From legibility to leveragability in performing nature-as-natural-capital

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Abstract. The contemporary moment of global crisis in both ecological and economic spheres is also the moment wherein 'nature' is being consolidated as 'natural capital'. Through this, key interlocking elements are systematically joining the previously rather distinct domains of economics, business and finance with ecology, environmentalism and conservation. The emerging 'green economy' assemblage of discourses, actors, institutions and calculative technologies underpins the creation of markets for ecosystem services, including carbon, and is critical in constituting the logic of REDD+ and associated financing. Following approaches in economic sociology that emphasise elements in creating what becomes treated as economic I delineates four key shifts - discursive, institutional, calculative and material – that are coming into play so as to perform the legibility and leverageability of nature-as-natural-capital. My aim is to enhance understanding of the structuring effects of natural capital as a frame for understanding, sustaining and leveraging nature.

Keywords. nature; natural capital; green economy; forest bonds; REDD+; framing; accounting; economic sociology

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There's an emergent view that natural capital is the new asset class for the future.[1]

1. Introducing 'natural capital'

Increasingly, it seems, 'nature' *is* actually money. The contemporary moment of global crisis in both ecological and economic spheres is also the moment wherein 'nature' is being consolidated metaphorically and materially as 'natural capital', a frame considered to facilitate better accounting, valuing, managing and allocating of nature's 'goods', 'services' and 'values'. In this paper I engage with the liveliness of this moment through considering the work performed by this metaphor (cf. Maasen and Weingaart, 1995) and tracing aspects of its recent and expansionary uptake into accounting, business and finance. Following economic sociologists such as Çalişkan and Callon (2009, 2010) and framing theorist George Lakoff (2010), I emphasise the corresponding 'economization' of both 'nature' and people effected through technical and evaluative processes of making nature legible as natural capital. Illustrative detail is provided by review of the emerging new asset classes of environmental bonds leveraged on calculated natural capital values and associated new income streams.

The success of the metaphorical device of 'natural capital' rests on its ability to assert that one multiplicitous category, namely 'nature', is the same as another multiplicitous category, namely 'capital'. Invocation of this device has a long pedigree (see, for example, Boulding, 1966; Schumacher, 1973). Its current uptake in service to a 'green' but nonetheless normatively growth-oriented economics, however, is a departure from its early usage. Little mentioned now, for example, is that E.F. Schumacher, in his somewhat counter-cultural 1973 text *Small is Beautiful: Economics as if People Mattered*, argued for a valuing of 'natural capital' precisely so as to *downsize* economic production such that the (re)productive life of the 'irreplaceable capital' of nature - which he termed 'natural capital' - would remain abundant (Schumacher, 1973: 4).

[1] Peter Carter, formerly Chief Environmentalist, European Investment Bank (EIB), summing up

Fast forward four decades and we arrive at the inaugural World Forum on Natural Capital held in Edinburgh in November 2013, amidst a technological and global context that might have been unrecognisable to Schumacher writing in 1973. Established with the support of now powerful international organisations including the United Nations Environment Programme (UNEP), the International Union for the Conservation of Nature (IUCN), and the CEO-led network of corporations that is the World Business Council for Sustainable Development (WBCSD), the forum website claimed that 'a revolution is taking place in how businesses and governments account for natural capital'[2]. In its intention to be 'a focal point for business leaders and others to explore the full implications of this rapidly evolving issue [i.e. how to factor natural capital values into business practice]', and 'with the aim of turning the debate into practical action', the Forum captured the attention of an array of major international corporations and financial institutions. An invite- or application-only CEO's club offering high-level networking over drinks and breakfast for the forum's most senior delegates was sponsored by Alliance Trust Plc., a self-managed investment company whose top invested companies include oil companies such as Royal Dutch Shell, BP, and Gulf Keystone Petroleum, financial institutions such as Lloyds' banking Group and HSBC Holdings, and construction companies such as Barrett Development Plc. The Forum was held against a background of concern regarding global environmental degradation and the roles of corporate and financial investment in contributing to this. But the emphasis was less on approaches to downsize economic activity, as urged by Schumacher in the 1970s, and more on how corporate and financial worlds might account for environmental costs and assets so as to both maintain and enhance profits and competitive advantage within this context of global environmental concern.

