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Christopher Holmes  and David Yarrow 

Abstract

This paper analyses the rise of environmental accounting in global governance via a case study of the UN System of Environmental-Economic Accounting. We draw on recent literature that highlights the boundary between ‘economy’ and ‘non-economy’ as an important site of politics, and which establishes the key role of accounting practices in constructing that boundary. We show how the conceptual framework underpinning emergent global environmental accounting standards attempts to distinguish economy from non-economy in a way consistent with mainstream macroeconomic thought. However, and in contrast to existing critical accounts, we demonstrate that attempts to draw a clear boundary between the ‘economic’ and ‘non-economic’ aspects of the environment sometimes end up de-stabilizing that very distinction, establishing heterogeneous

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2 *Economy and Society*

notions of economic value that are increasingly inconsistent with standard national accounting practices.

Keywords: environmental accounting; UN SEEA; measurement; national accounts; the market.

Introduction

Since the creation of the UN System of National Accounts (SNA) in 1953, economic growth as measured by gross domestic product (GDP) has served as the key global metric of governmental performance, prosperity and development (Fioramonti, 2013; Lepenies, 2016; Philipsen, 2015). However, decades of academic work has highlighted the limitations of GDP as a proxy for welfare, especially its failure to reflect the growing ecological, psychological and social ‘externalities’ of economic growth (Coyle, 2014). The stock response of economists has been to point out that GDP was never intended as a welfare measure, but rather as a narrow measure of output. However, given its widespread (mis)use, a growing number of politicians, NGOs and international organizations have advocated for developing alternative ways of measuring progress (Fleurbaey & Blanchet, 2013; Kubiszewski *et al.*, 2013). Since the 1970s, a panoply of alternative indices has emerged, including the Human Development Indicator, the Genuine Progress Indicator and Green GDP (see Cobb & Cobb, 1994; Eisner, 1988; Nordhaus & Tobin, 1973). Following the landmark publication of the Stiglitz Commission in 2009 (Stiglitz *et al.*, 2010), these have been complemented by a variety of official ‘beyond-GDP’ statistical programmes undertaken by state agencies and supranational bodies, grounded in a more formal accounting approach (see Hoekstra, 2019). These are aimed at (*inter alia*) making inequality more visible in national accounting data (OECD, 2013; ONS, 2015); expanding estimates of national income to include non-market work (ONS, 2016); and expanding the measurement of national capital to account for non-produced resources such as human capital (UNECE *et al.*, 2013; World Bank, 2021).

Key interventions in critical political economy and science and technology studies have understood the invention of GDP and national accounting as an important moment in the wider historical construction of ‘the economy’ (Çalışkan & Callon, 2009; Mitchell, 1998, 2002, 2008). For such scholars, the idea of a self-contained economic sphere relies upon contingent and unstable boundaries between ‘the economy’ on one hand, and the ‘non-economic’ realms of society and the environment on the other. As Timothy Mitchell puts it:

The economy must be constructed as a whole, with a boundary that marks its exterior. The boundary is established by excluding what is determined as non-economic. In this more complex sense, too, the economy depends upon the non-economic – and never quite succeeds in excluding it. (Mitchell, 1998, p. 99)

Mitchell argues that the development of GDP played a decisive role in consolidating these boundaries, suggesting that: '[The] elaboration of what came to be called the Gross National Product of each economy made it possible to represent the size, structure and growth of this new totality ... and imagine its existence as something natural [and] bounded' (Mitchell, 1998, p. 90). National accounting is thus seen as *productive* of economic reality, rather than merely descriptive of it (see also MacKenzie, 2008; Muniesa, 2014). By inscribing these boundaries in political discourse and practice, the idea of 'the economy' as a discrete object is normalized through routinized statistical production, becoming a common-sense part of the political lexicon, in turn shaping what kinds of governance and policy are conceivable.

If, as these authors have shown, GDP and the national accounts were fundamental to creating the idea of 'the economy' in the twentieth century, this paper asks: what are the implications of contemporary beyond-GDP statistical reforms for the idea of 'the economy' today? This question is of immediate interest for understanding the evolution of environmental economic governance, but it also has broader significance. 'The economy' remains a central ordering concept for the governance of society at all levels, so any projects which involve its reconfiguration have the potential for wider impact.

In this paper we seek to answer this question by focusing on the development of global environmental and ecosystem accounting practices. At the global level, one of the most prominent beyond-GDP statistical reforms has been the development of the UN System of Environmental-Economic Accounting (SEEA), an extension of the UN System of National Accounts (SNA). The SEEA, adopted by the UN General Assembly in 2012 as a UN statistical standard, complements the SNA by providing a 'a multipurpose conceptual framework for understanding the interactions between the economy and the environment ... [that] puts statistics on the environment and its relationship to the economy at the core of official statistics' (UN, 2014a, p. vii). It has become a key conceptual and methodological framework for standardizing the way in which nature is incorporated into national accounting and statistical systems, and consequently plays an important role in (re-)structuring how the boundaries between the human economy and the natural environment are represented, both in research and policy practice, and at multiple levels of governance (e.g. Ruijs *et al.*, 2019; Vardon *et al.*, 2022; World Bank, 2021). Given this role in setting norms and practices across a diverse range of contexts, the SEEA provides the ideal case study for examining the implications of beyond-GDP statistical reforms for 'the economy' as an idea.

Existing literature on beyond-GDP statistical reforms falls into two categories, which we can characterize in terms of Robert Cox's (1981) distinction between 'problem-solving' and 'critical' approaches. Problem-solving approaches to an issue, for Cox, take 'the prevailing social and power relationships and the institutions into which they are organized as the given framework of action' (Cox, 1981, p. 128). In this vein, architects and supporters of beyond-GDP reforms take a view in which there is little need to problematize our basic

conception of the economy in order to successfully incorporate environmental priorities into policymaking. The aim, rather, is to produce as more complete a set of information on the social and environmental externalities of economic production (e.g. Bateman *et al.*, 2013; Stiglitz *et al.*, 2010; World Bank, 2021). Though practical and political challenges are frequently recognized, the assumption is that, by addressing these information failures, national and global policy elites can better address these issues in a holistic and top-down manner.

