Muff (2016) called this "the big disconnect", and Ahlström et al. (2020) noted the impact of activities at an organization level is not reflected in planetary level deterioration. Most often multi-level analysis considers the organization (meso) interacting with global institutions (macro) (Frynas & Stephens, 2015).

Starik and Kanashiro (2020) have suggested that multi-level sustainability theories better serve sustainable organizations by offering a holistic perspective on a complex problem and by building in redundancy—thus, a group or location may compensate for another across or within levels, creating the potential for positive influences and collaborations across and within levels. They suggest that there are both opportunities and challenges at all levels in implementation; implementation does not necessarily ensure sustainability but offers a series of probabilities that need to be planned, implemented, and evaluated and that can facilitate it (Starik & Kanashiro, 2020). This emphasizes the importance of developing our conceptual model for multi-level implementation, particularly in relation to the NC approaches, to facilitate positive collaborations and build in redundancies when managing the complex global ecosystem. Furthermore, the importance of planning and evaluation in implementation in multi-level sustainability theories can be missed when translating theory into practice, a gap we included in our conceptualization.

2.3 | Ecosystem services and natural capital

In the late 20th century, a stream of research framed the biosphere in terms of functions and services that relate to human well-being, termed ecosystem services (IPBES, 2017; MA, 2005). Central to the concept is that human well-being is dependent on benefits provided by ecosystems. There are four groups of ecosystem services: supporting services (services necessary for the production of all other services), provisioning services (products obtained from the ecosystem), regulating services (benefits obtained from regulation of ecosystem processes), and cultural services (non-material benefits obtained from the ecosystem). The ecosystem service concept considers nature as a socio-ecological system. It includes a temporal aspect, as it analyses the flows of services and their change over time. Ecosystem service literature has burgeoned over the past 30 years, generating a wealth of evidence on ecosystem dynamics at multiple scales and across multiple socio-ecological systems.

NC is the stock of nature's assets from which ecosystem services flow. There has been wide uptake of NC approaches in policy and corporate circles (Guerry et al., 2015). CES research in this a has focused on planetary boundaries and sustainable entrepreneurship (Schaltegger et al., 2018) and corporate reporting (Bjørn et al., 2017; Rhodes et al., 2018). Haffar and Searcy (2018) explore the relationship between the biospheric integrity boundary with company environmental target setting. D'Amato et al. (2018) examined NC approaches in organizations in Finland and China, including ecosystem service benefits of the forestry sector. The authors develop a framework assessing and responding to corporate impacts, dependencies, risk, and opportunities of ecosystem services. We add two new stages to D'Amato et al. (2018) framework: (1) a scoping stage to understand value, scale, and motivations and (2) a monitoring, evaluation, and reporting stage. These additions are informed by Addison et al. (2020) and the NC Protocol (see the Supporting Information for frameworks). None of these frameworks take a multi-level perspective: Thus, we advance both NC implementation and multi-level management literature.

NC approaches are an important contribution to CES, and it is crucial that we develop a multi-level NC implementation framework given it reframes the environment as non-substitutable or non-tradeable assets which are measurable at multiple levels. This conceptualization makes three contributions to CES literature. First, the reframing of the humanity–nature nexus provides an anthropocentric framework of the environment as non-substitutable assets which require preservation or enhancement. Second, it increases the visibility of environmental impacts and dependencies that underpin the organization. Finally, the methodological compatibility with accounting practices allows multi-level comparisons facilitating monitoring of progress. We next discuss how these advancements can be conceptualized to advance multi-level NC approach implementation for CES.

2.4 | Multi-level natural capital implementation framework

To link the literature on NC approaches with the literature in management science, we must recognize global environmental sustainability as a complex multi-level issue. Having outlined the core concepts above, we propose a framework (Figure 1) to synthesize and (1) advance the "how" of NC implementation in CES, (2) emphasize the scoping and monitoring phases in CES, (3) highlight natural resource dependency, and (4) advance multi-level environmental management theory.

