

Accounting in the Anthropocene: a roadmap for stewardship

Jan Bebbington and Andy Rubin¹

Abstract

Keywords: Anthropocene; Environmental Accounting; Stewardship; Socio-ecological Accounting

¹ The authors are, respectively, Professor of Sustainability in Business at Lancaster University and Deputy Chair Pentland Brands. Correspondence should be addressed to Jan Bebbington at j.bebbington1@lancaster.ac.uk.

Accounting in the Anthropocene: a roadmap for stewardship

1. Introduction

This paper seeks to connect the notion that we are living in the Anthropocene to the practice of accounting. In brief, the Anthropocene is a term used to describe the current state of the planet and highlights the increasingly dominant effects that human activities have on the nature and functioning of earth system processes (for example, in terms of climate change and biodiversity loss). The material in the paper was developed for the Institute of Chartered Accountants of England and Wales, 2021 PD Leake lecture where we asked: how does people changing the planet, change accounting? The paper focuses on the practice of accountants in the Anthropocene and developing a roadmap for stewardship. We offer a wide-ranging discussion and provide illustrative (rather than exhaustive) examples of changing practices being used. We do not articulate a settled view of how to integrate the Anthropocene with accounting. Developing a sense of what is required to address the challenging, multi-dimensional and fast-moving environmental change is a wicked problem (Bebbington and Larrinaga, 2014) which requires informed conversations within the academy, in the world of business and accountancy, as well as between scholars and practitioners.

The paper is made up of three elements, each of which is part of a roadmap to stewardship and which together, we believe, will aid understanding of how the accounting craft could be fit for purpose in the Anthropocene epoch. The first element (Section 2) articulates the nature of the challenge that faces humanity in the Anthropocene which, as will be apparent, is not merely a new name for familiar environmental challenges but a more fundamental conceptualisation of how the combined scope and scale of environmental change creates a different ‘operating space’ for humanity (Rockström et al. 2009). It is in this context that we hope to enable organisations to enact stewardship. The second element (Section 3) of the

paper articulates the way in which organisations are connected to the Anthropocene both in a physical sense (through mobilising resources and producing pollution) as well as through how these impacts are mediated by institutions' reactions to these material risks (Bebbington and Larrinaga, in press), including changes to corporate governance. Two sub-themes are developed in this context, with the first considering how corporate purpose is being revisited. Second, the paper outlines how novel coalitions are developing between companies as they seek to make sense of, and respond to, Anthropocene concerns and may become corporate biosphere stewards (Folke et al. 2019). Section 4 turns to focus more closely on accounting concerns and considers the changing face of governance in the 21st century and how spatial sensibilities might inform accounting practice. Both of these aspects speak to possibilities for accounting to support biosphere stewardship. Before moving to the substantive sections, some points on how we conceive of the nature and functioning of accounting is necessary. In an idealised sense, accounting is an activity that seeks to provide information to inform organisational decision making as well as provide information to support discharge of accountability to those who have rights to information about organisational performance.¹ These functions are, most usually, exercised by those who own, manage or otherwise have an interest in organisations and their various impacts (especially in the form of externalities – see Unerman et al. 2018). In addition, governance systems (including, but not reducible to corporate focused governance) shape the actions of both organisations and their economic stakeholders and introduce social, economic and (critical for this paper) environmental dimensions of responsibility. In turn, these additional responsibilities require accounting systems to support decision making/organisational control/performance reporting. Taking a

¹ The complexity and nuance of how accounting, auditing and reporting achieve these outcomes is considerable and beyond the scope of this paper. Any serious engagement with Anthropocene thinking, however, will encompass a myriad of very specific considerations that would infuse all aspects of accounting practices.

more expansive view, accounting is also intimately inter-twined with the functionality of economic systems (Miller and Power, 2013) and, if operating effectively, underpins the stability of these systems. Economic stability is predicated on ecological systems functionality, with this reliance increasingly being salient as environmental conditions change.

Accounting, therefore, is made up of many technical aspects that drive organisational actions as well as providing the basis to communicate information about organisations. Accounting provides a bridge (primarily mediated through the provision of information) between: organisations who are in some kind of relationship with each other; organisations and institutions who govern organisational activities; and organisations and society in a broad sense. None of these aspirations change if we are living in the Anthropocene. What does change, however, is the context in which economic activity is played out, the role of organisations in responding to socio-ecological (cf. social and environmental) challenges and the underpinning contribution of accounting in that context.

2. Characterising the Anthropocene

This is not the first paper to explore accounting and Anthropocene connections and is a companion piece to Bebbington et al. (2020). The earlier paper contains more detail as to how epochs are scientifically determined, including: the rules that are used in order to recognize the Anthropocene, when its start date might be determined (and implications of those choices) as well as the variety of 'alternative' descriptions that problematise the term itself. At the time of writing the 2020 paper, the Anthropocene had not been formally recognised by the International Commission on Stratigraphy and it still has not been. What has happened since the earlier paper, however, is that the sub-committee charged with considering the Anthropocene has indicated that they believe that it should be recognized.

Regardless of the degree of formality ascribed to it, the idea of the Anthropocene continues to influence a wide array of scholarship and popular thought.

The Anthropocene is a term used by stratigraphers, who seek to describe the history of the Earth and divide it into time periods, each of which reflect a particular combination of biological, chemical and geological functioning (Davies, 2016; Lewis and Maslin, 2015 provide accessible outlines of this process). Critical for our purposes is that the Anthropocene is characterised as a time where human activities drive global environmental change through changing biological-chemical-geological assemblages. This is not to suggest that natural forces (such as volcanic activity) do not affect the earth system as a whole. Rather, the significance of the Anthropocene is that human activity has been identified as impacting Earth systems function on a global scale, alongside more local impacts that human societies have had in the past. Moreover, the reason why scientific and policy communities are concerned about entering the Anthropocene is that the nature of Earth system functioning may change in ways that will affect the ability of human populations to meet their various needs given the “two-way interactions between humans and the rest of the natural world ... [and the] sense of a current or imminent fundamental shift in the functioning of our planet as a whole” (Malhi, 2017, p. 79, see also Folke et al. 2021).