Against this, critical perspectives, according to Cox (1981), seek to explicitly bring into question the institutions, ideologies and power relations surrounding an issue as a strategy for thinking through, and bringing about, change to the existing order (pp. 129–130). Critical approaches to GDP-centrism tend to proceed in this vein, advocating a fundamental challenge to mainstream economic reasoning and the growth imperative, sometimes on ‘de-growth’ (Latouche, 2009) grounds. By this account, centralized statistical projects at best fail to unpack the social and political determinants of growth-centrism under capitalism, and at worst serve to co-opt the transformative potential of post-growth ideas and practices (Spash, 2021), promoting the commodification of nature (Gomez-Baggethun & Ruiz-Perez, 2011) or serving corporate greenwashing agendas (Spash & Hache, 2022).

This paper moves beyond critical accounts of beyond-GDP statistical reforms by highlighting the contradictory and incomplete nature of new valuation practices occurring under its banner, and by foregrounding their potential to create new terrains of conceptual uncertainty and contestation (Barry, 2002; Callon, 2010). By examining the UN SEEA and broader developments in ecosystem accounting, we show how the conceptual clash between economy and environment is both insurmountable and productive. It is insurmountable in the sense that efforts to engage or overcome it via statistical innovation are necessarily incomplete, because it is impossible to perfectly capture the multifaceted value of the environment in a way compatible with the foundational assumptions and categories of national accounting. The clash is productive, however, in the sense that engaging it potentially establishes new resources for contesting and politicizing the way in which the economy is represented. While this does not guarantee transformative outcomes, we argue that dismissing these initiatives as a simple extension of economic reasoning to the natural world forecloses their (productive) *failure* to straightforwardly fold complex environmental and ecological processes and values into the conceptual apparatus of mainstream economics.

This argument proceeds in five sections. The first reviews existing literature on beyond-GDP and environmental accounting. The second explores significant interventions into the history of the idea of ‘the economy’, starting with Karl Polanyi and Tim Mitchell’s analysis of the economy/non-economy boundary. We then move on to recent literature on the performativity of economics, which has highlighted the way in which measurement and accounting technologies can contribute to the redrawing of that boundary to create new forms of political contestation. This provides us with the conceptual language

necessary to make visible the political challenges that innovations in environmental accounting might present today.

The final three sections present an empirical analysis of the UN SEEA, drawing on methodological documents, official reports and interviews with accounting and statistical experts. Firstly, we show how, while the global environmental accounting agenda contests the primacy given to economic growth, the methods and concepts that underpin it tend to reproduce market-centric understandings of the economy. Secondly, however, we show how the very process of operationalizing these distinctions has tended to reveal their internal limitations, by making explicit the inherent embeddedness of markets in ecological processes. Finally, by analysing the more recent emergence of ecosystem accounting as a supplement to the central SEEA framework, we argue that the environmental accounting agenda has potential, though largely unrealized at present, to promote a more pluralistic view of economic values and policymaking. This potential does not arise from the stated aims of the project itself – i.e. the effort to establish economic values for a wider range of environmental externalities – but rather through the way in which the project reveals the inherent contingency and limits of unitary, macroeconomic constructions of ‘the economy’.

Perspectives on ‘beyond GDP’ statistical reform

In 1972, Donella Meadows, one of the authors of the Club of Rome’s influential *Limits to Growth* report, argued that:

Changing indicators can be one of the most powerful and at the same time one of the easiest ways of making system changes ... It only requires delivering new information to new places ... if there are good indicators of sustainable development, it will be almost impossible not to make decisions and take actions that make the indicators improve. (Meadows, 1998, p. 5)

Such problem-solving perspectives tend to offer a cautiously optimistic perspective on the potential of measurement reforms to effect transformative, top-down change. The conflation of GDP with welfare, in this account, is an information failure which distorts political debate by putting undue emphasis on economic growth over other concerns (Whitby *et al.*, 2014, p. 13). This outlook is reflected in the 2009 Stiglitz Commission report, which argued:

If we have the wrong metrics, we will strive for the wrong things ... We see the world through lenses not only shaped by our ideologies and ideas but also shaped by the statistics we use to measure what is going on ... flawed or biased statistics can lead us to make incorrect inferences. (Stiglitz *et al.*, 2010, pp. xvii–xix)

In this view, beyond-GDP measurement reforms allow governments and citizens to better understand trade-offs between ‘economic’ and ‘non-economic’

objectives such as sustainability (e.g. Kubiszewski *et al.*, 2013, p. 58). Environmental accounting contributes by providing a statistical picture of the environmental costs of market activity.

Ecosystem accounting initiatives, of which the SEEA is the most globally significant, typically proceed in a similar manner, where the emphasis is on constructing a picture of the value and condition of the environment compatible with conventional national accounting (Bateman *et al.*, 2013; Bateman & Mace, 2020; Mace *et al.*, 2012, 2015). Although it is frequently recognized that this is an imperfect exercise requiring judgment, negotiation and ongoing revision, this is, for such authors, a pragmatic move that translates environmental concerns into a language that policymakers understand and can act on. Ian Bateman and Georgina Mace (Bateman *et al.*, 2013; Bateman & Mace, 2020), for example, have worked with the UK treasury and other regulatory bodies on developing natural capital accounting methodologies, and their work starts from a problem-solving position in that it seeks to facilitate as complete a description of the environment in economic terms for policymakers as possible. Whilst recognizing the problems inherent in trying to capture nature statistically, they argue that monetary value is the ‘least-worst’ (Bateman & Mace, 2020, p. 4) measure of value for natural capital accounting, on the basis of its ability to commensurate different environmental harms and benefits.

