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Jan Bebbington, Tom Cuckston, C. Feger

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## Chapter 28- Biodiversity

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**Authors: Jan Bebbington, Tom Cuckston and Clément Feger**

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### Introduction

Our current best estimate of the number of eukaryotic species comprising Earth's biological diversity stands at 8.7 million (Mora, Tittensor, Adl, Simpson, and Worm 2011). Species interact in myriad ways, within different kinds of terrestrial and marine habitats, to form complex ecological systems (Begon, Townsend, and Harper 2006). The United Nations Convention on Biological Diversity (1992, p. 1), given the vital importance of these ecological systems for 'maintaining [the] life sustaining systems of the biosphere', recognises that 'conservation of biological diversity is a common concern of humankind'. Despite this collective sentiment, however, biologists warn that humanity's ongoing impacts upon the natural environment are causing losses of biodiversity at a rate equivalent to a mass extinction event (Ceballos et al. 2015). There remains a fundamental problem that, even if human societies collectively agree that Earth's biodiversity should be conserved, it is very difficult to translate this into effective action at the level of governments, organisations and individuals (Cuckston 2018a, 2018b). In this chapter, we review the emerging stream of research in accounting for biodiversity, which explores possible roles that accounting might play in creating conditions in which it becomes possible to achieve some form of sustainable development that conserves the biodiversity of the planet.

This chapter is structured as follows: in the first section we further examine the global picture of biodiversity loss through an analysis of what Gray and Owen (this volume) call an *account of nature*, the WWF Living Planet Report; in section 2 we evaluate intergovernmental initiatives to establish global governance and accountability frameworks for biodiversity; in section 3 we review research into organisation-level mechanisms of accounting for the biodiversity impacts of production activities and the uses of accounting in the organising of conservation activities; finally, in section 4 we suggest some possible future directions for accounting research that might help enable ecologically and socially sustainable ways of organising and managing Earth's biosphere.

## An Account of Nature

WWF's Living Planet Report is a biennial publication, described as a 'comprehensive study of trends in global biodiversity and the health of the planet' (WWF 2019). These trends are tracked quantitatively, principally via a global indicator that it calls the *Living Planet Index*. This indicator is a measure of wildlife population abundance, calculated using time-series data for 4,005 species of mammals, birds, reptiles, amphibians and fish from different biomes around the planet. The headline result is a stark representation of the scale of Earth's biodiversity loss.

The global index, calculated using available data for all species and regions, shows an overall decline of 60% in the population sizes of vertebrates between 1970 and 2014 (WWF 2018, p. 90).

Using the same database of species, the Living Planet Report also documents the principal threats that are driving wildlife population declines. These are shown to vary across taxonomic groups and across geographic regions, but habitat degradation/destruction (mostly from conversion of land to agriculture) and species overexploitation (especially unsustainable fishing) together account for two-thirds of recorded threats. These are seen to result from 'exploding human population and economic growth' (WWF 2018, p. 22), with rapidly accelerating demands for food, water and energy. Economic development has generated dramatic improvements in quality of life for a great many people. However, these advances in our well-being are only made possible by the life-supporting resources provided by functioning ecological systems.

All our economic activity ultimately depends on nature. It's estimated that, globally, nature provides services worth around US\$125 trillion a year (WWF 2018, p. 11).

Given this fundamental entanglement of the fates of human societies and Earth's biodiversity, it might be assumed that humanity should have a strong collective motivation to act, identifying and instigating some much needed 'major changes to production, supply and consumption activities' (WWF 2018, p. 28). On the contrary, the kind of international collaboration needed to achieve this has, thus far, been lacking.

The extinction of a multitude of species on Earth seems not to have captured the imagination, or attention, of the world's leaders enough to catalyse the change necessary (WWF 2018, p. 10).

Yet the Living Planet Report, and other such *accounts of nature* (cf. Russell, Milne, and Dey 2017), perhaps offer cause for hope. These are accounts that portray both biodiversity's immense value to human societies and economies, and the full extent of the impact that humanity's current ways of organising its societies and economies is having on this biodiversity. Is it possible that, in rendering these realities visible and comprehensible, these accounts might help propel us to seek new ways of organising that allow us to conserve Earth's biodiversity? Can we turn this awareness of our predicament into a vision for a better future and a viable plan to pursue it?