This multi-level NC assessment framework aids better understanding of the humanity–nature nexus. By framing nature for the services it provides, and by understanding the humanity–nature nexus as a socio-ecological system, with temporal (including intergenerational) and spatial dimensions, we can advance both theory and practice. Our conceptual framework moves away from the input–through–output

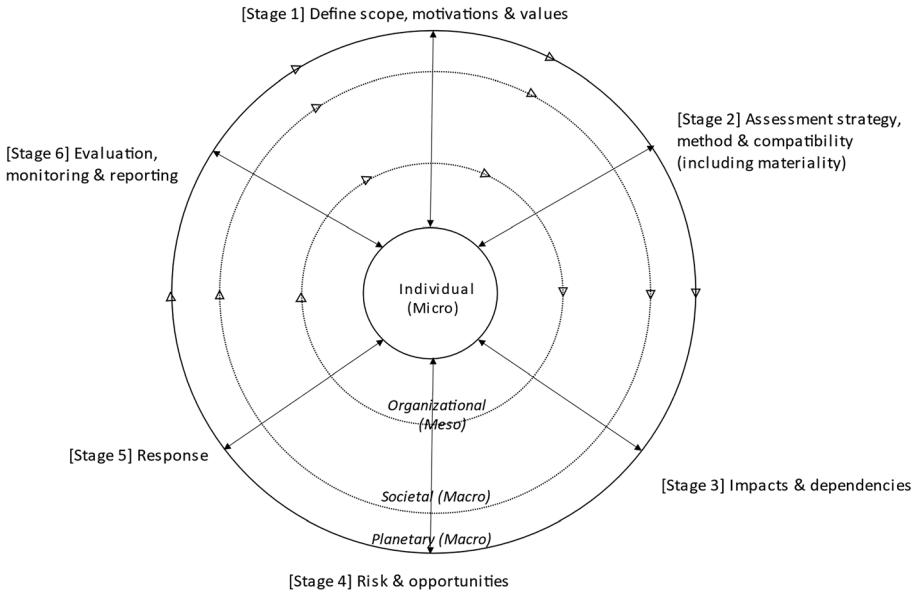

FIGURE 1 A multi-level natural capital implementation framework for corporate environmental sustainability (CES)

model which is embedded in the assessment stages (Stages 2–4) to broaden the focus on impacts, dependencies, risk and opportunities. There is a growing understanding of the finite nature of the planet that substituting NC is not possible and the opportunity costs of damaging NC now for future generations. By developing this framework, we contribute to bridging the divide between the organization and the ecosystem, through mapping out implementation of NC approaches across scales within the planetary boundaries. It is through this implementation framework that positive partnerships and resilience can be built in the complex organization–nature nexus currently missing in many CES approaches. Below we consider each stage and level of our conceptual framework in turn, bringing these concepts together in Table 4, a matrix of multi-level NC implementation framework considerations. We add depth to this conceptual framework by using a hypothetical water utility company in the developed world called Gaia Water, as an illustrative case study.

Gaia Water - an illustrative case study

Gaia Water is a hypothetical private water utility company based in a heavily regulated sector in the United Kingdom which is owned by three private equity investors. As an organization, they have a physical footprint, owning land both for water storage, distribution, and treatment. The organization has a good relationship with their environmental regulator, and its environmental performance is satisfactory. The organization has never adopted NC approaches before nor understood in detail the organizational relationship with the environment. For Gaia Water, the purpose of undertaking the NC assessment is to improve their understanding of their relationship with the environment, to manage risks and to meet emerging regulatory requirements. Information from the assessment will be used in their annual corporate report as well as to inform future investment decisions.

3 | STAGES OF IMPLEMENTATION

3.1 | Stage 1—Define scope, motivations, and values

The first stage of implementing a NC approach can often be omitted in theory and practice (e.g., in D'Amato et al., 2018). As noted by Starik and Kanashiro (2020), understanding the values of the human organization and planning the scope of any assessment are crucial. It is important to define why the NC approach is adopted (the motivations), how doing so aligns with previous work, and the values at mesolevel, microlevel, and macrolevel. Defining scope is important, that is, what are the boundaries of the work? Does the approach analyze direct operations or the whole supply chain? Is it a trial exercise on a specific product to be scaled up in the future? These scoping issues are important to understand from a multi-level perspective. Furthermore, this stage "closes the loop" using feedback and knowledge from previous environmental or NC work undertaken in the business or Stage 6 to continuously build and inform action.

At Stage 1, Gaia Water establishes the motivation for undertaking the initiative, with personal commitments (individual—microlevel) and statements from both board members and change agents across the organization communicating why it is important to the business and its investors. A scoping document positions the company commitments within national and global commitments on nature and NC, such as the UK national NC accounts, as well as positions organizational ambitions to the context of planetary boundaries and sustainable development goals. Stage 1 states how organizational commitments both align and stand apart from their investors commitments on NC (macrolevel compatibility), as well as regulatory requirements (mesolevel compatibility).