Given the centrality of organisations in providing goods and services that underpin human needs, Bebbington et al. (2020) proposed that accounting scholars need to conceptualise organisations as ecological *and* economic entities with their activities being placed within a socio-ecological system framing. In addition, they provided some indications of how accounting research might change if that were recognized, namely that: novel research objects and samples might emerge (reflecting ecological impacts of cohorts of companies), inter- and trans-disciplinary studies will be required, and that stewardship might be redefined as a new normative ideal for organisations in the Anthropocene. The role of organisations in

biosphere governance/stewardship is predicated on the hypothesis that a relatively small number of large (most often transnational corporations) have a significant effect on the earth system and that, in combination, these companies could be mobilised to act in areas where formal inter-governmental governance is difficult to achieve (see also Österblom et al. 2022a).

These ideas, as well as the idea of the Anthropocene itself, challenge social science norms. In particular, environmental change has not (to a large extent) been foregrounded in considerations of what ‘matters’ across social science disciplines (Hamilton et al. 2015; Howard-Grenville and Lahneman, 2021) with environmental concerns being seen as salient to some political groups but not to the mainstream of economic and social thought. This has been mirrored within the accounting discipline where environmental concerns have been examined within the social/environmental/sustainability accounting sub-field for approximately the last 30 years (Bebbington et al. 2021c) but have only recently attracted attention in more ‘mainstream’ accounting journals. The Anthropocene changes this presumption, with Horn and Bergthaller (2020, p. 5) describing this as “epochal consciousness ... [where nature concerns are] not just one political issue among others but deal with the very foundations on which any political community can exist”. We argue that the foundational role of the environment in organisational operations also needs to be recognised more formally, and hence Anthropocene thinking is salient for all areas of accounting research.

At the same time, it is one thing to say that organisations are embedded in social and environmental systems (something that is self-evidently the case) and another to be able to describe and/or characterise the nature of that embeddedness, how this affects organisational activities and how accounting can address this changed conception. Living in the Anthropocene means that “the environment is not something outside of the economy or

society, or a driver to be accounted for when preferred, but rather the very foundation that civilizations exist within and rely upon” (Folke et al. 2021, p. 836). As an example of what this means, an accessible scientific articulation of how these connections manifest in the global production system is provided by Nystöm et al. (2019) who describe the changed nature of production systems that supply food, fuel and fibre for human needs (that is, agricultural, fishery and forestry sectors). They trace three dynamics, namely: the simplification of ecological complexity in systems (thereby reducing resilience), an intensification of production that increases reliance on inputs (such as fertilizers, water and technology) and increased connectivity between systems (through global markets, trade and trans-national corporations). These underlying drivers increase global systems connectivity (meaning turbulence can propagate further and more quickly), dampen feedbacks (which might have otherwise resulted in changes to activities), and create spatial decoupling (where consumers of global ecological services do not see the harm that their behaviour engenders). Some of these dynamics (for example, increased connectivity and propagating turbulence) are the same ones that underpinned the global financial crisis: these dynamics are well appreciated by accounting scholars even if this ecological example is novel.

Existing organisational control routines are necessary for managing in the Anthropocene with additional nuance being demanded given the above dynamics. For example, there is a need to develop the capacity to trace connections (including dependencies and impacts) across time and between disparate places, as well as appreciating proximate and distal drivers: that is, effects/dependencies that are in close relationship with corporate action or where connections are not obvious and mediated by other system participants. Bebbington et al. (2020, p. 153) describe this as telecoupling: a process of seeking to “identify how a change in one part of a socio-economic-ecological system creates effects elsewhere”. Telecoupling means, for example, that a more sophisticated understanding of the ecological basis of supply chains is

needed alongside economic understandings, as well as being able to trace materials as they move across the globe. Moreover, with “rising system-wide turbulence” (Folke et al. 2021, p. 834) understanding risk might be more complex than hitherto appreciated and resilience considerations might be revisited (see Linnenluecke, 2017, for a systematic literature review of the use of that idea in management studies).

Indeed, corporate governance that reflect these dynamics is starting to emerge. For example, the Task-Force on Climate-Related Financial Disclosures (TCFD) describes the kind of information that would be required to articulate these connections, as well as emphasising that climate and financial stability are co-determined (TCFD, 2017). Inspired by this approach the Task-Force on Nature-Related Financial Disclosures (TNFD) have recently produced their first pass of how natural capital risks could be articulated. It is not surprising that these two elements are the first to be addressed as they are the biological and chemical aspects of the earth system that shape how and what goods can be produced by nature, and the operating conditions for organisations. Finally, it is important to appreciate that changes in the earth system are not thought to be part of a smooth or gradual process. Rather, change can happen quickly with new operating conditions being manifest. This feature means that scientists are keen to know what will trigger a change to a new state (known as ‘tipping points’). In the context of climate change, the desire to keep global warming below 1.5°C is because beyond this point there is a higher probability of a climate tipping point. Concerns also exist that any new ecological states do not reproduce the functions provided in earlier states and that it is impossible to revert to the previous, more desirable state.

These principles can also be illustrated using a different kind of global risk with the 2019 coronavirus outbreak providing a glimpse into Anthropocene dynamics. The emergence of novel coronaviruses in human populations has been linked to two changes in the natural environment. First, global bat diversity is shifting in response to climate change (Beyer et al.

2021), bringing species closer to human populations and enabling what Aronsson and Holm (in press) describe as multispecies entanglements. Second, these entanglements mean that viruses that were only present in wild species populations are increasingly encountering humans by way of human encroachment into previously unoccupied places (through the “expansion and intensification of agriculture, hunting and infrastructure development”, Beyer et al. 2021, p. 3). This means that either through direct means, or indirectly between humans and farmed animals who themselves are coming into contact with previously unencountered species, the virosphere is starting to homogenise. The outcome of these processes has been the global pandemic and, having gone through the tipping point, human populations will contain the Covid-19 virus or the foreseeable future. This new dynamic also expands health concerns from human health to the interconnected and mutually determined planetary-animal-human nexus that underpins the One Health approach.² This is also an example of how social and environmental concerns are now intertwined: that is, they are of a socio-ecological nature.

Given the significance of these changes, international bodies such as the Intergovernmental Panels on Climate Change and on Biodiversity and Ecosystems Services provide a focal point for international agreements to address elements of the earth system. The agreements forged in these fora are often, eventually, enshrined in countries’ legal and policy frameworks that affect organisations’ activities and related accounting/reporting demands (for an example of this in the context of biodiversity see Bebbington et al. 2021b and for water see Russell, 2021). In a similar manner, the United Nations Sustainable Development Goals (see Bebbington and Unerman, 2018, 2020) also reflect Anthropocene related concerns and

² This approach recognizes that human health is closely linked to animal health, both of which are dependent on the health of the environment. While the example in the paper focuses on zoonotic diseases (that is, diseases that are spread between people and animals) it also includes concerns about antimicrobial resistance (which is itself dependent in part on how animals are raised).

remedies. At other times, voluntary inter-organisational agreements are forged to progress responses to environmental (and social) problems that exist. In all these cases, accounting practice and scholarship (underpinned by the accounting profession) are also conditioned by how organisations are affected and respond to the Anthropocene.