[W]hat the world requires is bold and well-defined goals and a credible set of actions to restore the abundance of nature to levels that enable both people and nature to thrive (WWF 2018, p. 110).

In the next section we will review the existing international governance and accountability frameworks for biodiversity and consider the mechanisms that are meant to compel action by governments and corporations.

### **International governance and accountability frameworks**

Accounting and reporting activities are social artefacts that arise from particular governance contexts within which demands for accountability emerge, based on responsibility being assigned for actions and/or impacts. Taking this perspective, this section will outline the source(s) of responsibility for organisational biodiversity impacts.

At the global level of resolution, the *United Nations Convention on Biodiversity Diversity* provides an overarching source of normativity (see Bebbington, Kirk, and Larrinaga-Gonzalez 2012) that shapes the context in which organisations operate. A key carrier of normativity in this context are the *Aichi Targets* (for a summary see Table 28.1). These goals are addressed to national governments and, through them, provide a point of connection between organisations and the biodiversity outcomes sought. In particular, the goals provide a coherent framework for any organisation to reflect upon their biodiversity and ecosystem services interactions.

**Table 28.1: Strategic goal for biodiversity (see <https://www.cbd.int/sp/targets/> for more detail on specific targets under each goal)**

Address underlying causes of biodiversity loss (and mainstream biodiversity across government and society)

Reduce direct pressures on biodiversity and promote sustainable use (across a number of production sectors and including the cross over impacts of climate change on biodiversity)

Protect and enhance biodiversity by safeguarding ecosystems, species and genetic diversity.

Enhance the benefits that flow from biodiversity and ecosystem services.

Enhancing implementation through participatory planning, knowledge management and capacity building.

Inter-governmental agreements create commitments that are the responsibility of state actors to implement and actions by states will directly affect organisations in the countries in which they operate. Examples of such cascades of requirements include legal and regulatory provisions covering resource extraction, such as the:

- granting of resource extraction permits, rules for harvesting processes and requirements for remediation after corporate activities,
- pollution control, in order to protect biodiversity and the functionality of ecosystems (including point source and diffuse pollution), and
- regulation of competing demands for resources (for example, by setting areas beyond use for conservation).

In this way, the regulatory environment encompasses both conservation concerns as well as the impact of productive sectors.

A more recent overarching inter-governmental attempt to define the goals towards which global society (including organisations) need to address themselves can be found in the *Sustainable Development Goals* (for an accounting-based introduction, see Bebbington and Unerman 2018)). While all the Goals interact and are inter-dependent of each other, four main goals are at the heart of the organisation-biodiversity nexus, namely:

- Responsible Consumption and Production (Goal 12),
- Climate Action (Goal 13),
- Life Below Water (Goal 14), and
- Life on Land (Goal 15).

Responses to the imperatives of the SDGs will also affect the accountability context of organisational activities.

By their nature, the effects of these sources of normativity will vary according to what biodiversity and/or ecosystem service is affected as well what standards are applied. It is also the case that some organisational activities take place in areas that are beyond state jurisdiction, notably in ocean ecosystems. In this context, non-state actors (such as Regional Fisheries Management Organisations) exert influence on organisational responsibilities. There is an ongoing process to address marine biodiversity of areas beyond national jurisdiction – see <https://www.un.org/bbnj/>.

In order for organisations to navigate this context (as well as to address biodiversity well) there are also a myriad of voluntary initiatives and guidelines to support companies across an array of industries. Bebbington, Larrinaga, Russell, and Stevenson (2015) describe some of these including the *Business and Biodiversity Offsetting Programme*, *Natural Value Initiative* and the *Corporate Ecosystem Services Review*. In addition, product certifications (such as those provided by the *Marine Stewardship Council* and the *Forest Stewardship Council*) create a private voluntary regulatory space for organisations to address biodiversity responsibilities. As previously noted in this chapter, translating protection of biodiversity and ecosystems services to organisational levels is non-trivial and it is to this that attention now turns.