This scoping document also establishes the NC approach in the context of the physical geography, socio-economic context, details the governance structure, and identifies the areas of the business which are particularly material to NC assessment. Once the

organizational context is mapped, the scope of the NC approach can be detailed: That is, whether a section of the business such as water distribution or specific site is the focus of the first NC assessment, or whether an organization-wide assessment is undertaken. This is then complemented by scoping the supply chain: That is, are the assessments to take place only on the direct operations of the business, or up and down the supply chain? Gaia Water decided to focus on direct operations and for the purposes of the (NC) assessment divide the business into land holdings and business operations. Establishing the scope of the assessment builds in robustness and transparency to the NC approach and provides a strong base to build partnerships, resilience, and clarity to the organization–nature nexus.

3.2 | Stage 2—Assessment strategy and method

The second stage of implementation focuses on the assessment strategy and method. The strategy is influenced by the level and type of decision that the assessment is looking to influence: Is it an individual, project, organizational, or societal decision? What level of detail is required to inform the decision? NC assessments can be quantitative, qualitative or a combination of the two, and may or may not include monetary values. These factors should be considered individually and then across levels to facilitate knowledge sharing, partnership building and action. The skills, capacity, and data at all levels form the basis of the strategy and inform method selection, so work builds on existing environmental data, knowledge, and action. There are many methods and tools to implement NC approaches. These allow for context and sector specificity in NC assessment when the correct methodology is selected for the correct case. A review of different tools and methods is required in Stage 2, to record and justify the method adopted.

At Stage 2, a materiality assessment analyzes the full suite of NC impacts *and* dependencies for relevance and proportionality to the organization, whether that is at a microlevel, mesolevel, or macrolevel. This materiality assessment further defines the boundaries and meaningful issues across the levels (e.g., micro, meso, and macro) and across the supply chain. It is important that the materiality assessment is transparent and published alongside the NC assessments to understand what has been omitted in one assessment which may need to be incorporated in another NC assessment (particularly across levels).

At Stage 2, Gaia Water reviews available NC tools and chooses their environmental regulator's freely available NC assessment tool (N-CRAT), to facilitate working with the regulator (partnership working at the mesolevel). A materiality assessment is undertaken and the relevant NC assets are identified. As part of the materiality assessment, relevant stakeholders are identified and opportunities for partnership working are built. For Gaia Water, local farmers and land owners are identified as part of the farmer co-operative within the water utility catchment areas and wildlife groups with an interest in the NC work.

This materiality assessment and the tool selection are recorded in the NC strategy document that describes the method that will be adopted and the material elements of the business when considering NC. As this is the first time Gaia Water have undertaken a NC assessment they choose, will gather both quantitative and qualitative information and, only if possible, assign financial value.

3.3 | Stage 3—Impacts and dependencies

The third stage appraises the NC impacts and dependencies at relevant level of analysis. Bateman and Mace (2020) suggest a NC assessment framework for sustainably efficient and equitable decision making. It is a clear, comprehensive, and transparent framework for considering the NC impacts and dependencies at any level, embedding the input–process–output chain, with considerations of other forms of capital and opportunity costs to future generations NC. Like Starik and Kanashiro (2013), we believe the linear model of inputs–processes–outputs is an important part of analysis. However, literature has advanced to frame the humanity–nature nexus as including impacts (both positive and negative) and dependencies, embedding the inputs–processes–outputs chain within this assessment (Figure 1, Stages 2 and 3). Furthermore, a time factor is part of Stage 3 as the NC assessment considers before and after a potential change. This temporal factor has often been omitted in implementation theories. Bateman and Mace (2020) note that the decision to deplete NC is a tradeoff with future generation's use of that NC (see also Hahn et al., 2010; Slawinski & Bansal, 2015). This intergenerational consideration offers an advancement, embedding temporal considerations in CES.

Gaia Water identified the following ES impacts and dependencies in the operation of the business as well as the management of their land holdings.

By undertaking Stage 3, Gaia Water learns about the impacts and dependencies of the business operation on the ecosystem and also where those services are located, what is the current condition of those ecosystems, and which sections of the business impact or rely on which services. The granularity of this information highlights to decision makers across the business the connections between business success and health of the ecosystem, for example, soil erosion rate at nearby farms affecting surface water quality. At the end of Stage 3, Gaia Water has a better understanding of the impacts and dependencies of the business with the ecosystem.