The discursive and material capturing of natural capital by corporate and financial worlds is contested. The 'formal' Forum on Natural Capital thus was accompanied by a 'Counter-Forum on Natural Commons' held by an association of social movements and civil society organisations, who think that this 'revolution' in accounting for natural capital 'is the first step to creating financial markets in water, air, soil and forests' and thus 'effectively privatising nature'[3]. The associated 'value struggles' (cf. de Angelis, 2007; Sullivan and Hannis 2014) can be illustrated by some of the many tweets tugging on the concept of natural capital in this interplay between Natural Capital/Commons Forums:

> **Nick Dearden**
> Good news for delegates at #NatCap13 on Wednesday. You can pick up Loch Ness for a song today. http://www.ebay.co.uk/itm/Loch-Ness-including-clean-water-and-fresh-air-/200990214743 …? Nature #NotForSale 19/112013
>
> **NatCapForum**
> If CEOs and CFOs get it, things happen – @andyheald on embedding #naturalcapital accounting. #natcap13 21/11/2013
>
> **bmatulis**
> Concept of #naturalcapital has more to do with the expansion of capitalism than sound ecological management #natcap13 21/11/2013
>
> **NatCapForum**
> People abuse nature if they think it is free, they'll value it better if they see its value – @AlexSalmond #NatCap13 21/11/2013

And so on.

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[2] http://www.naturalcapitalforum.com/who-should-attend, accessed 10 November 2013.
[3] See http://www.wdm.org.uk/events/forum-natural-commons-counter-conference.

Following a section on method and interpretive framework (section 2), this paper traces a series of consolidating, if also contested, 'shifts'[4] (cf. MacDonald, 2013: 49) in the making of nature as natural capital. Through these shifts the domains of economics, business and finance are interlocking systematically with the previously rather distinct domains of ecology, environmentalism and conservation, around the stabilising and materialising of the metaphorical category 'natural capital'. In section 3 I trace the *discursive shift* that has reframed understandings of external natures in economic and financial terms (amongst which 'natural capital' and 'ecosystem services' are paramount). I also point to the corresponding *institutional shift* that has occurred so as to constitute organisations, networks and alliances as an interlinked assemblage organised around making the metaphor of nature-as-natural-capital appear as accounted for natural capital. In section 4 I draw into focus the current *calculative and accounting shift* that is enabling nature aspects to become technically inscribed as numerical signifiers of capital, such that these can be added to and offset against other forms of accounted capital and in economic models more generally. In the fifth section I consider the materialising possibilities of the conception and construction of nature as natural capital (i.e. the fourth shift noted above), through analysing proposals for leveraging the 'natural capital' carbon value of standing tropical forests as the underlying asset for new financial bond structures. I close with a brief conclusion suggesting that this metaphorical construction and performance of nature as a 'bank of natural capital' presents something of a double-edged sword. On the one hand, the metaphor may indeed encourage strategies of wise use and the saving of natural capital assets, as suggested by proponents. On the other hand, given that actual financial banking practices are built on massive indebtedness, the proliferation of capital values through splitting practices, and few checks on the nature of subsequent re-investments, translations of nature-as-natural-capital into the 'liquid nature' of circulating finance capital might be cause for concern (cf. Sullivan 2013a; Büscher 2014).

But first, a word on 'nature'. Raymond Williams (1976: 213), in his discussion of 'keywords', is credited with describing nature as 'the most complex word in the English language' (see also Castree, 2005, 2013; Descola 2013). I am coming from a position that for humans 'the natural' is always also 'the social' - approached through social categories and socialised practices, as well as entangled and infused with the human in myriad material and energetic ways. Indeed, our 'socialising' of 'the natural' has culminated in the geological epoch of the 'Anthropocene' - in which by definition 'nature' today is very much enmeshed with the modern industrial human. Clearly it is problematic to think in terms of there being some sort of dividing line between the social and the natural (cf. Latour 2004; Descola 2013), and thus it perhaps is more appropriate to always speak of 'socionature' or 'culturenature'. Having made this disclaimer, for ease of reference I will nonetheless use the term 'nature' to refer to places and 'ecosystems', usually involving