### **Organisational-level accounting for biodiversity**

Recently, accounting as both a field of critical research and a space for innovation has turned to the issue of biodiversity conservation. This dynamic has been fuelled by confidence in the fact that accounting has real potential to contribute to the improvement, enforcement and operationalization of the above-mentioned complex systems of accountabilities that are instrumental to biodiversity conservation. We will now review the main research areas that have been explored by accounting for biodiversity research, at the organisational-level and beyond. We will do so by following the triple movement that has so far characterized the development of the field (Feger 2016, chap. 2; Feger and Mermet 2017): *extension* of the historical accountability perimeter of organisations to biodiversity and natural capital; *decentring* from the corporation to study accounts produced in the context of wider biodiversity governance programs and market mechanisms; and actively *re-centring* accounting

research on organized action at the ecosystem-management level to put it at the service of conservation strategies.

At the organisational level, business and biodiversity issues have been increasingly framed as a problem of managing firms' interdependencies with biodiversity and ecosystem services (i.e. the benefits that humans receive from nature), also often conceptualised as « natural capital » (Bishop 2012; van den Burg and Bogaardt 2014). In that perspective, a new family of tools and accounting devices has flourished in the past decade, designed specifically to support managers from different industrial sectors to better identify and reduce the impacts of their activities on biodiversity and ecosystems and/or assess the value that various ecosystem services bring to their organisation in biophysical or monetary terms. Examples include biodiversity life cycle assessment tools (Zhang, Singh, and Bakshi 2010), full cost accounting methods applied to biodiversity issues and used to measure hidden costs associated with ecosystem degradation (Davies 2014), and a large spectrum of *ad-hoc* qualitative and quantitative decision-support tools, frameworks and guidelines designed to analyse risks and opportunities associated with organisations' interdependences with ecosystems (e.g. NCC 2016; Waage and Kester 2015). Other authors have also proposed methods to account for costs and revenues associated with the use of ecosystem services by organisations along their supply chains, and integrate them directly in their existing management accounting systems (Houdet and Germaneau 2014).

Staying at the organisational-level, another strand of accounting for biodiversity research, well in line with social and environmental accounting's main research orientation since its early development, focuses not on the managerial level of decision-making but rather on how organisations (could) develop forms of biodiversity reporting, enabling them to be accountable to external stakeholders regarding their impacts on ecosystems and their commitments to reduce them. Pioneering research on this topic has been the development of a methodology based on structured inventory of fauna, flora and critical habitats under the stewardship of a given organisation (Jones 1996). This approach privileges the intrinsic value of nature rather than an ecosystem services philosophy, often considered as being too anthropocentric (Barter 2015; Jones and Solomon 2013). Biodiversity reporting does not solely concern private organisations and similar research has studied biodiversity reporting in public sector organisations such as the Government of Bangladesh, Australian regional authorities or UK local councils (Gaia and Jones 2017; Siddiqui 2013; Raar 2014).

One important challenge when it comes to organisational disclosure is the need for standardization, or at least for a gradual convergence of the proposed frameworks and indicators that would allow comparability between organisations under a shared narrative. This is particularly difficult for topics as complex and heterogeneous as biodiversity and ecosystem services (Kareiva et al. 2015). Organisations such as the *Global Reporting Initiative* for instance have been proposing indicators on biodiversity (e.g. regarding land management; proximity of activities to protected areas, etc.) as well as on ecosystem services (GRI 2016; 2011; 2007). Other proposals have been put forward such as using indicators developed as part of national and international biodiversity assessment and governance programmes (Thomson, 2014) or frameworks based on species extinction metrics (Atkins and Maroun 2018). With the constant improvement of conservation science and datasets, initiatives to develop corporate-level "biodiversity footprint" tools and synthetic biodiversity indicators based on scientific modelling are now increasing (Lammerant, Müller, and Kisielewicz 2018).

However, recent critical studies of current reporting practices of Swedish, Danish, British, German as well as Top-fortune companies have put into perspective the effectiveness of these biodiversity reporting. They show that information levels on this subject are still very low in the Sustainable Development/CSR reports of big companies (with the exception of highly exposed sectors such as mining) (Boiral 2016; Van Liempd and Busch 2013; Rimmel and Jonäll 2013; Samkin, Schneider, and Tappin 2014; Adler, Mansi, and Pandey 2018; Adler et al. 2017). These studies reflect the progress that is yet to be made in moving towards more specific and quantifiable forms of reporting that would allow satisfactory assessment of firms' responsibilities and commitments on biodiversity (Addison, Bull, and Milner-Gulland 2018).