3. Organisations and organising in the Anthropocene

With the scale and nature of Anthropocene challenges outlined, this section starts the process of drawing out a roadmap for stewardship as it pertains to organisations. In the first instance, it is appropriate to acknowledge that the organisational social sciences have not been especially focused on environmental matters, a fact that has attracted criticism (Goodall, 2008; Diaz-Rainey et al. 2017; Patenaude, 2011; Linnenluecke and Griffiths, 2013). That being said, there is a growing literature that is framed under the guise of ‘grand societal challenges’ (Ferraro et al. 2015; and George et al. 2016) and this work could be read as shorthand for thinking about how organisations might be affected by the Anthropocene (for a summary see Brammer et al. 2019). There is also some scholarship that directly addresses Anthropocene issues (Heikkurinen et al. 2016), albeit that it tends to be relatively philosophical in nature. In a practical sense, two questions arise in our attempt to develop a roadmap: what ends are corporations pursuing? And how are they collaborating to exercise stewardship? Each of these questions will be addressed, focusing on: the potential for developing more regenerative forms of capitalism and how novel coalitions of organisations might emerge to address Anthropocene pressures.

Corporate purpose and capitalism in the Anthropocene

The scale of environmental (and associated social and economic) change that is likely to be experienced as the earth system leaves the Holocene has prompted some writers to question the nature of capitalism. Indeed, Bebbington et al. (2020, p. 157) note that there are many alternative names suggested for the Anthropocene, including that of the ‘Capitalocene’ (see

Baskin, 2015, for a general discussion and also Malm, 2016) which explicitly links our current ecological crisis to capitalism. Indeed, there is a case to be made that system-wide environmental effects and the extent to which they undermine human flourishing might cause us to question whether capitalism ‘as we knew it’ (to use a phrase from Gibson-Graham, 1996) is fit for purpose (see also Raworth, 2017). This is manifested in notions of ‘regenerative capitalism’ (Elkington, 2021); ‘net positive’ business (Polman and Winston, 2021); the need for a ‘great reset’ (Schwab and Malleret, 2020) and Carney’s (2021) examination of value(s). While some of these contributions are authored by practitioners who have long questioned how business is conducted (John Elkington), it is notable that there are increasingly mainstream voices in these discussion (the ex-Governor of the Bank of England is hardly a radical or marginal voice).

These publications focus on problems that arise from focusing on the short-term financial interests of shareholders with some arguing that the Friedman doctrine is “not the business paradigm for the twenty-first century ... [and that believing this mantra is] ... so significant and misconceived as to threaten our existence” Meyer (2018 p. 2). This has led Meyer (2018), among others, (for example, Schwab, 2021) to identify that corporate purpose, ownership and governance need to be reformed to ensure that a longer term, shared value and purposeful approach to corporate behaviour is more commonplace (having been the bed rock for many organisations in the past including many family, employee and co-operatively based enterprises). In a similar vein the advent of the ‘benefit’ corporation (‘B corp’) form where profits and social purpose are more carefully integrated could be seen as a way to reformulate capitalist enterprises. At the same time, companies themselves engage in collaborations that could be seen as addressing Anthropocene inspired concerns (see Brocken et al. 2014).

Coalitions for stewardship transitions

While individual organisations can, and do, champion stewardship actions, collective approaches to stewardship are more apparent. These might take the form of product labelling/certification programmes (such as the Marine Stewardship Council) as well as voluntary environmental programmes (Blasiak et al. 2021). A relatively new approach that speaks more closely to an Anthropocene framing is that of ‘keystone actor’ analysis.

Keystone actors are corporations whose size and connectivity in global production systems shape the fields in which they operate. In this context, the possibility emerges that these actors might also work together to bring a stewardship focus on those systems (for an introduction see Österblom et al. 2015, 2017; Hileman et al. 2020; Viridin et al. 2021 for other examples). This approach is different from identifying cohorts of companies who produce goods that have ecological impacts and/or which underpin economic systems (for example, see Heede, 2014). Rather, the cohorts are brought together with the aim to reshape the systems in which they operate: hence the connection both to stewardship and Anthropocene thinking.

The case study used in Bebbington et al. (2020) to illuminate how accounting research might change in order to address the Anthropocene is an example of a keystone actor cohort in the seafood industry. More recent publications further illuminate how this science-business experiment has progressed in practice (Österblom et al. 2022b). The processes within this live experiment, identified as necessary for stewardship, are: developing a shared vision for stewardship; identifying social and ecological priority areas (where stewardship needs to be exercised); re-examining operations through the combined stewardship-priorities lens (including enhancing supply chain traceability); developing new data/operational procedures to enable action to be taken; identifying time bound goals; and creating new information flows to discharge accountability. While still a work in progress, the SeaBOS (Seafood Business for Ocean Stewardship) initiative provides evidence for the potential of corporation

action in the Anthropocene biosphere where pre-competitive collaboration (enabled by a partnership with science) creates the conditions for stewardship thinking and action. This approach, however, is not a quick fix and requires a self-conscious approach from the companies involved as well as substantial investment (in the form of company policy development, enhanced data collection, investment of management time and active engagement across supply chains). To date, keystone actor cohorts have been corporations. The concept, however, could equally apply to public sector entities who are anchor organisations in their locales: that is, they have an important presence in a place by virtue of employment, purchasing activities or holdings of land and other assets. Experimentation of this type is important where control is distributed between many organisations and responsibility is shared.

In summary, this section has identified that a roadmap for stewardship requires (at least) a broader perspective on organisational purpose and the opportunity for collaboration with others who are motivated by stewardship ideals and who (in combination) can affect the systems in which they operate (what Dahlmann et al. 2020 call ‘purpose ecosystems’). This also requires active collaboration with accounting, audit, financing and reporting functions. There is also literature (for example, Gebreyes et al. 2021; Scoones et al. 2020) that focuses on how transitions come to pass and how they might become more common: ‘scaling out’ in the language used by Moore et al. (2015). This includes identifying where leverage for change could be exerted. For example, Jouffray et al. (2019) investigated if owners could exert pressures on firms to embrace stewardship and found that this particular leverage point was not present in the seafood sector. Other studies look for ‘translocal’ effects whereby innovation in one place might be replicated elsewhere such that the the system itself changes and also possibilities for amplification and scalability of innovations (Lam et al. 2020). It is possible (but as yet not formally investigated) that accounting, audit and reporting activities

might provide possibilities for such effects to be promulgated into and through organisation focused activities.