Critical perspectives are much more radical in their assessment of the changes needed to address the kinds of concerns raised under the beyond-GDP banner. In line with Cox’s formulation (1981, p. 129), such perspectives start from a fundamental critique of market-centric understandings of economy and society, and the constraints that this ideational structure exercises on political discourse (e.g. Fotopoulos, 2007, p. 2; Spash, 2021), often emphasizing the need to localize economic decision-making (Latouche, 2009). In consequence, statistical representation in elite policy spaces remains unexplored as a potential site of politics, because genuine political alternatives must come ‘from below’ (Fioramonti, 2013, pp. 82–144). Post-growth accounting efforts are generally dismissed as a mere ‘smokescreen exercise to “humanize” statistical accounting’ (Fioramonti, 2013, p. 114).

Sian Sullivan has developed critical themes in relation to environmental accounting specifically. Whilst not hailing from a de-growth perspective, she argues that establishing the commensurability of nature via monetary valuation is unwise, partly because environmental harms and benefits are heterogenous, but also because naming nature ‘natural capital’, and thereby making it amenable to economic calculation, opens the potential for exploitation and profit generation by those already endowed with power in capitalism – high-net-worth individuals, investors and banks – whilst marginalizing other potential narratives of nature (Sullivan, 2017a, 2017b).

Sullivan’s suspicions are rooted in a lineage of critical thought, stretching back to Max Weber at least, which implicates quantification, measurement and calculation as logics of power unique to post-enlightenment society, both within the modern bureaucratic state and in the disciplinary accounting

technologies of capitalist enterprise (see Foucault, 2010; Miller & Napier, 1993; Porter, 1996; Scott, 1998). Here, quantification is seen as a technocratic tool which de-politicizes economic knowledge and entrenches broader neoliberal governing logics (Lehtonen, 2015; Miller, 2008; Miller & Rose, 1990; Rose, 1991). Accordingly, the problem-solving approach underestimates the degree to which statistical representation is itself a medium of politics. Despite the purported aim to produce paradigm change, there are important ways in which a problem-solving approach might therefore reinforce, rather than challenge, existing ways of thinking about the economy.

In this paper, we start from the same analytical premises as critical scholars: the way in which we describe things is not politically neutral, because it constructs the conceptual space within which people and nature are governed, and we ought to be suspicious of any notion that the language of capital accumulation can so easily be bent towards environmental concerns. But we want to push the insights of critical scholars further by thinking about the unintended consequences of efforts to extend the calculative apparatus of capitalism to the environment. Our argument is that, because it is impossible to straightforwardly apply concepts and statistics designed for capitalist growth to the environment and global ecosystems, we should be alert to the ways in which the effort to do so might de-stabilize and re-politicize the economy as an idea. This is not to endorse efforts to render the environment 'legible' (Scott, 1998, p. 2) to capitalism, but rather to reveal nuances in the conceptual conflict between economy and environment in practice. The next section provides the theoretical basis for this argument.

Constructing the economic/non-economic boundary

The act of representation plays a role in constructing the categories of thought one uses to understand a thing's existence, and Karl Polanyi was one of the first to recognize this dynamic in relation to the way we understand economy and society. For Polanyi (2001 [1944]), the emergence of the notion of market self-regulation in the nineteenth century was pivotal because it embodied the assumption that utilitarian incentives were universal to all human beings, and hence markets, whether for workers, land, or financial resources, produced a natural, even inevitable, distribution of costs and benefits across society. In this view, the market was 'disembedded' from society and the natural world; a system with its own internal laws of motion (Polanyi, 1968, p. 81). For Polanyi, this representation could never be complete because of the 'embedded' nature of the economy: the economy was, in Polanyi's view, a product of social relations between people, political relations between states and ecological relationships between people and the natural environment, systems which bore no necessary relation to utilitarian assumptions, and which were thus not 'economic' in the sense suggested by the self-regulating market view (Polanyi, 2001 [1944], p. 48; 1968, p. 120). When industrial growth produced

new social and ecological ills, the disembedded view of economy-as-market did not provide the conceptual resources necessary to tackle them. Instead it became fashionable to view poverty, social upheaval and the destruction of the natural environment as arising from political interference with the utilitarian incentives within markets, rather than as effects arising from the market system itself, which might be addressed politically.

A second key episode in the construction of ‘the economy’ occurred with the genesis of macroeconomics in the twentieth century. In the 1930s, the notion of markets as self-regulating systems had been challenged by global depression and the collapse of the gold standard. The liberal view of economy was crumbling, replaced by widespread demands for activist state management of the economy, from the US New Deal to fascism to communism. Yet, as Tim Mitchell (1998, 2002) has shown, it was precisely at this time that the principle of utility maximization became truly mathematized and spatially fixed into the geographically bounded notion of ‘the economy’ that we are familiar with today:

Only towards the end of the 1930s was the new idea of ‘the economy’ realized ... as the sphere of rational and numerical calculation, it was the one most easily represented in statistical and algebraic forms. For this reason, the most abstract and mathematical of the social sciences, economics, claimed the task of representing what seemed the most real aspect of the social world. (Mitchell, 1998, p. 82)

In this period, new statistics – GDP, but also standardized interest rates, price levels, real wages, etc. – were developed by international institutions, and new classes of experts – macroeconomists – emerged to use and disseminate them. In result, ‘it became possible to imagine the economy as a self-contained sphere, distinct from the social, the cultural, and other spheres’ (Mitchell, 1998, p. 93).

These accounts highlight how conceptually fixing the economy can depoliticize it by establishing boundaries between economy and non-economy, and by establishing technocratic, rather than political or democratic, governance as the appropriate logic for understanding the economy. Yet recent sociological work on the ‘performativity’ of economics has extended this argument to also emphasize how statistical technologies and measurement systems can open up new sites of political contestation (Barry, 2002). Andrew Barry (2002), for example, has emphasized what he terms the ‘fragility of metrological regimes’, noting (in the context of debates about rail privatization) that because: ‘standardised procedures will not be able to capture the complexity of objects and practices in actuality ... far from creating a clean and secure connection between the world of politics and the world of the economy, measurement becomes a conduit for contamination’ (pp. 275–280). Consequently, Barry argues that ‘[While] sociologists have long argued [that] calculation tends to function as an “anti-political” device ... In practice, metrological and calculative practices may serve to open up new objects to political reflection and contestation’ (Barry & Slater, 2002, p. 181).