3.4 | Stage 4—Risks and opportunities

Stage 4 involves reviewing the risks and opportunities, in the form a NC risk and opportunities register, to understand at which level the risks and opportunities lie. Applying a multi-level NC appraisal framework allows the consideration of whether the risks and opportunities are borne at the same or different levels as the impacts and dependencies. This provides greater clarity at each stage (e.g. Stages 3 and 4) and a more holistic appraisal of the NC risks and opportunities. Second, *opportunities* may arise from NC impacts and dependencies. There may be positive outcomes by building partnerships to manage

common goods within or across levels. There may be a better understanding of the embeddedness of humanity within nature or better appreciation of the opportunity costs for future generations. Opportunities for by-product re-use in the supply chain may emerge or economies of scale with other sectoral partners may reduce negative impacts. Finally, assessment of the NC risks and opportunities involve a time factor. Future generations are considered in the risks and opportunities that may be present for each NC stock at microlevel, mesolevel, and macrolevel. This intergenerational sustainability consideration further advances both CES theory and practice.

Gaia Water has gathered data for each of the ES relevant to business operations highlighted in Table 1. The data include both quantitative data (e.g., on climate regulation, flood and storm protection, GHG emissions, and pollution control), as well as qualitative data (e.g., on recreation). Gaia Water reviews these ES for the risks and opportunities they pose to it. The opportunities are clear as a water utility, improving water pollution, flood, and storm protection; climate regulation will all contribute to improved service to their customers and improved reputation with regulators and broader, an improved health of the environment. By undertaking this NC assessment, the organization obtains quantitative data which can be shared with stakeholders and investors to evidence their environmental value across levels, as well as qualitative data, for example, on the recreational and aesthetic value of Gaia Water's land holdings to surrounding communities. Climate regulation, flood and storm protection, mass stabilization, and erosion control are services that benefit the company (Table 2). The organization depends on each of these environmental services for the continuation of the business and takes action (such as implementing nature-based solutions for flood mitigation within catchments) to mitigate or contribute to improving the health of each of these environmental services. The opportunities that the improved environmental performance of Gaia Water could contribute to include improved recreational and aesthetic value of land as well as water quality within catchments.

TABLE 1 Natural capital impacts and dependencies of Gaia Water

Dependencies	Impacts
Water quality (ground and surface water)	GHG emissions (production and transportation)
Climate regulation	Non-GHG emissions (production and transportation)
Flood and storm protection	Water pollution
Mass stabilization and erosion control	Soil pollution
	Disturbances (e.g., noise and light)

TABLE 2 Natural capital risks and opportunities for Gaia Water

Risks	Opportunities
Climate regulation	Recreation
Flood and storm protection	Water quality
Mass stabilization and erosion control	Aesthetic and improved landscape value

3.5 | Stage 5—Response

Stage 5 identifies the appropriate response to the findings generated in Stages 2–4. The response is the decision that an individual, organization, or society makes to take action. Any response is informed by the opportunity costs that decisions and actions incur, for other levels and parties and intergenerationally. For example, Gaia Water could decide to take part in a watershed-level partnership to improve water quality and supply in its catchments. Our framework provides clarity that helps to ensure that the response is at an appropriate scale in relation to the impacts, dependencies, risks, and opportunities identified in the earlier stages of the NC appraisal (see Figure 1). This can facilitate sectoral or regional stakeholder partnerships to address NC issues. Responses may also include peer-to-peer initiatives to scale-up responses to NC degradation. Finally, it is important to reflect on the planned actions, to analyze any capital substitutions that have been assumed in the response. These capital substitutions may then be either reversed or trigger future actions to mitigate these substitutions. For example, Gaia Water identified nitrate pollution and water supply as crucial risk and dependencies to their business, as well as greenhouse gas emissions (impacts) driving their customer legitimacy to operate. Nitrate pollution is often localized but can severely impact Gaia Water's ability to supply water (see Table 3).

3.6 | Stage 6—Monitoring, evaluating, and reporting

Stage 6 considers whether the response has been successful and feeds back to the next iteration of the NC approach. If response has not achieved its aim, an explanation is sought for why this has happened? A second component of Stage 6 is to report on the NC approach to external parties. Information may be shared across levels, such as organizational accounts being shared with national accounts, or at the individual level, for example, with employees or stakeholders. NC approaches may also form part of the corporate reporting process.