4. Returning to accounting

The issues addressed in this paper are not novel for accountants, with professional focused work on environmental issues first emerging in the early 1990s (Gray, 1990; Macve and Carey, 1992; Canadian Institute of Chartered Accountants, 1992, 1993a,b, 1994; FEE 1993) not long after the founding of global bodies to address climate change and biodiversity loss (see Warde et al. 2018). At the same time, an academic community emerged that sought to address environmental, as well as social and sustainability, concerns (see Bebbington et al. 2021a; 2021c). There is, however, something novel that emerges when these concerns are placed alongside the Anthropocene framings introduced in the preceding two sections. First, the nature of the context in which accounting might be responding to organisational, stakeholder and market demands for information is considerably different from the provision of a limited set of financially material information about environmental aspects of corporate behaviour. This implies that the scale and nature of accounting, audit and reporting responses will be qualitatively different (see Bebbington and Larrinaga, 2014; Bebbington et al. 2020; and Larrinaga, 2021 who lay out some of these differences). Second, whereas environmental accounting was a sub-set of mainstream accounting preoccupations, the dynamics that are set in motion in the Anthropocene means that all accounting practice and scholarship becomes relevant. This observation warrants a little more consideration.

The mainstream of accounting research and sustainability focused accountants have occupied relatively separate spheres of academic endeavour over the last 30 years. This is to be expected, as sustainability accounting has honed its conceptual and methodological approaches, as well as knowledge of the topic domains which it considers (such as climate change). Periodically there are calls for more integration between these relatively distinctive

fields but this is hindered by the extent to which journal publishing norms and expectations of what constitutes accounting research have not encouraged a mixing of perspectives. This is a classic example of how peripheral aspects of a field (sustainability accounting) are not readily available in mainstream outlets due to tight boundary keeping (Gendron and Rodrigue, 2021). These authors offer remedies such as “incremental development of spaces for receptivity” (Gendron and Rodrigue, 2021, p. 1) as well as nurturing “academic empathy” (Michelon, 2021, p. 7). Thinking about accounting in the Anthropocene will require these ambitions to be realised and we hope this paper may be one part of creating new points of connection and stimulating opportunities for collaboration. With these observations in mind, this section provides two touch-down points that might be of interest to all accountants, namely: information for ecological based organisational governance and the role of spatial data in identifying organisational activities. Both of these themes link to our ongoing laying out of a roadmap for stewardship in that governance affects what organisations might be held accountable for while the development of a more spatially aware accounting creates potential for enhanced organisational control over activities (echoing the control and accountability focus of accounting).

Governance in the 21st Century

If we return to Meyer’s (2018) proposition (outlined in section 3) that corporate purpose, ownership and governance needs to transform in the Anthropocene and combine this with Larrinaga’s (2021) propositions about the mode of corporate governance required in the 21st century, we have a landscape on which to understand the wider ramifications of changes in disclosure regulations that are emerging across multiple jurisdictions. Larrinaga (2021, p. 83-84) outlines the contrasts between pristine (exemplified by Friedman), enlightened, adaptive and transformative governance approaches for corporations in the Anthropocene. Enlightened and adaptive governance motifs are reflected in ideas about longer-term, stakeholder

capitalism whereas ideas about regenerative capitalism link with transformative governance. Larrinaga (2021, p. 89 and echoing the keystone actor idea previously developed) differentiates between these governance approaches noting that while adaptive governance “strives to mitigate and adapt to changes in the configuration of socio-ecological systems to ensure a steady flow of ecosystem services” it may not be sufficient given the challenges posed by the Anthropocene. If that is the case, transformative governance may be required that “problematizes current configuration and seeks a regime shift” (Larrinaga, 2021, p. 89). To enact these forms of governance, the provision of information is central. Reporting on environmental impacts of organisations within annual report and accounts packages, as well as in separate reports (first framed as stand-alone reports and latterly as sustainability reporting) and in some kind of integrated format has a 30-year history. While the legal requirements for reporting have become more widespread over time, it is uncontroversial to claim that some form of reporting on environmental (and related matters) is de facto compulsory for large, publicly listed corporate entities (Larrinaga and Bebbington, 2021). Likewise, as environmental impacts have salience for financial risk, reporting may be expected even in the absence of non-financial reporting norms and requirements. The fact that information is provided about selected environmental interactions, however, is not the same as reporting that provides information on how well an organisation might navigate the dynamics of the Anthropocene: for example, Bjørn, et al. (2017) note that such reporting largely does not reflect ecological limits.

Reporting that articulates actions that management are undertaking to purposefully address how they impact upon/are impacted by wider systemic change in socio-ecological networks links to reporting on biosphere stewardship. Information provided in this context would be of a different nature to that currently provided.

In this context, the World Economic Forum’s (2020) Stakeholder Capitalism Metrics warrant consideration as they are (on one reading) a model for ‘what matters’ for purposeful business, drawn from existing reporting initiatives but streamlining them into a small set of metrics (see Table 1). As these have only recently been endorsed, it is too soon to say how this synthesis will be enacted but it appears to have some promise for articulating performance against some social minimum (for example, in the area of wages) and ecological maximum (for example, in the area of water use in stressed areas) which resonate with earth systems framing of Anthropocene focused authors (Rockström et al. 2009; Raworth, 2017; Folke et al. 2021). Other initiatives are emerging that also have this stewardship flavour. For example, the Science Based Targets Initiative (a private governance approach that seeks to ensure that the ambitions of corporate actors are sufficiently strong to achieve a science outcome) prompts corporations to set goals that are sufficiently strong for the scale of the climate challenge.

Table 1: Core metrics for stakeholder capitalism

People	Diversity and inclusion; pay equity; wage level (cf. minimum wages and also as a ratio to CEO pay); risk of incidents of child, forced or compulsory labour; health and safety; and training provided.
Planet	Greenhouse gas emissions; Task-Force for Climate-related Financial Disclosures implementation; land use and ecological sensitivity; and water consumption and withdrawal in water-stressed areas.
Prosperity	Employment statistics; economic contribution; financial investment contribution; research and development expenditure; community investment; and total tax paid.