In the past two decades, research on accounting for biodiversity has pioneered the decentring of the social and environmental accounting agenda beyond the « obsession of the corporation » towards new accounting entities and « new accounts » (Gray, Brennan, and Malpas, 2014). Decentring from the organisational level as the main accounting entity, part of biodiversity accounting research has turned to the critical study of accounting practices emerging along with the development of new biodiversity governance schemes and market mechanisms involving multiple organisations.

Cuckston (2013) for instance analyses how biodiversity conservation is integrated through financial calculations into the construction of new "goods" in emerging carbon markets such as the *Reducing Emissions from Deforestation and forest Degradation* mechanism (REDD). The same author shows how the creation of value for nature under such schemes entails the alienation of people from nature (Cuckston 2018c). In his study of reporting practices under REDD in Kalimantan (Borneo), Khan (2014) proposes the development of a "multi-faceted framework of biodiversity reporting and disclosure" model that would make it possible to account for the impacts of multiple organizations on the area's ecosystems (companies in the palm oil supply chain, environmental NGOs, local administrations that finance conservation projects, the Indonesian government, etc.).

New forms of 'accounts' are also being developed as part of environmental certifications, be it on terrestrial (Eden 2008) or marine ecosystems (Bear and Eden 2008). Borsato et al. (2014) show for instance how the LIFE® Certification program has assessed biodiversity impacts of many companies in Brazil and has developed a rating system of their biodiversity-friendly voluntary actions that creates new forms of accountabilities for companies as well as an incentives to act. Elad (2014) studies the Forest Stewardship Council (FSC) programme and its methods for certifying logging companies in the Congo Basin, and shows how biodiversity monitoring and reporting audits based on fauna/flora inventories are conducted to help ensure a form of control of the quality of forest management by companies.

Turning to biodiversity offsetting mechanisms, Tregidga (2013) and Sullivan and Hannis (2017) provide critical analysis of methods used to create 'biodiversity credits', and question whether biodiversity quantification methods based on financial accounting logics can really lead to better ecosystem protection. Cuckston (2019) studies another type of offsetting mechanism developed by the New South Wales authorities (Australia) based rather on biophysical units, highlighting how more *ecocentric* alternatives exist to progress towards reconciling economic development and biodiversity conservation goals.

Explicitly breaking with an accounting entity approach centred on an organization, a government authority, a well-bounded protected area, or a biodiversity-governance or market mechanism, Dey

and Russell (2014) adopt a system-level conceptualisation of the accounting entity encompassing both the ecosystem itself (a river and its catchments) and the stakeholders operating around it. They analyse how these various actors produce and exchange a variety of accounts around this entity as they pursue diverging courses of action: environmental reports produced by the company in charge of a dam structure; 'external accounts' produced by public regulatory actors or associations and citizens concerned by the quality of the river and its salmon, etc. Feger and Mermet (2017) and Cuckston (2017) adopt similar approaches when respectively re-centring their analytical lens on West Vancouver Island coastal ecosystems and the way natural capital scientists attempt to re-negotiate its future with multiple stakeholders, and on a degraded blanket bog habitat and the works undertaken to restore it.

Developing such an ecosystem-centred or 'accounting for the management of ecosystems' perspectives is now crucial, since when it comes to obtaining measurable ecological performance at the ecosystem-level, conservation practitioners (scientists, NGOs, etc.) often have to act in deeply strategic contexts where the way they produce and/or demand biodiversity accounts is in fact only one dimension of wider collective organized action dynamics that thus require special attention and in-depth analysis (Feger and Mermet 2017). With several decades of critical studies on the intricate links between accounts design and use, on the one hand, and the details of organising decisions and actions in a diversity of organisational contexts, on the other hand, accounting research is now well-equipped to be put at the service of conservation practitioners' actions, strategies and goals (Cuckston 2018a; Feger and Mermet 2017). In that perspective, the foundations for a fruitful interdisciplinary dialogue have now been laid out, between accounting researchers motivated by obtaining results on the biodiversity front and conservation scientists well aware of the limitations of their multiple information tools in creating expected changes (Feger and al. 2018). This dialogue now needs to be pursued and enriched with more empirical case studies, constructive critical reflexivity and theoretical developments at the crossroads of accounting and biodiversity conservation, to contribute to a wider agenda of accounting *for* sustainable development (*Ibid*; Bebbington and Larrinaga 2014).