This is also reflected in the concept of ‘overflowing’ developed by Michel Callon. Callon suggests that any construction of a boundary between the

economy and that which is left outside it (for instance, ‘the environment’) necessarily creates new entanglements, ambiguities and controversies:

Politics, involved in a certain definition of the economy and economic markets, is found in the misfires and overflowings inevitably produced by this formatting ... Saying and doing the economy – because all economies are said and done – means entering into the agonistic field where the delimitation-bifurcation between the economy and politics is constantly being debated and played out. Structurally, the performativity of economics implies a demarcation between that which is economic and that which is not. Every economic performance programme calls for a counter-programme which takes as its starting point that which was left out. (Callon, 2010, pp. 164–165)

In contrast to the major historical turning points surveyed by Polanyi and Mitchell, Callon thus visualizes an equally politically significant, but more fluid, economy/non-economy boundary which is being reconfigured in smaller ways all the time.

Applying these intuitions to our case, we can venture that the ongoing global environmental accounting agenda may not *necessarily* have the straightforwardly technocratic, depoliticizing effects on political understandings of environmental values that existing critical accounts suggest. Any new drawing of the boundary between economy and environment potentially creates space to destabilize dominant understandings of what the economy is. The remainder of the analysis draws on this conceptual framework to assess how the development of global environmental accounting standards has attempted to incorporate the natural world into the conceptual framework of national accounting.

The disembedded economy in global environmental accounting

Consideration of the environment was explicitly excluded from early national accounting frameworks: the 1953 UN SNA stated that ‘charges made for the depletion of exhaustible natural resources are not included in the provisions for the consumption of fixed capital’ (UN, 1953, p. 7). Yet, ecological critiques of economic growth rose in number over the post-war period (Club of Rome, 1972; Daly, 1987) and became prominent in global governance discourse in the 1980s. The concept of ‘sustainable development’ was popularized by the 1987 report of the UN World Commission on Environment and Development (UNWCED, 1987), and by the 1990s, the search was on for ways of operationalizing this concept in policymaking. With work on the UN’s environmental accounting system still in its infancy, two main approaches were taken: sustainable development indicator dashboards and adjusted national income measures (i.e. Green GDP).

Indicator-based approaches encountered growing criticism during the 2000s (UNECE *et al.*, 2008, p. 3) for lacking conceptual rigour and in the late 2000s

the global approach to measuring sustainability was increasingly reoriented around a more formal accounting framework rooted in neoclassical capital theory (Kulig *et al.*, 2010; Eigenraam & Obst, 2018). Influential in this respect was the joint UNECE, OECD and Eurostat taskforce created by the UN in 2005 (UNECE *et al.*, 2013), which advocated the capital-based approach to sustainability, positing stocks of natural, human and social capital as components of extended national balance sheets:

[T]o assess the potential of future generations to pursue their well-being, information is needed on changes in the stocks of economic, natural, human and social capital. If these stocks are calculated using a common measure and assumptions are made about the substitutability of various capital stocks, changes in the total stock of wealth (per capita) will provide information on the sustainability of the development path of each country. (UNECE *et al.*, 2013, p. 63)

Work by the World Bank (2006), OECD (2001) and UN Environment Programme (UNEP, 2014) also influenced the trend for addressing sustainability from the perspective of capital theory. In 2009, the Stiglitz Commission further cemented this shift, with its final report stating that ‘sustainability requires the simultaneous preservation or increase in several “stocks” ... not only of natural resources but also of human, social and physical capital’ (Stiglitz *et al.*, 2010, pp. 77–78).

Whilst theoretically elegant, this accounting approach was difficult to implement in practice. Neoclassical capital theory, on which contemporary national accounts are based, links the value of a capital good to the discounted market income which they yield their owner (Fisher, 1906). Thus, clear property rights and the ability to produce exchange value are central to establishing the value of an asset in this approach. However, as widely acknowledged, natural and ecological resources share an ambiguous relationship to market exchange: beyond the immediate marketable value of natural resources, they produce collective and public goods that contribute indirectly to market activity, as well as direct welfare benefits to humans that are not reflected in market prices at all. The mainstream response to this problem has been to draw a conceptual line between the ‘economic’ components of natural capital and its ‘non-economic’ components, with an acceptance that the non-economic components of nature are too complex to value monetarily. The monetized economic component could then be used as a macroeconomic aggregate to analyse, for instance, substitution between factors or productivity levels (OECD, 2011).

A 2008 report by the joint UN, Eurostat and OECD taskforce on measuring sustainable development contained an extended discussion about this problem. On the one hand, the taskforce argued that ‘there is good reason to argue that market prices for capital assets come close to theoretically ideal accounting prices. This applies to all financial and produced capital. It also applies to those

elements of natural capital and related products that are commonly traded in the market including, timber, fish, minerals and energy' (UNECE *et al.*, 2008, p. 59). Yet on the other hand, the taskforce accepted that many aspects of natural capital are crucial to the generation of wellbeing, yet could not be linked to market transactions. These assets were designated as falling outside of the economy, as their monetary value cannot be derived from observed market prices:

*Economic wealth measures only the capital base that contributes to market income ... Well-being is also created by 'consuming' non-market flows of goods and services, such as breath-taking scenery on a smog-free day ... [but] economic wealth is equal to the sum of the value of all assets that contribute to market production, including financial, produced, natural, human and social capital. (UNECE *et al.*, 2008, p. 60, emphasis added)*

On this basis, the taskforce recommended a dual set of indicators to measure sustainable development: (1) 'economic wellbeing', understood as a flow measure of market income captured by GDP, accompanied by a monetized 'stock' measure of economic wealth reflecting the market-relevant aspects of natural (and human) capital; and (2) 'foundational wellbeing', representing various non-market forms of welfare, measured by non-monetized indicators of the state of the environment, in physical units.