Governance	Setting purpose; governance body composition; material issues impacting stakeholders; anti-corruption; protected ethics and reporting mechanisms; and integrating risks and opportunity into business process.
------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Source: World Economic Forum (2020).

Alongside developments in reporting, there are demands for investor transparency, especially within the European Union. Prompted by the European Green Deal and the European Commission’s Action Plan for Financing Sustainable Growth, there is a recognition of the relative absence of environmental and social considerations within investment decisions (by banks as well as investors) alongside a desire to “reorientate capital flows towards sustainable investments ... manage financial risks stemming from climate change, resource depletion, environmental degradation and social issues; and foster transparency and long-termism in financial and economic activity” (European Commission, 2018, p. 2). To bring these ambitions together (and to complement corporate reporting regimes) a taxonomy of activities that can be understood to be environmentally sound is developing alongside the requirement for investors (to the extent to which they profess it to be the case) to prove the ‘green’ credentials of their investment decisions. Taken together these requirements compliment corporate reporting requirements and extends scrutiny to owners and funders, requiring them to provide evidence of their environmental performance. This is also an area experiencing rapid change.

Another link in the governance chain is provided by guidelines of how to identify and report on (for example) the financial ramifications of risks arising from climate change (drawing on the Task-Force for Climate-related Financial Disclosures) as well as biodiversity (in the form of the Task-Force for Nature-related Financial Disclosures). These are opening steps for accounting and reporting practices to mediate between natural and financial systems: an

ecological turn as it were. At the same time, stock exchanges are also seeking to understand their role in such a landscape (see International Organization of Securities Commission, 2020). These examples are familiar to accounting and finance scholars who consider financial risk. What is less certain is if financial and environmental risk dynamics operate in the same way (see reservations from Crona et al. 2021) and hence if mediation, translations, or hybridisations are possible and/or robust.

Taken together, new governance arrangements (with associated disclosure requirements) seem to be emerging that move towards addressing organisational impacts and performance against ecologically determined standards. These arrangements are different from the consolidation of various reporting frameworks under the umbrella of the International Sustainability Standards Board, primarily because this body has decided to focus on financial materiality in the first instance. The ambition for governance that promotes stewardship in the Anthropocene biosphere will base itself in biophysical reality and then seek to evaluate performance against what is needed to have the best chance of preventing tipping points. There are also some attempts (outside of organisational research) to trace organisational impacts across the earth system itself.

Bringing a spatially sensibility to accounting

As identified in section 3, economic and ecological effects are linked together in the Anthropocene in ways that are not immediately apparent, and hence places where interventions could support stewardship (framed as leverage points) are not fully understood. Innovation in geo-spatial technologies has opened up the possibility for aspects of corporate activities to be viewed in novel ways that may provide greater information to stakeholders about an organisation's activities. For example, remote sensing might provide information about activities in areas that cannot easily be viewed directly and might provide evidence of

corporation activities on the high seas (in the case of Global Fishing Watch data) or land environments (for example deforestation) which might support better organisational control and, if reported, greater accountability. Studies have recently attempted to use such data. For example, McDonald et al. (2021) examine fishing vessels tracks to identify those that have risky profiles (in this instance for forced labour). Data of this kind might provide opportunities for organisational stewardship of supply chains (should there be strong traceability in place), as well as providing greater transparency of corporate behaviour (noting the limits of transparency as a mode of governing – see Mol, 2006).

Another potential innovation can be observed in two studies that sought to connect earth system changes, corporate activities and corporate owners (these are the only studies of this kind that we have been able to find). Galaz et al. (2018) focused on the common owners of companies who are operating in forests, that are themselves critical for environmental stability (these forests are known as sleeping giants). Corporate activities in these forests include pulp and paper extraction, along with beef and soy production, all of which affect deforestation. The paper traces which companies operate in the largest global forest systems as well as who owns the said companies to uncover if there are common owners who may have (or could be persuaded to have) incentives to protect the forests. This process uncovered what the authors term ‘hidden financial sleeping giants’ in the form of BlackRock, State Street and Vanguard, alongside a realisation that their ownership share was too diffused for these actors to drive changes in corporate behaviour (even if environmental governance was part of these investors business models). Jouffray et al. (2019) had a similar ambition: they examined if there are leverage points in the seafood sector arising from ownership stakes (they find there are not in this instance). These studies have been executed by earth system scientists (with co-authorship from accounting and finance colleagues) and are seeking to

identify the hidden connections (the teleconnections in the language we have used in this paper) that might support better governance of organisational impacts and behaviours.

In summary, this section of the paper has sought to develop ideas for accounting in the Anthropocene. A common thread between the various suggestions is the opening out of accounting to consider how it connects to ‘links in the chain’ between organisations and socio-ecological systems. As Cuckston (2021) puts it “accounting becomes a vital force in the work of organising socio-ecological systems” given these interconnections (see also Ferger and Mermet, 2017; Russell et al. 2017).

5. Closing comments

Developing “collective wisdom to navigate the Anthropocene to sustain a liveable biosphere for people and civilizations, as well as for the rest of life with which we share the planet, is the most formidable challenge facing humanity” (Folke et al. 2021, p. 834). In this paper we have focused on developing practice-based insights that may support accounting to better guide organisations which are, and which increasingly will be, operating in the Anthropocene. The work of accountants in informing internal decision making, in assuring the quality of information and in supporting the external provision of information already provides guidance for economic and (some) environmental action. What we are arguing, building on Bebbington et al. 2020, is that this work needs to advance further - and at a pace - to be fit for purpose. Detailed understandings of how accountants are undertaking this task and the extent to which accounting routines and reporting practices (themselves nested in governance regimes) are able to support stewardship and Anthropocene demands is left for future research. This work would be more than business-as-usual accounting research as it would most usefully be conducted with a strong ecological frame and likely in partnership with ecologists, following Bebbington et al. 2020.