In the final section, we reflect on some possible future directions for accounting research aimed at advancing society's capacity for pursuing forms of sustainable development that conserve biodiversity.

### **Future directions**

The vast extent to which humanity has come to reshape Earth's biosphere has led geologists to coin the term Anthropocene to describe the current era, in which human society and nature are inseparably entwined (see Crutzen 2002). Returning to the WWF's *Living Planet Report*, the challenge of biodiversity loss is characterised here in terms of how humanity can find a way of continuing to pursue its economic development whilst, in its own interests, conserving nature and sustaining healthy ecological systems. Is it possible that human society and nature can find a sustainable form of co-existence?

It is not known whether a stable Anthropocene state will come to exist. It certainly isn't stable now (WWF 2018).



The *Anthropocene* concept renders biodiversity loss into an organisational challenge, inviting us to seek out ways to organise and manage the biosphere to enable sustainable development that conserves biodiversity (Bebbington et al. 2019; Cuckston 2017). It is a basic premise in the study of accounting as a social practice that accounting constitutes what Miller and Power (2013, p. 587) call a 'productive force', driving and shaping processes of organising by rendering different forms of action thinkable and possible. As such, accounting research offers the potential for valuable insights into how this kind of organising of Earth's biosphere might be pursued.

A recent survey of 9,264 conservationists, seeking to gauge areas of consensus and disagreement on the future of conservation and on 'fundamental questions regarding why, what and how to conserve', enabled Sandbrook et al. (2019, p. 316) to identify three 'dimensions of conservation thinking'. These are people-centred conservation, science-led ecocentrism, and conservation through capitalism. We suggest that accounting research can potentially contribute to thinking within each of these dimensions.

People-centred conservation relates to the role of human participants and stakeholders in conservation work. This is essentially the ethical dimension of conservation thinking, concerned with the effects of conservation on people (especially those living in poverty) and with how to ensure that conservation work has the support of those impacted by it. A key question for community-based conservation, which aims to engage and benefit local people, ensuring fair and just access to natural resources, is how to encourage and enable people to accept responsibility for conserving the biodiversity around them and to act in ways conducive to its protection. The accounting academe has studied, in numerous contexts, how the calculative devices of accounting work to invent and shape particular calculating selves, capable of being organised and managed (Miller 2001; Vollmer 2019). It may be that insights generated from this kind of research can provide a basis for studies of how various calculative devices can/should be deployed in organising and managing community-based conservation initiatives.

Science-led ecocentrism is a dimension of conservation thinking concerned with how the work of conserving species and ecosystems is informed and guided by the biological sciences. A key question for science-led conservation is how ecological principles and knowledge can be deployed in the management of protected areas, including areas subject to so-called sustainable management practices. The accounting academe has studied, in numerous contexts, how codified knowledge – especially economics – comes to be embodied within, and performed by, the calculative devices of accounting (Hopwood 1992; Skaerbaek and Tryggstad 2010). It may be that insights from this kind of research can provide a basis for studies of how the biological sciences can/should be operationalised within various calculative devices used to organise and manage different kinds of protected areas.

Conservation through capitalism relates to the role of corporations, economic metaphors and market-based approaches. This is the dimension of conservation thinking that has so far attracted the most attention from accounting scholars. A fundamental question for the conservation movement is how, if at all, the capitalist economic model can be shifted to make it less ecologically destructive and more capable of reconciliation with conservation objectives. Much accounting research has been highly pessimistic about the prospects of such a shift (Gray and Milne 2018). Yet, emerging work in accounting for sustainable development holds out the promise of an enabling role for accounting

practice and research in addressing the ecological and social challenges facing humanity (Bebbington and Larrinaga 2014; Bebbington and Unerman 2018). Might it be that this mode of accounting research can provide insights into how production landscapes and ocean spaces, can/should be organised and managed by corporations and through market mechanisms in ways that make these less hostile to wildlife and more supportive of ecological processes?