This approach, to isolate the economic components of natural capital and link these to the generation of market income, was consolidated at the global level with the adoption of UN SEEA framework in 2014, which stated that:

[T]here is no requirement in physical terms that environmental assets must deliver economic benefits to an economic owner ... In physical terms, the measurement scope for each individual component is broad, extending to include all the resources that may provide benefits to humanity. However, in monetary terms, the scope is limited to those individual components that have an economic value based on the valuation principles of the SNA. (UN, 2014a, p. 128)

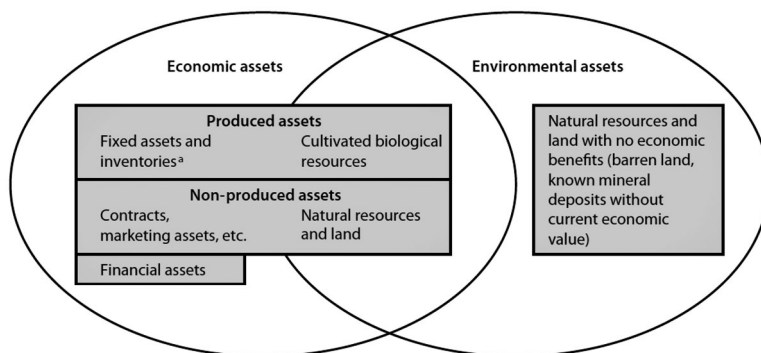
Likewise, the broader 'ecosystem services' rendered by the environment were not included in the core SEEA, but in a separate set of guidelines (UN, 2014b) that were initially experimental but were then formally adopted by the UN Statistical Commission in 2021 (UN, 2021). Whilst the border between the economic and the non-economic is shifted to include aspects of the environment that were not included before in this new approach, the UN SEEA still erects market exchange as a key dividing line. As shown in [Figure 1](#), while 'capital' has been conceptually extended to include environmental and ecological resources, this is kept from threatening the conflation of the economy with market exchange by clearly isolating the economic component of natural wealth (reflected in observed market prices) from its non-economic components (not observable from market prices).

The ecological embeddedness of markets

Despite these efforts to establish a clear boundary between economy and environment, translating the complex reality of ecological processes into the concepts inherited from twentieth-century accounting theory has posed considerable challenges. Paradoxes emerge when treating natural resources subject to property rights as economic, and those held in common as non-economic, both for apparently straightforward provisioning services that nature provides to the market economy, and for the more nebulous ecological systems that are crucial to all human, and therefore economic, activity (the carbon cycle, biodiversity, pollination, etc.).

These problems stem from the underlying neoclassical understanding of capital, where capital is that part of the physical universe subject to property rights (Fisher, 1906). This understanding is reflected in the SEEA, where '[A] distinction is made between whether the resources are cultivated or natural, based on the extent to which there is active management over the growth of the resource' (UN, 2014a, p. 126). Accounting theory has since built on and attempted to clarify these distinctions, in particular aligning them with the SNA concepts of the 'asset boundary', defining economic wealth/capital owned by economic units, and the 'production boundary', defining the generation of economic goods and services from capital assets, labour and intermediate goods (see Eigenraam & Obst, 2018). But when applied to natural assets – which are inevitably bound up with the wider biosphere and complex ecological processes – drawing such clear boundaries is not a simple matter, particularly where natural resources are owned and

Relationship between environmental and economic assets



^a Other than cultivated biological resources.

Figure 1 SEEA boundary between 'economic assets' and 'environmental assets'
Source: UN (2014a, p. 128).

traded in some contexts, but held under collective stewardship, or not subject to clear property rights, in others. Examples include fish stocks, animals, forests and mineral resources. As the SEEA states:

In some cases, the management activity is highly involved, which is the case for battery farming of chickens and the use of greenhouses for horticultural production. In these situations, the unit undertaking the production creates a controlled environment, distinct from the broader biological and physical environment. In other cases, there may be relatively little active management as is the case, for example, with broad-acre cattle farming and the growing of plantation timber. In these cases, the biological resource is exposed constantly to, and interacts as a part of, the broader biological and physical environment ... In practice, it may be difficult to distinguish between cultivated and natural biological resources. (UN, 2014a, p. 126)

This point is illustrated by attempts to define which forestry assets should enter the SEEA. Regarding timber, the SEEA states that ‘determining whether timber resources are cultivated or natural is important in the application of the appropriate accounting treatment’ (UN, 2014a, p. 177). This is due to the different treatment of native unenclosed forests (not treated as an economic asset or a source of production), natural forest that is enclosed, owned and felled (treated as a non-produced asset) and plantation forests (treated as a produced asset).

However, a statistician working on the OECD’s headline natural resources index – a monetary measure of natural capital based on the SEEA – highlighted the practical problems of operationalizing these accounting concepts in practice:

It is difficult to distinguish between cultivated forest and natural forest, and that makes a difference. The nice thing about forests from the valuation side is that forest products are quite widely traded. You can get data on that, you can get the price of timber. But we don’t know what per cent is produced, and what percentage is taken from natural forests. (Interview with author)

Even if it is possible to operationalize these distinctions for accounting purposes, it inevitably leads to somewhat arbitrary distinctions: trees growing in wild unenclosed forests count as neither an economic asset nor as a source of economic production. The same trees, if growing in an enclosed natural forest, would count as a non-produced asset, but would cross the production boundary and count towards GDP only when felled. The same trees, if grown a mile away within a plantation, would count as a produced economic asset and would be included in the production boundary as they are growing, with the volume of timber grown added each year as economic output (see Eigenraam & Obst, 2018, pp. 250–251).