[4] There are echoes here with Thomas Kuhn's (1970[1962]: ix, 1) well-known historical analysis of scientific knowledge building. Kuhn argued that knowledge in the physical sciences tends towards the production of relatively stable constellations of 'facts, theories, and methods' that become normative and paradigmatic, but which nonetheless are susceptible to revolutionary 'shifts' towards a different constellation whenever there are sustained 'violations of expectation'. Kuhn's work demonstrates the constructed and contingent nature of scientific objects in the 'hardest' of sciences, as well as the simultaneously conservative nature of much scientific practice (i.e. in working to sustain accepted paradigms), and the tendency of scientific paradigms to experience crises that encourage 'paradigm shifts'. Whilst the present work takes the notion of interconnected 'shifts' as relevant for understanding the current predominance and productivity of 'natural capital thinking', my emphasis is slightly different. I am attempting to understand 'natural capital' as a normative paradigm for thinking about non-human natures that is being actively promoted, technically inscribed, instrumentalised and universalised perhaps less by the physical sciences than by the social science of economics and through innovations in the technical endeavour of accounting.

contemporary or historical dwelling by people, whose *immanent vitality*, i.e. ability to *self*-regenerate with a recognisable degree of qualitative persistence, is considered relatively intact.

2. On method and interpretive framework

The metaphorical noun and category of 'natural capital' is taking hold in productively interesting ways that can be diagnosed and documented empirically. The observations and reflections on which my analysis is based derive from two key sources of data. The first is review of recent and inter-connected public domain policy documents, as referenced throughout the text. Whilst not subjected to a formal textual analysis (although see Sullivan and Hannis 2014), these documents have been read closely and were selected because they frequently refer to each other and are considered representative of the broad move towards formalised natural capital accounting practices considered in this paper. Secondly, my analysis has been influenced by 'observant participation' (cf. Sullivan, 2005) and 'event ethnography' (cf. Brosius and Campbell, 2010; MacDonald and Corson, 2012; Dempsey forthcoming) conducted as a participant and occasional speaker at so-called 'high-level' policy events and conferences regarding strategies for biodiversity conservation under contemporary 'green economy' influences.[5] Participation in these events has enabled direct observation and discussion regarding the uptake of, and struggles over, 'natural capital' thinking in these contexts.

In delineating and understanding the 'shifts' noted above, my interpretive framework shares kinship with a range of cognate analyses, as identified in Table 1. These include Tania Murray Li's analytics of 'practices of assemblage' (e.g. 2007), and work by Ken MacDonald, Catherine Corson and colleagues on key policy events and discourses as orchestrations that align nature-as-natural-capital with market logics and socio-technical devices (see, for example, MacDonald and Corson, 2012; Corson et al., 2013; MacDonald, 2013; Suarez and Corson, 2013). My framework also connects with an emerging conceptual approach to value creation proposed collaboratively in a Leverhulme Trust research project on value-making for which I am a Co-Investigator (see Bracking et al., 2014; Fredriksen et al., 2014)[6]. This framework owes much to work by economic sociologist Michel Callon and colleagues who emphasise ways in which the application of technical calculative devices, discourses and institutional practices calculate and constitute entities and people as formally economic, and thus able to participate in and perform what becomes enrolled in the economic sphere (see, for example, Mackenzie and Millo, 2003; Callon and Muneisa, 2005; Callon, 2006; MacKenzie et al., 2007; Çalişkan and Callon, 2009, 2010). The creation of natural capital accounts and of bonds associated with the calculated value of 'natural capital', as detailed below, are thereby interpreted as significant calculative devices that, through discursive and practical application, perform 'nature' in diverse ways as formally economic.