In the era of the Anthropocene, accounting research has a potentially pivotal role to play in envisaging a future where Earth's biosphere is organised and managed in ways that are ecologically and socially sustainable.

## References

- Addison, P., Bull, J., and Milner-Gulland, E., 2018. Using conservation science to advance corporate biodiversity accountability. *Conservation Biology*, 33 (2), 307–328.
- Adler, R., Mansi M., and Pandey, R., 2018. Biodiversity and threatened species reporting by the top Fortune Global companies. *Accounting, Auditing and Accountability Journal*, 31 (3), 787–825.
- Adler, R., Mansi M., Pandey, R., and Stringer, C., 2017. United Nations Decade on Biodiversity: A study of the reporting practices of the Australian mining industry. *Accounting, Auditing and Accountability Journal*, 30 (8), 1711–1745.
- Atkins, J., and Maroun, W., 2018. Integrated extinction accounting and accountability: building an ark. *Accounting, Auditing and Accountability Journal*, 31 (3), 750–786.
- Barter, N., 2015. Natural capital: dollars and cents/dollars and sense. *Sustainability Accounting, Management and Policy Journal*, 6 (3), 366–373.
- Bear, C., and Eden, S., 2008. Making space for fish: the regional, network and fluid spaces of fisheries certification. *Social and Cultural Geography*, 9 (5) 487–504.
- Bebbington, J., Kirk, E., and Larrinaga-Gonzalez, C., 2012. The production of normativity: a comparison of reporting regimes in Spain and the UK. *Accounting, Organizations and Society*, 37 (2), 78–94.
- Bebbington, J., and Larrinaga, C., 2014. Accounting and sustainable development: an exploration. *Accounting, Organizations and Society*, 39 (6), 395–413.
- Bebbington, J., Larrinaga, C., Russell, S., and Stevenson, L., 2015. Organizational, management and accounting perspectives on biodiversity. In A. Gasparatos and K. Willis, eds. *Biodiversity in the green economy*. London: Routledge, 213-239.
- Bebbington, J., and Unerman, J., 2018. Achieving the United Nations Sustainable Development Goals: an enabling role for accounting research. *Accounting, Auditing and Accountability Journal*, 31 (1), 2-24.
- Bebbington, J., Österblom, H., Crona, B., Jouffray, J., Larrinaga, C., Russell, S., and Scholtens, B., 2019. Accounting and accountability in the Anthropocene. *Accounting, Auditing and Accountability Journal*, In Press, <https://doi.org/10.1108/AAAJ-11-2018-3745>
- Begon, M., Townsend, C., and Harper, J., 2006. *Ecology: from individuals to ecosystems*. Oxford: Blackwell.
- Bishop, J., ed., 2012. *The economics of ecosystems and biodiversity in business and enterprise*. London and New York: Earthscan.
- Boiral, O., 2016. Accounting for the unaccountable: biodiversity reporting and impression management. *Journal of Business Ethics*, 135 (4), 751–768.
- Borsato, R., Filho, J.T.M., Milano, M.S., Salzmann, A.M., Brasil, B., Alexandre, M.A., De Lourdes Da Silva Nunes, M., Borges, C., and Posonski, M., 2014. Biodiversity accountability in Brazil: the