A similar problem occurs when determining which fish stocks are included within the ‘economic’ component of natural capital. Here, the same attempt is

made to draw a distinction between farmed fish stocks, that are counted as a 'fixed capital' asset, and wild fish stocks that are considered to lie outside of the asset boundary:

In practice, the scope [of the asset accounts in the Central Framework] is limited to those aquatic resources that are subject to commercial activity ... [because] farming implies some form of intervention in the rearing process ... [and] individual or corporate ownership of the stock being cultivated. (UN, 2014a, p. 184)

Nevertheless, as with timber, this distinction between enclosed or appropriated dimensions of nature is muddled and transgressed in practice, due to the essential embeddedness of market resources in broader ecological processes. As the SEEA goes on to explain:

In some cases, the life cycle of aquatic resources may start in an aquaculture establishment before transfer to the wild. In other cases, fish are captured in the wild for further growth in aquaculture facilities ... Some aquaculture is undertaken using netted areas in rivers or offshore; hence, there is an interaction between the fish and the aquatic environment in which it is situated ... In practice, it may not be possible to distinguish between cultivated aquatic resources on the basis of the farming practice. (UN, 2014a, p. 186)

As we can see, attempts to implement this distinction reveal how even private, appropriated, natural resources – apparently subject to clear property rights regimes – share a porous boundary with the unappropriated ecosystems with which they constantly interact.

Adding to this problem is the complex nature of the property rights which cover much of the world's environmental resources. Overlapping systems of quotas and access rights exist between countries, governed by various international treaties and agreements, many incompletely monitored and enforced. This is complicated further by migratory animals, as a statistician working on this problem at the OECD explained:

With fish and fisheries, there's the additional problem of international ownership ... property rights are very limited. Even if the fish was *caught* in a certain place, how do we know if it was really from 'that place?' (Interview with author)

Walter Radermacher – head of Eurostat – expressed similar concerns in a discussion paper on natural capital accounting:

The use of natural goods and services leads very often to questions related to the (unclear) property rights of public goods. The oceans, global atmosphere, rainforests, ecosystems could be seen as global public goods. Their use and

degradation is first and foremost a difficult point for political negotiations at international level. (Radermacher & Steurer, 2014, p. 7)

In other words, even for the resources that nature provides directly as inputs to the market economy, it has proved challenging to uphold a neat boundary around those components of the natural world that are enclosed by the system of property rights and those that fall outside it. While much conceptual work has been done to extend and align national accounting concepts and categories with natural resources (Eigenraam & Obst, 2018), the interactions between them are always messy and entangled.

This problem is even more apparent when it comes to the issue of the broader ecosystem services which nature provides. These services produce benefits which are appropriated by private actors in market exchange, but isolating those benefits from the wider 'cultural' and 'social' benefits provided by ecosystems has proven extremely difficult. Debates over the economic benefits of pollination services illustrate this. For instance, a report on ecosystem service accounting by the European Commission and the EEA noted that:

The demand for pollination services is generated by the decision of the farmer to plant crops, which profit from pollination. At this point, wild pollinators deliver economic value which can be measured (or modelled) and accounted for ... As soon as these insects start foraging, ecosystems that host these insect populations have the potential to increase the yield of adjacent crops that are dependent on insect mediated pollination. (European Commission, 2016, p. 26)

As this makes clear, economic value is directly generated by the services of ecosystems that necessarily overflow them, to use Callon's term (2010, p. 164). Thus, even with a narrow measure of the *market* income generated by natural capital, there is no consistent justification for excluding these services.

Even when attempting to focus purely on the narrow market benefits of nature, the SEEA framework encounters the fact that these activities are embedded in wider ecological processes. There is no way to coherently sustain the idea that unenclosed nature merely provides social or cultural services that can be conceptually hived off as the 'non-economic' dimensions of natural capital. Ultimately, as national accounting practitioners implementing the SEEA framework understand, the environmental values on which even narrowly defined market activity depends are impossible to practically isolate from surrounding ecological systems.

Ecosystem accounting and the heterogeneity of economic values

In response to these problems, accountants and scholars are increasingly accepting the need for the co-existence of multiple and more contextual monetary values for environmental resources (ONS, 2012). Bateman, Mace and co-

authors, for example, note that prices established in markets are not always able to produce meaningful values because some types of benefits are not traded (they list water quality and air pollution as examples, Bateman & Mace, 2020, p. 779). They add that in cases where effective non-market valuation is impossible, for example in establishing the full value of biodiversity (see also Bateman *et al.*, 2013; Mace *et al.*, 2012), then alternative approaches should be incorporated into decision-making.

In the context of the SEEA, this shift is reflected in the development of a supplementary ecosystem accounting framework (UN, 2021). This was initially published alongside the central SEEA as an experimental standard, but in 2021 was adopted as an official component of the SEEA itself (UN, 2021). Due to this later adoption, use cases for ecosystem accounting globally have been various (Bagstad *et al.*, 2021), and it is difficult to draw generalizable conclusions about their transmission into national statistical frameworks and decision-making processes (see Vardon *et al.*, 2016). But there have nevertheless been important developments as regional and national statistical agencies look to implement and operationalize these emergent global frameworks. The EU (see Bagstad *et al.*, 2021; European Commission, 2015a, 2016) has been a notable policy entrepreneur in the use of ecosystem accounting, as has the United Kingdom at the national level. While noting the growing use and impact of ecosystem accounting in diverse contexts around the world, the focus of the discussion here is on how the emerging global ecological accounting framework has begun to be applied in these European policy contexts.