At the same time, we are acutely aware that thinking about the Anthropocene is difficult because we are also simultaneously in it. As Schaberg (2020, p. 22-23) observes the: “Anthropocene is an overwhelming topic to think about, partly because it implicates the thinker. But also, because ... the Anthropocene ‘demands action’ ... But just what sort of action? From whom, exactly? How soon? On what scale? And to what end?”. The line of argument that we have advanced in this paper is that stewardship provides the basis for starting to address these questions. In this respect, “stewardship is not merely a stronger form of accountability but reflects a fundamentally different set of relations” (Bebbington et al. 2020, p. 169). In particular we suggest that in the Anthropocene there is a need to consider if organisations have stewarded earth resources that they have in their care: these ‘resources’ include stable ecological systems operating within planetary boundaries. Stewardship is a familiar concept to accounting (see Gjesdal, 1981), albeit that it is currently usually narrowly focused on financial stewardship. There is every reason, however, to draw from a more encompassing sense of public value (Vollmer, 2021) and a wider sense of corporate purpose and for this to inform accounting practice.

Of course, all these propositions are normative: they reflect our desire to use accounting to keep the earth system in something resembling its current dynamic equilibrium state. At the same time, not to seek to act when faced with the planetary emergency recognised in the Anthropocene framing is also normative, especially as organisations are implicated in this emergency and are able to act as planetary stewards. We hope that this paper provides a set of arguments and practice-based examples to support the case for the relevance of the Anthropocene to accounting and that it has sketched out the start of a roadmap for stewardship. There are also a myriad of topics on which future researcher might focus, including: Do organisational control routines reach into systems that are subject to Anthropocene level perturbations? Are corporate governance innovations (alone or in

combination) addressing Anthropocene concerns? And if so how, or why not? Is reporting able to address accountability and stewardship concerns, and how does/can it do that?

Research across these (and other) broad topics would be underpinned by ecological literacy that ensures that what is at stake in the Anthropocene is integrated into the research topics.

Acknowledgements: Ideas do not emerge in a vacuum and there are numerous co-authors (past and present) who have informed the ideas that have come together in this paper. Jan Bebbington is especially indebted to a group of colleagues who have been meeting since early 2020 to imagine a socio-ecologically informed accounting in the Anthropocene. Many of the thoughts in this paper have been prompted and discussed by that group in the various structured research meetings we have had since our initial meeting (totally ten meetings from February 2020 to June 2021). These colleagues are: Charika Channuntapitat, Stuart Cooper, Tom Cuckson, Mercy Denedo, Nuria Descalzo, Colin Dey, Bisola Joloko, Matias Laine, Carlos Larrinaga, Giovanna Michelin, Nick Rowbottom, Shona Russell, Richard Spencer, Madlen Sobkowiak, Ian Thomson, Helen Tredigia, and Hendrik Vollmer. Thanks also go to Robert Blasiak, Carl Folke, Jean-Baptiste Jouffray and Henrik Österblom for the stimulation that working with them has brought to this paper and detailed comments from Shona Russell on an earlier draft of the paper. All great ideas emerge from our collective conversations, and all mis-specified ideas remain our own responsibility.

Declaration of interest statement: No potential conflict of interest was reported by the author(s)

References

- Aronsson, A. and Holm, F., in pres. Multispecies entanglements in the virosphere: Rethinking the Anthropocene in light of the 2019 coronavirus outbreak. *The Anthropocene Review*.
- Baskin, J., 2015. Paradigm Dressed as Epoch: The Ideology of the Anthropocene. *Environmental Values*, 24(1), 9-29.
- Bebbington, J., 2021a. Foundations of Environmental Accounting, 17-28. In Bebbington, J., Larrinaga, C., O'Dwyer, B. and Thomson, I. (eds), 2021c. *Routledge Handbook on Environmental Accounting*. Abingdon, UK: Routledge.
- Bebbington, J., Cuckston, T., and Ferger, C., 2021b. Biodiversity, 377-387. In Bebbington, J., Larrinaga, C., O'Dwyer, B. and Thomson, I. (eds), (2021c). *Routledge Handbook on Environmental Accounting*. Abingdon, UK: Routledge.
- Bebbington, J. and Larrinaga, C., 2014. Accounting and sustainable development: an exploration. *Accounting, Organizations and Society*, 39(6), 395-413.
- Bebbington, J., Larrinaga, C., O'Dwyer, B. and Thomson, I. (eds), 2021c. *Routledge Handbook on Environmental Accounting*. Abingdon, UK: Routledge.
- Bebbington, J. and Larrinaga, C. (in press). The influence of Power's Audit Society in environmental and sustainability accounting. *Qualitative Research in Accounting and Management*.
- Bebbington, J., Österblom, H., Crona, B., Jouffray, J-B., Larrinaga, C., Russell, S. and Scholtens, B., 2020. Accounting and Accountability in the Anthropocene. *Accounting, Auditing and Accountability Journal*, 33(1) 152-177.
- Bebbington J. and Unerman, J., 2018. Achieving the United Nations Sustainable Development Goals: an enabling role of accounting research. *Accounting, Auditing and Accountability Journal*, 31(1) 2-24.

Bebbington J. and Unerman, J., 2020. Advancing research into accounting and the UN Sustainable Development Goals. *Accounting, Auditing and Accountability Journal*, 33(7) 1,657-1,670.

Beyer, R., Manica, A. and Mora C., 2021. Shifts in global bat diversity suggest a possible role of climate change in the emergence of SARS-CoV-I and SARS-CoV-2. *Science of the Total Environment*, 767, 145413.

Bjørn, A., Bey, N., Georg, S., Røpke, I. and Hauschild, M., 2017. Is Earth recognized as a finite system in corporate responsibility reporting? *Journal of Cleaner Production*, 163, 106-117.

Blasiak, R., Dauriach, A., Jouffray, J-B., Folke, C., Österblom, H., Bebbington, J., Bengtsson, F., Causevic, A., Geerts, B., Grønbrekk, W., Henriksson, P, Käll, S., Leadbitter, D., McBain, D., Crespo, G., Packe,r H., Sakaguchi, I., Schultz, L., Selig, E., Troel,l M., Villalón, J., Wabnitz, C., Wassénus, E., Watson, R., Yagi, N. and Crona, B (2021) Evolving Perspectives of Stewardship in the Seafood Industry. *Frontiers in Marine Science*, 8:671837.

Brammer, S., Branicki, L., Linnenluecke, M., and Smith, T., 2019. Grand challenges in management research: Attributes, achievements, and advancement. *Australian Journal of Management*, 44(4), 517–533.

Brocken, N., Short, S., Rana, S. and Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner Production*, 15, 42-56.

Canadian Institute of Chartered Accountants, 1992. *Environmental Auditing and the Role of the Accounting Profession*. Toronto, Canada: Canadian Institute of Chartered Accountants.