- role of LIFE certification. In: M.J. Jones, ed. *Accounting for Biodiversity*. Oxon: Routledge, 172–188.
- van den Burg, S.W.K., and Bogaardt, M.J., 2014. Business and biodiversity: a frame analysis. *Ecosystem Services*, 8, 178–184.
- Ceballos, G., Ehrlich, P., Barnosky, A., Garcia, A., Pringle, R., and Palmer, T., 2015. Accelerated modern human-induced species losses: entering the sixth mass extinction. *Science Advances*, 1 (5), e1400253.
- Crutzen, P., 2002. Geology of mankind. *Nature*, 415, 23.
- Cuckston, T., 2013. Bringing tropical forest biodiversity conservation into financial accounting calculation. *Accounting, Auditing and Accountability Journal*, 26 (5), 688–714.
- Cuckston, T., 2017. Ecology-centred accounting for biodiversity in the production of a blanket bog. *Accounting, Auditing and Accountability Journal*, 30 (7), 1537–1567.
- Cuckston, T., 2018a. Making accounting for biodiversity research a force for conservation. *Social and Environmental Accountability Journal*, 38 (3), 218–226.
- Cuckston, T., 2018b. Making extinction calculable. *Accounting, Auditing and Accountability Journal*, 31 (3), 849–874.
- Cuckston, T., 2018c. Creating financial value for tropical forests by disentangling people from nature. *Accounting Forum*, 42 (3), 219–234.
- Cuckston, T., 2019. Seeking an ecologically defensible calculation of net loss/gain of biodiversity. *Accounting, Auditing and Accountability Journal*, 32 (5), 1358–1383.
- Davies, J., 2014. Full cost accounting - integrating biodiversity. In: M.J. Jones, ed. *Accounting for Biodiversity*. Oxon: Routledge, 81–102.
- Dey, C., and Russell, S., 2014. Who speaks for the river? Exploring biodiversity accounting using an arena approach. In: M.J. Jones, ed. *Accounting for Biodiversity*. Oxon: Routledge, 245–266.
- Eden, S., 2008. Being fieldworthy: environmental knowledge practices and the space of the field in forest certification. *Environment and Planning D: Society and Space*, 26 (6), 1018–1035.
- Elad, C., 2014. Forest certification and biodiversity accounting in the Congo basin countries. In: M.J. Jones, ed. *Accounting for Biodiversity*. Oxon: Routledge, 189–211.
- Feger, C. 2016. “Nouvelles comptabilités au service des écosystèmes. Une recherche engagée auprès d’une entreprise du secteur de l’environnement.” Sciences de gestion, Paris: AgroParisTech. <https://pastel.archives-ouvertes.fr/tel-01563379/document>.
- Feger, C., and Mermet, L., 2017. A blueprint towards accounting for the management of ecosystems. *Accounting, Auditing and Accountability Journal*, 30 (7), 1511–1536.
- Gaia, S., and Jones, M.J., 2017. UK local councils reporting of biodiversity values: a stakeholder perspective. *Accounting, Auditing and Accountability Journal*, 30 (7), 1614–1638.
- Gray, R., Brennan, A., and Malpas, J., 2014. New accounts: towards a reframing of social accounting. *Accounting Forum*, 38 (4), 258–273.
- Gray, R., and Milne, M., 2018. Perhaps the Dodo should have accounted for human beings? Accounts of humanity and (its) extinction. *Accounting, Auditing and Accountability Journal*, 31 (3), 826–848.
- GRI, 2007. *Biodiversity: a GRI reporting resource*. Amsterdam: Global Reporting Initiative.
- GRI, 2011. *Approach for reporting on ecosystem services. Incorporating ecosystem services into an organization’s performance disclosure*. Global Reporting Initiative. <https://www.globalreporting.org/resourcelibrary/Approach-for-reporting-on-ecosystem-services.pdf>.
- GRI, 2016. *GRI 304: Biodiversity*. Amsterdam: Global Reporting Initiative.
- Hopwood, A., 1992. Accounting calculation and the shifting sphere of the economic. *The European Accounting Review*, 1, 125–143.
- Houdet, J., and Germaneau, C., 2014. Accounting for biodiversity and ecosystem services from an EMA perspective: towards a standardised biodiversity footprint methodology. In: M.J. Jones, ed. *Accounting for Biodiversity*. Oxon: Routledge, 62–80.