Gaia Water produces an annual report each year and is subject to assurance from their investors. The data gathered through the NC assessment are used in the corporate report to evidence how they are managing their relationship with nature. Once Stage 5 actions are implemented, a process of monitoring (particularly for intervention to control nitrate pollution) is implemented over a 2-year program to ascertain whether the interventions are successful. The board members have committed to undertaking a NC assessment as a minimum every 2 years with the aim of moving to yearly assessment. As a consequence, relationships with regulators have improved as they are provided with greater assurance and evidence on the company's environmental performance. Similarly, national and international partnerships improve awareness of emerging policies and targets which

TABLE 3 Natural capital risks and dependencies for Gaia Water

Ecosystem services	Micro	Meso	Macro
Risk—water pollution (nitrate)	Recruit an employee to lead a nitrate water quality campaign within the business.	Cross-sector working seeking nature-based solutions for removing nitrate pollution at source. Work with local farmers to educate alternative farming practices such as cover crops to reduce nitrate leachate.	Share data at national and international scale on water quality practices.
Dependency—water supply	Employee awareness to encourage every employee to promote sustainable water use across the business.	Partnership working with large water users in catchments incentivizing water efficiency schemes.	Working with research organizations share knowledge and data on rainfall, water use in area and improve forecasting.
Impact—greenhouse gas emissions	Assign board level responsibility (an individual) to be responsible for achieving GHG and carbon sequestration targets.	Cross-sector working with other utility provider and stakeholders to establish nature-based solutions contributing to carbon emission reductions. Work with national regulators to contribute to learning and data collation.	Feed into national and international data gathering initiatives. Work with thought leaders to better understanding GHG in the utility sector.

allows the Gaia Water board to be more comfortable with the future direction and sustainability of the business.

Next, we focus on explaining in greater detail the microlevel, mesolevel, and macrolevel of our NC framework.

3.7 | INDIVIDUAL (MICRO)

At the microlevel, individuals play a range of roles in the human organization–nature nexus. They may be consumers, employees, stakeholders, shareholders, or citizens to mention but a few. We focus on individuals as members of an organization: as an employee, manager, shareholder, volunteer, or non-executive board member. NC approaches often originate from an individual such as a sustainability manager, the CEO, or a passionate change agent. An individual may initiate a microlevel, mesolevel, or macrolevel assessment (Figure 1) and influence the success or speed of change. Given the transformation ought, change agents can play a crucial role in implementation (Benn et al., 2014) by bringing energy, drive, and knowledge to an organization in relation to NC. Harnessing the power of individuals to embed NC approaches in organization is crucial to successful implementation at all stage and scales. At Gaia Water, a board member (microlevel) is particularly interested in accounting for nature having had a conversation with an investor at a networking event and sees the NC account as her "pet project." Therefore, at each stage in the implementation process, she is keen to hear and report to her fellow board members on progress. This senior level engagement facilitates implementation and action within the business to deliver on the initiative.

3.8 | ORGANIZATION (MESO)

The mesolevel focuses on an organization, a region or, potentially, a nation. At the mesolevel, a company or government may commit to integrated reporting or multi-capital monitoring, where NC is monitored and reported alongside other forms of capital. Alternatively, the mesolevel can relate to reporting on regulatory requirements or local stakeholder expectations on environmental performance. While we have chosen to focus the mesolevel at an organization, and the macrolevel at the societal level, our framework is flexible so that the mesolevel could be the national accounts and the macrolevel a supranational organization. This is why Stages 1 and 2 of our conceptual framework are vital to delineate the levels, boundaries, and interactions in each context. The constant in our conceptual framework is that every application is bounded by and considered within planetary boundaries. Gaia Water uses the assessment to both build trust with their national regulators and customers to enhance its reputation on environmental performance.

3.9 | SOCIETAL AND PLANETARY (MACRO)

We have divided the macrolevel into societal—the human organization at national and international levels and planetary—the finite cap of this conceptual multi-level framework. Societal institutions seek to manage human interactions with public goods and services but to date the macrolevel has not been managed well, hence the unprecedented rate of biodiversity decline. International initiatives such as the Convention on Biological Diversity (CBD), the UN Sustainable Development Goals (SDGs), the United Nations (UN) Framework Convention on Climate Change (UNFCCC), and the UN Convention to Combat Desertification all aim to tackle the decline in NC (Banerjee et al., 2020). Much work is done by governing bodies to develop national and supranational NC assessments (a summary of the current progress is provided in Hein et al. (2020)).