Canadian Institute of Chartered Accountants 1993a. *Environmental Stewardship: Management, Accountability and the Role of Chartered Accountants*. Toronto, Canada: Canadian Institute of Chartered Accountants.

Canadian Institute of Chartered Accountants 1993b. *Environmental Costs and Liabilities: Accounting and Financial Reporting Issues*. Toronto, Canada: Canadian Institute of Chartered Accountants.

Canadian Institute of Chartered Accountants 1994. *Audit of Financial Statements Affected by Environmental Matters*. Toronto, Canada: Canadian Institute of Chartered Accountants.

Carney, M. 2021. *Values(s): Building a Better World for All*. London, UK: William Collins.

Crona, B., Folke, C. and Galaz, V., 2021. The Anthropocene reality of financial risk. *OneEarth*, 4, 618-628.

Cuckston, T., 2021. Accounting and Conservation: to Live in Harmony with Nature, We Must Organise Nature. *Social and Environmental Accountability Journal*, 41(1-2), 1-7.

Dahlmann, F., Stubbs, W., Raven, R. and Porto de Albuquerque, J., 2020. The ‘purpose ecosystem’: Emerging private sector actors in earth systems governance. *Earth System Governance*, 4, 100053.

Diaz-Rainey, I., Robertson, B. and Wilson, C., 2017. Stranded research? Leading finance journals are silent on climate change. *Climatic Change*, 143, 243-260.

Davies, J., 2016. *The Birth of the Anthropocene*. Oakland, USA: University of California Press.

Elkington, J., 2021. *Green Swans: The coming boom in regenerative capitalism*. New York, USA: Fast Company Press.

European Commission, 2018. *Action Plan: Financing Sustainable Growth*. Brussels: 8.3.2018 CoM 97 final.

FEE, 1993. *Environmental Accounting and Auditing: Survey of Current Activities and Developments*. Brussels: Belgium: FEE.

- Feger, C. and Mermet, L., 2017. A blueprint towards accounting for the management of ecosystems. *Accounting, Auditing & Accountability Journal*, 30(7), 1511-153.
- Ferraro, F., Etzion, D. and Gehman, J., 2015. Tackling Grand Challenges Pragmatically: Robust Action Revisited. *Organizations Studies*, 36(3), 363-390.
- Folke, C., Österblom, H., Jouffray, J-B. ... de Zeeuw, A., 2019. Transnational corporations and the challenge of biosphere stewardship. *Nature Ecology & Evolution*, 3, 1396-1403.
- Folke, C., Polasky, S., Rockström, J. ... Walker, B., 2021. Our future in the Anthropocene biosphere. *Ambio*, 50, 834-869.
- Galaz, V., Crona, B., Dauriach, A., Scholtens, B. & Steffen, W., 2018. Finance and the Earth system – Exploring the links between financial actors and non-linear changes in the climate system. *Global Environmental Change*, 53, 296-302.
- Gebreyes, M., Mekonnen, K., Thorne, P. ... and Yasabu, S., 2021. Overcoming constraints of scaling: Critical and empirical perspectives on agricultural innovation scaling. *PLoS One*, 16(5), e0251958.
- George, G., Howard-Grenville, J., Joshi, A., and Tihanyi, L., 2016. Understanding and Tackling Societal Grand Challenges through Management Research. *Academy of Management Journal*, 59 (6), 1880–1895.
- Gendron, Y. and Rodrigue, M., 2021. On the centrality of peripheral research and the dangers of tight boundary gatekeeping. *Critical Perspectives on Accounting*, 76, e102076.
- Gibson-Graham, J. K., 1996. *The End of Capitalism (as we knew it): A Feminist Critique of Political Economy*. Minneapolis, USA: Minnesota Press.
- Gjesdal, F., 1981. Accounting for stewardship. *Journal of Accounting Research*, 19(1), 208-231.

- Goodall, A., 2008. Why have the leading journals in Management (and other social sciences) failed to respond to climate change? *Journal of Management Inquiry*, 17, 408-420.
- Gray, R., 1990. *The Greening of Accountancy: The Profession after Pearce*. London, UK: Chartered Association of Certified Accountants.
- Hamilton, C. Bonneuil, C. and Gemenne, F., 2015. (Eds.), *The Anthropocene and the Global Environmental Crisis*. London, UK: Routledge.
- Heede, R., 2014. Tracing anthropogenic carbon dioxide and methane emissions to fossil fuel and cement producers, 1854–2010. *Climatic Change*, 122(1), 229-241.
- Heikkurinen, P., Rinkinen, J., Järvensivu, T., Wilén, K. and Ruuska, T., 2016. Organising in the Anthropocene: an ontological outline for ecocentric theorizing. *Journal of Cleaner Production*, 113, 705-714.
- Hileman, J., Kallstenius, I., Häyhä, T. ... and Cornell, S., 2020. Keystone actors do not act alone: A business ecosystem perspective on sustainability in the global clothing industry. *PLoS ONE*, 15(10), e0241453.
- Horn, E. and Bergthaller, H., 2020. *The Anthropocene: Key Issues for the Humanities*. Abingdon, UK: Earthscan.
- Howard-Grenville, J. and Lahneman, B., 2021. Bringing the biophysical to the fore: Re-envisioning organizational adaption in the era of planetary shifts. *Strategic Organization*, 19(3), 478-493.
- International Organization of Securities Commission., 2020. *Sustainable Finance and the Role of Securities Regulators and IOSCO*. International Organization of Securities Commission: Madrid.
- Jouffray, J.-B., Crona, B., Wassénus, E., Bebbington, J. & Scholtens, B., 2019. Leverage points for seafood sustainability in the financial sector. *Science Advances*, 5 (10): eaax3324.

Lam, D., Martín-López, B., Wiek, A. ... and Lang, D., 2020. Scaling the impact of sustainability initiatives: a typology of amplification processes. *Urban Transformations*, 2, 3.

Larrinaga, C., 2021. Environmental Accounting and 21st Century Sustainability Governance, 78-91. In Bebbington, J., Larrinaga, C., O'Dwyer, B. and Thomson, I. (eds), 2021c. *Routledge Handbook on Environmental Accounting*. Abingdon, UK: Routledge.

Larrinaga, C. and Bebbington, J., 2021. The pre-history of sustainability reporting: a constructivist reading. *Accounting, Auditing and Accountability Journal*, 34(9), 131-150.