In this evolving ecosystem accounting discourse and practice, there is a greater acceptance of the possibility of monetary valuation even in contexts where there is no obvious market return or transaction. Consider an answer given by Dieter Helm, chair of the UK's Natural Capital Committee (an expert body charged with mainstreaming ecosystem accounting in policymaking in the United Kingdom), when pressed on the question of monetary valuation by the UK Parliament's Environmental Audit Committee:

I don't accept your premise that there are several assets that are not economic, and there are several assets that are ... These all have benefits to people, and those benefits are what we are interested in. Some of them have direct market prices and some of them do not, but from a resource allocation point of view, it is precisely about wanting to make sure that those that do not have prices in markets at the moment are not given, effectively, a value of zero ... Many benefits that people derive that you put in your category of noneconomic ... they should influence the way we make decisions. (EAC, 2014, pp. 7–8)

Where the SEEA initially sought to isolate the economic component of nature, based on the availability of price information observed from market transactions, in the ecosystem accounting view, all interactions with the natural world are included in a decision-making process over the use of these resources. Thus, in the process of implementing ecosystem accounting, the link between

price-forming markets and ‘the economy’ which Polanyi highlighted, is being challenged through attempts to value non-market phenomena.

Secondly, this move towards monetizing the various non-market benefits of ecosystems has been accompanied by an acknowledgement that the complex values of ecosystems are necessarily heterogeneous, discrete and incommensurable. These benefits are categorized as ‘provisioning’ services, i.e. the material products appropriated by humans; ‘regulating’ services, important to the broader stability of the climate and ecological systems; and ‘cultural’ services such as the recreational, symbolic and spiritual values of nature. EU ecological accounting literature explicitly states that the process of establishing their values may be distinctive in each case, and that they cannot be meaningfully aggregated into a single macroeconomic figure which could provide a value for ecosystem assets as a whole:

Most provisioning services are, or will be, valued using market prices. Most regulating services using methodologies based on costs, where possible. Monetary valuation of cultural ecosystem services, which are mainly valued using stated valuation methods, is much more complicated ... [we] should not aggregate these different techniques. (Peterson & Gocheva, 2015, p. 24)

Radermacher has similarly argued that: ‘while valuation is useful for assessing an incremental change, the total value of all ecosystems of the planet has no meaning’ (Radermacher & Steurer, 2014, p. 8). This is a significant development because it challenges a core assumption of conventional macroeconomics, which is that the economy should be represented as a unitary system of flows and stocks, where every transaction is balanced by another item in the framework, and where one unit is fungible with any other.

Thirdly, the various non-market and market values of ecosystems are increasingly linked to a specific geographical location: There are widespread moves to develop ‘spatially disaggregated accounts’ for ecosystems that can inform decision-making processes at different scales, including local and regional. The UN SEEA EA framework recognizes and promotes this, stating for examples that:

The SEEA EA is a system conceived as an integrated, internally consistent series of accounts. At the same time, its design is such that it can be implemented equally well in parts, i.e., the implementation can be flexible and modular ... Depending on the specific environmental and economic context, a country may choose to implement only a selection of the accounts or to compile accounts for selected regions within their country. (UN, 2021, p. 4)

Reflecting this, a key EU report on ecosystem accounting stated that:

Different types of natural capital assets and associated service flows, managers and users of natural capital assets, and the territorial focus of relevant policies,

all exist or operate at various spatial scales. The ability to use a common spatial reference frame for ‘multi-scale’ assessments and analyses will therefore be an essential issue in the development of any natural capital accounting approach. (Peterson & Gocheva, 2015, p. 41)

EU projects such as KIP-INCA (European Commission, 2016) and Mapping and Assessing Ecosystem Services (MAES) increasingly draw upon granular land-use classifications and tagging systems, such as LUCAS, COPERNICUS and INSPIRE (European Commission, 2015b). Furthermore, the development of ‘ecosystem habitat accounts’, which map the economic values associated with cross-cutting ecological zones such as forests or wetlands, also holds potential to disturb the assumption that the economy is an entity contained within the nation, naturalized by the SNA (including GDP). These developments are permitting newly localized, fragmented and spatially embedded representations of the economic values of nature to emerge.

As an illustrative example, consider a visual representation (see Figure 2) of the various values associated with forestry in Wales based on ecosystem accounting, developed by the UK’s Natural Capital Committee (NCC, 2013).

Here we see how market and non-market values are considered together as equally relevant to the economic management of this ecosystem. These different vectors of value are not aggregated into a single indicator, but displayed as discrete factors which weigh on political calculations over the use of this environment, an approach which contrasts sharply with the unitary vision of economy as represented in the original SNA (see Figure 3).

Whereas the SNA’s vision is of an abstract and mathematical space, rooted at the level of the nation, in which all values are commensurable, the ecosystem

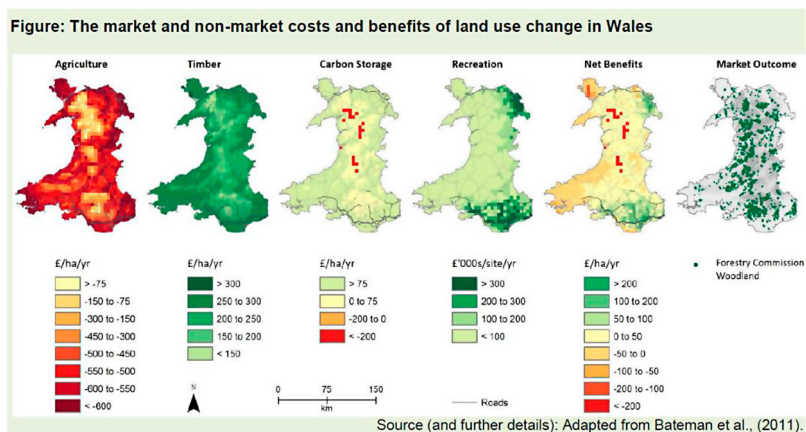
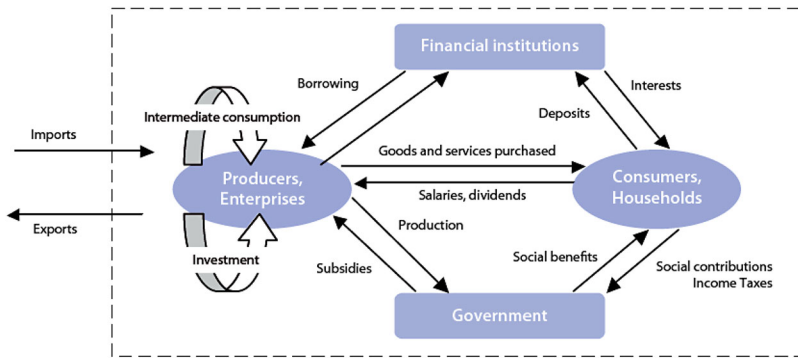


Figure 2 Spatially disaggregated representation of the multiple values of forestry in Wales

Source: NCC (2013, p. 37).