Many countries have already undertaken national NC assessments which feed into policy, although this is still often disjointed. The regulator for Gaia Water will mandate in 2 years time that all

TABLE 4 Multi-level natural capital implementation framework considerations by stage and level

Stage	Level		
	Micro	Meso	Macro
1. Scope	- Identify individual/leadership values and motivations and how this will shape the subsequent stages. - Plan the scope of natural capital (NC) assessment to be undertaken and justify. - Understand connection to other levels of analysis.	- Identify organizational values and motivations and how this will shape the subsequent stages. - Plan the level of NC assessment to be undertaken and justify. - Understand how this will feed into other levels of analysis.	- Understand regulatory and socio-political influences of assessment (if necessary, across geographies). - Plan the level of NC assessment to be undertaken and connect to planetary boundaries.
2. Assessment strategy	- Delineate boundaries across levels, geographies, and supply chain. - Analyze individual knowledge and resource capabilities. - Identify, engage, and support change agents.	- Delineate boundaries across levels, geographies, and supply chain. - Establish and justify natural capital method to be used, ensuring compatibility with microlevel/macrolevel assessments. - Develop an assessment strategy to common goods and services and record. - Analyze individual knowledge and resource capabilities. - Identify engage and support change agents.	- Delineate boundaries across levels, geographies, and supply chain. - Global/national collaborative assessment strategies. Produce guidance on methodologies and compatibility guidelines including information on common goods and services.
3. Impacts and dependencies	- Conduct a balanced assessment ensuring a clear understanding of the individual/employee level dependence on NC, for example, food and fresh water.	- Transparent assessment of the positive/negative impacts and dependencies of "common" goods and services. - Consideration of the feedbacks/interrelationships both within levels and across of each NC asset impacts and dependencies.	- Transparent assessment of the positive/negative impacts and dependencies of "common" goods and services. - Consideration of the feedbacks/interrelationships both within levels and across of each NC asset impacts and dependencies.
4. Risk and opportunities	- Consideration and positive framing of opportunities in sustainable accounting in NC. - Multi-level risk analysis identifying where risks lie both within levels and across.	- Consideration and positive framing of opportunities in sustainable accounting in NC. - Multi-level risk analysis identifying where risks lie both within levels.	- Consideration and positive framing of opportunities in sustainable accounting in NC. - Multi-level risk analysis identifying where risks lie both within levels
5. Response	- Reflection on Stages 3 and 4 leading to a decision on appropriate action within and across scales.	- Reflection on Stages 3 and 4 leading to a decision on appropriate action within and across scales.	- Reflection on Stages 3 and 4 leading to a decision on appropriate action within and across scales.
6. Evaluating, monitoring, and reporting	- Individual evaluation of leaning outcomes and reflection following NC assessment, including changed values and behaviors. - Consideration of how evaluation of success and monitoring is compatible with mesoscale and macroscale monitoring. - Evaluation of outcomes of Stages 1–6 and feedbacks and implication for the next iteration of implementation process.	- Consideration of how evaluation of success and monitoring is compatible with microscale and macroscale monitoring. - Evaluation of outcomes of Stages 1–6 and feedbacks and implication for the next iteration of implementation process.	Consideration of how evaluation of success and monitoring is compatible with microscale and mesoscale monitoring. - Evaluation of outcomes of Stages 1–6 and feedbacks and implication for the next iteration of implementation process.

water companies should report their NC accounts annually. This sectoral information can then be used to feed into the national and global accounts. This national to global scale accounting is still in development. The UN has led on the System of National Accounts (SNA) which has recently been superseded by the System of Environmental Economic Accounting (SEEA), with an aim to produce a UN

standard by the end of 2021 (Hein et al., 2020; La Notte et al., 2019). These macrolevel assessments further advance use and understanding of NC approaches. However, it is important to consider the multiple levels of NC assessments in order to start to understand how each level and assessment may inform the planetary scale.

We bring these stages and levels together in Table 4 to illustrate how the implementation framework facilitates the consideration of cumulative multi-level issues and interactions that occur at each stage and level.

4 | DISCUSSION

The multi-level NC implementation framework outlined above improves understanding of the humanity–nature nexus in four ways. First, it advances "how" to apply NC approaches in corporate environmental scholarship, a gap identified in Whiteman et al. (2013) and Ahlström et al. (2020). Second, the framework includes scoping and monitoring stages which responds to a deficiency in previous frameworks (Starik & Kanashiro, 2020). These stages—scoping and monitoring facilitate iterative improvements in implementation—close the process loop. Third, the framework advances our understanding of humanity's natural resource dependencies and associated risks (Figge & Hahn, 2020; Tashman, 2021). Finally, we advance work on multi-level CES as suggested by Starik and Kanashiro (2020) and Williams et al. (2021) by adding granularity to the links across the humanity–nature nexus within planetary boundaries. We expand on each of these below.