Lewis, S. and Maslin, M., 2015. Defining the Anthropocene. *Nature*, 519, 171-180.

Linnenluecke, M., 2017. Resilience in business and management research: A review of influential publications and a research agenda. *International Journal of Management Reviews*, 19 (1), 4–30

Linnenluecke, M. and Griffiths, A., 2013. Firms and sustainability: Mapping the intellectual origins and structure of the corporate sustainability field. *Global Environmental Change*, 23, 382-391.

Malhi, Y., 2017. The Concept of the Anthropocene. *Annual Review of Environment and Resources*, 42(1), 77-104.

Macve, R. and Carey, A., 1992. (eds), *Business, Accountancy and the Environment: A Policy and Research Agenda*. London, UK: Institute of Chartered Accountants in England and Wales

Malm, A., 2016. *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming*. London, UK: Verso.

McDonald, G., Costello, C., Bone, J., Cabral, R., Farabee, V., Hochberg, T., Kroodsma, D., Mangin, T., Meng, K. & Zahn, O. (2021). Satellites can reveal global extent of forced labor in the world's fishing fleet. *Proceedings of the National Academy of Science*, 118(3), e2016238117.

Meyer, C., 2018. *Prosperity: Better Business Makes the Greater Good*. Oxford, UK: Oxford University Press.

Michelon, G., 2021. Accounting research boundaries, multiple centers and academic empathy. *Critical Perspectives on Accounting*, 76, e102204.

Miller, P. and Power, M., 2013. Accounting, organizing, and economizing: Connecting accounting research and organization theory. *The Academy of Management Annals*, 7(1), 557-605.

Mol, A. (2006). Environmental Governance in the Information Age: the emergence of informational governance. *Environment and Planning C: Government and Policy*, 24(4), 497-514.

Moore, M-L., Riddell, D. and Vocisano, D., 2015. Scaling Out, Scaling UP, Scaling Deep: Strategies for Non-profits in Advancing Systemic Social Innovation. *The Journal of Corporate Citizenship*, 58(1), 67-84.

Nyström, M., Jouffray, J-B; Norström, A., Crona, B., Søgaard Jørgensen, P., Carpenter, S., Bodin, Ö., Galaz, V. and Folke, C., 2019. Anatomy and resilience of the global production system. *Nature*, 575, 98-108.

Österblom, H., Bebbington, J., Blasiak, R., Sobkowiak, M. and Folke C. (2022a). Transnational Corporations, Biosphere Stewardship, and Sustainable Futures. *Annual Review of Environment and Resources*, 47(1). <https://doi.org/10.1146/annurev-environ-120120-052845>.

Österblom, H., Folke C., Rocha, J., Bebbington, J., Blasiak, R., Jouffray, J-B., Selig, E., Wabnitz, C., Bengtsson, F., Crona, B., Gupta, R., Henriksson, P., Johansson, K., Merrie, A., Nakayama, S., Ortuño Crespo, G., Rockström, J., Schultz, L., Sobkowiak, M., Søgaard Jørgensen, P., Spijkers, J., Troell, M., Villarubia-Gómez, P. and Lubchenco, J. (2022b).

Scientific mobilization of keystone actors for biosphere stewardship. *Scientific Reports*, 12, 3802.

Österblom, H., Jouffray, J.-B., Folke, C. . . . and Rockström, J., 2015. Transnational Corporations as ‘Keystone Actors’ in Marine Ecosystems. *PLoS ONE*, Vol. 10 No. 5, pp. e0127533.

Österblom, H., Jouffray, J.-B., Folke, C. and Rockström, J., 2017. Emergence of a global science–business initiative for ocean stewardship. *Proceedings of the National Academy of Sciences*, Vol. 114 No. 34, pp. 9038-9043.

Patenaude, G., 2011. Climate change diffusion: While the world tips, business schools lag. *Global Environmental Change*, 21(1), 259–271.

Polman, P. and Winston, A. (2021). *Net Positive: How Courageous Companies Thrive by Giving More Than They Take*. Boston: Harvard Business Review Press.

Raworth, K., 2017. *Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist*. London, UK: Random House.

Rockström, J., Steffen, W., Noone, K., . . . Foley, J., 2009. A safe operating space for humanity. *Nature*, 461 (7263), 472-475.

Russell, S., 2021. Water, 365-376. In Bebbington, J., Larrinaga, C., O’Dwyer, B. and Thomson, I. (eds), (2021b). *Routledge Handbook on Environmental Accounting*. Abingdon, UK: Routledge.

Russell, S., Milne, M. J., & Dey, C., 2017. Accounts of nature and the nature of accounts: Critical reflections on environmental accounting and propositions for ecologically informed accounting. *Accounting, Auditing & Accountability Journal*, 30(7), 1426-1458.

Schaberg, C., 2020. *Searching for the Anthropocene: A Journey into the Environmental Humanities*. New York, USA: Bloomsbury.

Schwab, K. (with Vanham, P.), 2021. *Stakeholder Capitalism: A Global Economy that Works for Progress, People and Planet*. Hoboken, USA: Wiley.

Schwab, K. and Malleret, T., 2020. *Covid-19: The great reset*. Geneva, Switzerland: World Economic Forum.

Scoones, I., Stirling, A., Abrol, D., ... and Yang, L., 2020. Transformations to sustainability: combining structural, systemic and enabling approaches. *Current Opinion in Environmental Sustainability*, 42, 65-75.

Task Force on Climate-Related Financial Disclosures (2017). *Technical Supplement: The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities*. TCFD, London.

Unerman, J., Bebbington, J. & O'Dwyer, B., 2018. Corporate Reporting and Accounting for Externalities. *Accounting and Business Research*, 48(5) 497-522.

Viridin, J., Vegh, T., Jouffray, J.-B., Blasiak, R., Mason, S., Osterblom, H., Vermeer, D., Wachtmeister, H. and N. Werner. 2021. The Ocean 100: Transnational corporations in the ocean economy. *Science Advances* 7: eabc8041.

Vollmer, H., 2021. Public value and the planet: accounting in ecological reconstitution. *Accounting, Auditing and Accountability Journal*, 34(7), 1527-1554.

Warde, P., Robin, L. and Sörlin, S., 2018. *The Environment: A History of the Idea*. Baltimore, USA John Hopkins University Press:

World Economic Forum, 2020. *Measuring Stakeholder Capitalism Towards Common Metrics and Consistent Reporting of Sustainable Value Creation*. Geneva, Switzerland, World Economic Forum.