Sources: European Statistical Training Programme, Course: *Advanced national accounts*, 2007

Figure 3 The abstract space of the national economy as represented in the SNA
 Source: Eurostat (2014, p. 22).

services view is of heterogeneous values in a specific geographical location. In contrast with accounting identities such as GDP or the balance of payments – but also with the central SEEA framework – these values are placed *somewhere*, suggesting a more spatial and disaggregated economic imaginary. This pluralistic approach to the values of nature is becoming more influential in UK economic policy through developments such as the roll-out of the UK Natural Capital Accounts, and the central role these are playing in the framing of post-Brexit land-use and agriculture policy, as well as in evaluating the 25-year Environment Plan (ONS, 2018).

This is not to suggest that the SEEA EA framework will necessarily or unproblematically promote these shifts in the wider policy landscape. Indeed, a notable feature of the adoption of the EA in 2021 is the cautious approach to monetary valuation of ecosystem services, which is restricted to more narrowly market-based ‘exchange value’ approaches to valuing ecosystem services, in contrast to the often broader valuation processes which, as we have seen, have been implemented in regional and national contexts. For instance, the:

Ecosystem accounting data in monetary terms is valued using the concept of exchange values wherein ecosystem services and ecosystem assets are valued at the prices they are, or would be, exchanged on a market. This approach to monetary valuation facilitates comparison with the monetary values recorded in the national accounts... the use of exchange values does not provide a broader monetary value that incorporates the direct and indirect benefits received from ecosystems including their non-use values. (UN, 2021, p. 29)

In this sense, the more cautious and market-centric approach to monetary valuation the SEEA EA has adopted may actually serve to constrain more expansive and pluralist valuation practices that have emerged in national and regional use contexts. Even where these more pluralist conceptions of monetary

values have been developed in national contexts, it is notable that their incorporation into decision-making has so far been managed institutionally in ways that prevent their impacting the core macroeconomic policy functions of the state. In the UK context, for example, their use has generally been promoted either by environment-specific agencies such as DEFRA or the newly created Environmental Protection Office (DEFRA, 2021), or the level of local or regional growth and land-use strategies, such as their use in the Oxford to Cambridge Arc regional development plan (OxCam, 2021).

In other words, in these contexts at least, the tensions between different (incommensurable) values that ecosystem accounting reveals is currently manifest in practical distinctions between government departments or between local and central government, rather than, for example, being used as a basis through which to build a more deliberative approach to valuation which represents the market and non-market impacts of policies as all equally part of ‘economic’ policy. Yet where one accepts plural notions of value, the implication is inevitably that different viewpoints must be considered as part of the same decision-making processes. With co-authors, Mace has developed this point by suggesting that effective action requires a ‘pluralistic’ method, where the approaches of different stakeholders – in communities, decision-making sites and in academia – are brought into conversation to establish the value of biodiversity in particular contexts and at particular times (Mace *et al.*, 2015, p. 649; see also Pascual *et al.*, 2021).

We agree with existing critical scholarship that the mere establishment of new metrics and indicators about supposedly non-economic issues is unlikely to produce change by itself. However, the above analysis highlights how the technical and conceptual shifts involved in the development of ecosystem accounting initiatives within the UN SEEA framework do hold latent (if unrealized) potential to destabilize currently dominant notions construction of ‘the economy’ as an ontologically discrete category. This is because conceptual shifts involved go beyond the kinds of tradeoff between ‘economic’ and ‘non-economic policy’ goals envisaged in problem-solving approaches to the beyond-GDP agenda. They rather recognize that ‘economic’ values themselves are multiple, incommensurate, and overflow any ability to represent them as a coherent unified object on the basis of market prices.

Conclusion

The basic categories of thought that people use to understand reality are an important terrain of politics, establishing the framework within which legitimacy for certain types of expertise and governance is established. In the field of economic governance, ‘the economy’ is the most significant category of all, underpinning mainstream, growth-centric macroeconomics and the economic policy discourses it supports. Any governance project which involves its reconfiguration – especially one conducted under the relatively conservative auspices of the UN – therefore warrants attention. In common with Polanyi, we

have argued that there is an inescapable tension between the neoclassical notion of the economy as a self-contained market system – embodied in GDP – and the complexity of environmental and ecological processes in which markets are embedded. As long as environmental protection remains on the political agenda, and statisticians remain charged with finding ways to create meaningful data upon which politicians can act, then that tension will continue to shape policy in the future.

If the outcome of ecosystem accounting exercises was only the production of money values for increasing spheres of the natural world, then critical fears rooted in suspicions of commodification, enclosure and rent-seeking (Gómez-Baggethun & Ruiz-Pérez, 2011; Lohmann, 2009; Robertson, 2006) would be fully substantiated. Certainly, these are real dangers. By rendering diverse uses of natural resources commensurate, it is possible that ecosystem valuation may facilitate the ongoing development of financial markets in ecosystem services or biodiversity offsetting, which often serve to do little more than green-wash corporate profit-making. But this trajectory is not certain, because, as we have shown, lack of commensurability of values is inherent to the technical underpinnings of ecosystem accounting as it is developing within the SEEA framework, and this framework is beginning to be built into decision-making processes at various scales. At present, this is mostly occurring only in elite policy spaces. But, if such accounts continue to become more significant in public deliberation over the use of resources and the management of nature, then it has the potential to evolve into a key terrain on which contestation about prevailing constructions of ‘the economy’ and ‘economic policy’ might enter mainstream political discourse.

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