4.1 | Implementation framework for multi-level NC

Our framework offers practical insights for implementing NC in CES, advancing the literature on cumulative environmental impacts over time. To date, the CES literature has not sufficiently discussed how to apply theory (Whiteman et al., 2013), particularly NC approaches (van den Belt & Blake, 2015). Given that the UN, World Bank, and IPBES are monitoring the Earth Systems using NC approaches, it is important that businesses and management scholars also help to improve understanding of their implementation. The framework we propose for implementing NC approach also responds to the literature calling for greater embedding of temporal factors into decision making in two ways (Slawinski & Bansal, 2015). First, our framework considers opportunity costs to future generations by assessing the impact of depleting the stock of NC available for future use, and second, monitoring (Stage 6) includes an appraisal of the outcomes of implementation, reviewing changes of the NC stock over time.

In addition, our framework identifies boundaries across levels, reducing the likelihood of double counting, and decreasing the likelihood of omissions from assessments, a risk noted in multi-tier assessments literature (e.g., Banerjee et al., 2020). Acknowledging that mesolevel and microlevel NC assessments are embedded within macrolevel assessment (Figure 1) improves our understanding of the nature of each assessment. Macro (societal) NC assessments monitor the state of the environment independently of the mesolevel and microlevel. This gives rigor to the implementation of multi-level NC assessments, highlighting where specific NC assets are declining, and informs mesolevel and microlevel assessments. Thus, cumulative effects and potential feedbacks of microlevel and mesolevel NC assessment can be better understood. Furthermore, where organizations operate at an international or transnational level, macrolevel analysis may highlight spatial inequalities in the operation of organizations and supply chains. Macrolevel NC assessments are vital as a "check" to monitor the health of larger NC stocks. Figure 1 contributes to this literature (e.g., Haffar & Searcy, 2018) by highlighting how cumulative impacts of multiple NC assessment at multiple levels should be considered.

4.2 | Scoping and monitoring

Our framework advances previous conceptual models by including scoping and monitoring stages. Including a scoping stage in our framework advances work on values, motivations, and complexity of NC for CES. First, establishing values and motivations at the individual, organization, and societal levels provides transparency and frames why the NC approach is important to the relevant actor. Values, deeply held beliefs and assumptions, are important to understand in designing effective action. Our framework allows for a deeper understanding of values at all levels, particularly the microlevel. Placing microlevel (individual) values at the center of the human organizing framework emphasizes that individuals drive values at all levels (meso and macro) aligning with arguments from Whiteman and Cooper (2000).

One of the challenges with NC frameworks in the corporate context is the complexity of impacts and dependencies across multiple scales and throughout the supply chain (standardized in Figure 1). Including a scoping stage improves the transparency of assessments and implicit assumptions and also enables assessments to be undertaken at a scale appropriate to the decision the assessment needs to inform. Defining terms and how these relate to the specific assessment context illustrates a depth of understanding and facilitates partnerships across levels and sectors. These definitions enable greater comparability between sectors, levels, or context and improve the relevance of an assessment to informing policy and decision-making practices at all levels.

Unprecedented rates of environmental decline are in part due to poor evaluation and monitoring (Dyllick & Muff, 2016). Monitoring the NC stock following an action identifies whether the action was a success. This stage is essential to gather data to feed back into the next iteration of a NC appraisal but is often poorly conducted or omitted entirely. One example is that of the widely used industry standard, the Natural Capital Protocol, where implementation at the organizational level is detailed but monitoring, reporting and evaluating is not included (Natural Capital Coalition, 2016). Stage 6 of our framework (NC reporting, monitoring and evaluation) has been omitted in

previous frameworks, being perhaps considered too complex or "someone-else's problem," for example, national or international governance agencies should manage the global commons. However, the multi-level framework makes it clear that each level has a role in monitoring and evaluating NC, not least to monitor and evaluate the consequences of actions taken. Introducing Stage 6 advances previous conceptualizations by closing the process loop. For example, a fashion business may depend upon rainfall to irrigate crops that form the primary resources of the textile supply chain. Rainfall frequency and intensity is changing due to climate change. Monitoring changes in fresh water availability (from a previous NC assessment) can inform whether to broaden the scope of the next iteration of this company's NC assessment to understand the catchment-wide NC impact, dependencies, risks, and opportunities of freshwater.

4.3 | Highlighting natural resource dependencies

Dependencies of the individual, organization, and society on nature have remained less well researched (Figge & Hahn, 2020). The dependencies that describe how the environment underpins business practice, not only directly but also indirectly by sustaining the workforce, for example, food or fresh water, have often been omitted entirely and are not well understood (La Notte et al., 2019). Our framework includes the assessment of dependencies as a stage in its own right, at microlevel, mesolevel, and macrolevel. This speaks to literature on natural resource dependency perspectives (Tashman, 2021) by providing a framework to analyze humanity's dependency on nature at multiple levels.