- Jones, M.J., 1996. Accounting for biodiversity: a pilot study. *British Accounting Review*, 28 (4), 281–303.
- Jones, M.J., and Solomon, J.F., 2013. Problematising accounting for biodiversity. *Accounting, Auditing and Accountability Journal*, 26 (5), 668–687.
- Kareiva, P., McNally, B., McCormick, S., Miller, T., and Ruckelshaus, M., 2015. Improving global environmental management with standard corporate reporting. *PNAS*, 112 (24), 7375–7382.
- Khan, T., 2014. Kalimantan’s biodiversity: developing accounting models to prevent its economic destruction. *Accounting, Auditing and Accountability Journal*, 27 (1), 150–182.
- Lammerant, J., Müller, L., and Kisielewicz, J., 2018. *Biodiversity accounting approaches for businesses. Discussion paper for EU Business and Biodiversity Platform*. Draft report.
- Miller, P., 2001. Governing by numbers: why calculative practices matter. *Social research*, 68 (2), 379–396.
- 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.
- Mora, C., Tittensor, D., Adl, S., Simpson, A., and Worm, B., 2011. How many species are there on Earth and in the ocean? *PLOS Biology*, 9 (8), e1001127.
- NCC, 2016. *Natural Capital Protocol*. Natural Capital Coalition. [www.naturalcapitalcoalition.org/protocol](http://www.naturalcapitalcoalition.org/protocol).
- Raar, J., 2014. Biodiversity and Regional Authorities: A common-pool resources and accounting perspective. In: M.J. Jones, ed. *Accounting for Biodiversity*. Oxon: Routledge, 103–123.
- Rimmel, G., and Jonäll, K., 2013. Biodiversity reporting in Sweden: corporate disclosure and preparers’ views. *Accounting, Auditing and Accountability Journal*, 26 (5), 746–78.
- Russell, S., Milne, M., and Dey, C., 2017. Accounts of nature and the nature of accounts: critical reflections on environmental accounting and propositions for ecologically informed accounting. *Accounting, Auditing and Accountability Journal*, 30 (7), 1426–1458.
- Samkin, G., Schneider, A., and Tappin, D., 2014. Developing a reporting and evaluation framework for biodiversity. *Accounting, Auditing and Accountability Journal*, 27 (3), 527–562.
- Sandbrook, C., Fisher, J., Holmes, G., Luque-Lora, R., and Keane, A., 2019. The global conservation movement is diverse but not divided. *Nature Sustainability*, 2, 316–323.
- Siddiqui, J., 2013. Mainstreaming biodiversity accounting: potential implications for a developing economy. *Accounting, Auditing and Accountability Journal*, 26 (5), 779–805.
- Skaerbaek, P., and Tryggestad, K., 2010. The role of accounting devices in performing corporate strategy. *Accounting, Organizations and Society*, 35 (1), 108–124.
- Sullivan, S., and Hannis, M., 2017. ‘Mathematics maybe, but not money’: on balance sheets, numbers and nature in ecological accounting. *Accounting, Auditing and Accountability Journal*, 30 (7), 1459–1480.
- Thomson, I., 2014. Biodiversity, International Conventions, Government Strategy and Indicators: The Case of the UK. In: M.J. Jones, *Accounting for Biodiversity*. Oxon: Routledge, 149–171.
- Tregidga, H., 2013. Biodiversity Offsetting: Problematisation of an Emerging Governance Regime. *Accounting, Auditing and Accountability Journal*, 26 (5), 806–832.
- UN, 1992. *Convention on Biological Diversity*. New York: United Nations.
- Van Liempd, D., and Busch, J., 2013. Biodiversity reporting in Denmark. *Accounting, Auditing and Accountability Journal*, 26 (5), 833–872.
- Vollmer, H., 2019. Accounting for tacit coordination: the passing of accounts and the broader case for accounting theory. *Accounting, Organizations and Society*, 73, 15–34.
- Waage, S., and Kester, C., 2015. Making the invisible visible: analytical tools for assessing business impacts and dependencies upon ecosystem services. BSR. [http://www.bsr.org/reports/BSR\\_Analytical\\_Tools\\_for\\_Ecosystem\\_Services\\_2015.pdf](http://www.bsr.org/reports/BSR_Analytical_Tools_for_Ecosystem_Services_2015.pdf)
- WWF, 2018. *Living Planet Report - 2018: aiming higher*. Gland, Switzerland: WWF.
- WWF, 2019. *What is the Living Planet Report?* Retrieved from [https://wwf.panda.org/knowledge\\_hub/all\\_publications/living\\_planet\\_report\\_2018/](https://wwf.panda.org/knowledge_hub/all_publications/living_planet_report_2018/)

Zhang, Y.I., Singh, S., and Bakshi, B.R., 2010. Accounting for ecosystem services in life cycle assessment, Part II : toward an ecologically based LCA. *Environmental Science and Technology*, 44 (7), 2624–2631.