4.4 | Multi-level implementation within planetary boundaries

Our framework also advances literature by providing a way to implement NC approaches in a way that respects planetary boundaries. NC impacts and dependencies may occur at multiple levels, which has created complexity and confusion in implementation to date (Banerjee et al., 2020). Figure 1 and Table 4 provide the means to understand these multi-level impacts and dependencies. Furthermore, the NC impacts and dependencies may not arise at the same level: For example, a mesolevel may have macrolevel—planetary—impacts and dependencies.

By providing a standard structure to analyze multi-level issues, it is possible to build a cumulative picture both of multiple assessments within one level (e.g., all organizational impacts: mesolevel) and across levels (between micro, meso, and macro). Planetary boundaries form the limits within which all NC assessments are undertaken. While further research is required to address practical implementation challenges (see Mace et al., 2014), our framework provides a multi-level framework to advance this discourse. Furthermore, emphasizing that humanity comprises, and is part of, nature speaks to previous literature on organizational ecosystem embeddedness (Winn & Pogutz, 2013) and to the dependency of humanity on nature discussed in socio-ecological system literature (Ostrom, 2009; Pogutz & Winn, 2016).

5 | CHALLENGES

While we suggest that multi-level implementation of NC approaches in CES scholarship improves our understanding of the humanity–nature nexus, we also recognize there are practical challenges to implementation. The fuzziness of boundaries is a challenge because implementation of multi-level theory for the humanity–nature nexus within planetary boundaries implies an infinite number of possible connections. For this reason, a theoretical framework must be flexible enough to recognize the context for each application. Like Starik and Kanashiro (2020), we have chosen micro, meso, and macro to allow flexibility in application. For example, a supranational organization such as Nestlé or Unilever (both of whom use NC approaches) can transcend regional, or even national, (meso) level assessments. For this reason, Figure 1 is ultimately bounded at the macroscale by the planetary boundaries as the finite limit for all NC approaches. Thus, the supranational organization (mesolevel) may operate across much larger spatial scales than national NC accounts. To facilitate cross-level compatibility, supranational NC assessments should consider how they can inform and be informed by national and planetary level accounts in both Stages 1 and 2.

Second, and as discussed above, many methods and tools exist for implementation of NC approaches (Guerry et al., 2015). These allow for context and sector specificity but challenge multi-level approaches, as different methodologies may be incompatible across levels. This challenge has been recognized at the macrolevel and mesolevel with national and international standard development (e.g., BS 8632 and EU INCA project). This should facilitate multi-level method compatibility and advance CES in future.

6 | CONCLUSIONS AND FURTHER RESEARCH

Global environmental sustainability is a complex, multi-national, multi-system, and multi-level issue. CES scholarship seeks to address this complexity within the study of organizations, but the endeavor is still disconnected from the effect of humanity on nature. Our aim through the multi-level framework is to reiterate that the decline of nature is ultimately the decline of humanity. Multi-level NC approaches offer an opportunity to address this disconnect. Successful use of NC concepts could transform CES practice by advancing discussion of "how" to implement NC approaches in CES, emphasizing scoping and monitoring phases, improving awareness of natural resource dependencies, and advancing multi-level environmental management theory for NC. There are limitations to this conceptualization, including the focus on a multi-level implementation framework rather than a multi-system implementation framework. We acknowledge that the idea of nested

systems analysis suggests some value in another level of complexity to our multi-level systems analysis.

Similarly, at each stage, we noted the importance of the compatibility between NC methodologies deployed for different purposes. Much work needs to be done to ensure compatibility between assessments at different levels and geographies. Transdisciplinary research connecting planetary boundary data from natural and social sciences, with national capital accounts and supranational corporate accounts, is particularly important. Further research is needed to expand and explore this emerging area of CES scholarship. The multi-level implementation framework draws upon sustainability management theory, and while we have focused on environment, an integrated approach broadening the scope to include social elements (including governance) is beneficial. Furthermore, research exploring a specific NC asset, for example, timber production from source to the return to the biosphere across levels, could offer focused insight into the humanity–nature nexus. Such research could follow the flow of benefits and services through the Earth's systems, studying the human interactions throughout. Insights from this analysis could both inform knowledge of the health of an ecosystem and identify potential risks in supply chains and would therefore continue to enhance scholarship on the implementation of CES.

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