Insert Table 1

[5] Recent events have included: presenting at a policy workshop on *Markets for Biodiversity and Ecosystem Services: Challenges and Opportunities* at Chatham House, London (November 2011); participating in a 'Dialogue Seminar' on *Biodiversity and Finance*, organised by the Secretariat of the United Nations Convention on Biological Diversity (CBD) and donors in Quito, Ecuador (March 2012); speaking on a plenary panel at the 7th Trondheim Conference on Biodiversity focusing on *Ecology and Economy for a Sustainable Society* Norway (May 2013); attending as a non-corporate delegate the Inaugural World Forum on Natural Capital in Edinburgh (November 2013); and attending the conference *To No Net Loss of Biodiversity and Beyond*, London (June 2014).

[6] See www.studyofvalue.org

At the same time, my emphasis is somewhat distinct from an analytics of particular practices of assemblage (as in Murray Li 2007), or of the orchestration strategies observed in key environmental policy events (as in MacDonald and Corson, 2012; Corson et al., 2013; MacDonald, 2013; Suarez and Corson, 2013). These analyses share an understanding of how citizens are encouraged 'to engage in debate' while the agenda is in fact limited to approved scripts (Murray Li, 2007: 274). They consider in relatively less detail the roles of specific technical inscriptions and calculative devices (section 4) or the materialisations (section 5) currently or projected to arise from these inscriptions (although see Dempsey 2013). With Murray Li (2007: 274), my consideration of the productive metaphorical transformation of 'nature' as 'natural capital' is not singular, but emphasises different directions towards which this transformation pulls, the tensions and frictions that thereby arise, and the contingent and historicised nature of current shifts. I proceed with review of the discursive and institutional shifts that have accelerated in recent years towards a consolidated framing of nature as natural capital.

3. Equating 'natural capital' with 'finance capital' – two histories

As noted above, the term 'natural capital' was introduced several decades ago, but its ascendancy into common and popular parlance, as well as analytical usage, has intensified in recent years. In this section I trace two parallel and connected histories that tell the tale of this proliferating use of the term. The first draws attention to the stabilising of 'natural capital' as a category embodying all of 'external nature' within the disciplines of environmental and ecological economics, and highlights some of the tensions present from the start in the uptake of the metaphor in these quarters. The second traces a growing tendency to conceive of nature as a 'bank of (natural) capital', as business and financial actors and organisations have taken up the metaphor in identifying with 'green' discourses and agendas.

'Natural capital' in environmental and ecological economics

The conceptualising of 'nature' as 'natural capital' has been significant in environmental and ecological economics for the last three decades. The term tends to be attributed to the late Professor David Pearce, as, for example, in Foster and Gough's 2005 volume on *Learning, Natural Capital and Sustainable Development* (e.g. see Åkerman, 2005). Pearce was an influential environmental economist and government advisor who wrote several defining environmental economics texts (for example, Pearce et al. 1989; 1993; Pearce and Moran 1994; Pearce 1998). In 1988 (page 598), Pearce stated that '[s]ustainable development is categorised by economic change subject to "constancy of natural capital stock"', such that, and as Åkerman (2005: 35) describes, 'natural environments are thought of as a stock of natural assets serving economic functions'. In the then emerging discipline of *ecological* economics, this notion of 'natural capital' as a stock of value-generating assets was confirmed in statements such as, 'what natural capital and manufactured capital have in common is that they both conform to the working definition of capital as a stock (collection, aggregate) of something that produces a flow (a periodic yield) of valuable goods or services' (Prugh et al. 1999: 49). This 'stock of natural capital' is conceived as all of 'external nature': the 'nonhuman nature' constituting 'the environment' that in conventional economic models have tended to be treated as 'externalities', i.e. non-costed resources whose use frequently becomes overuse and degradation. More recently, in Daily et al.'s (2011: 3) introduction to the Oxford University Press volume *Natural Capital: The Theory and Practice of Mapping Ecosystem Services*, 'living natural capital' encompasses 'Earth's lands and waters and their biodiversity' and provides the 'ecosystem services' that flow from these. The UK's Natural Capital Committee (NCC), established in 2013, uses a similar definition, namely: '[n]atural capital refers to the elements of nature that produce value or benefits to people (directly and indirectly), such as the stock of forests, rivers, land, minerals and oceans, as well as the natural processes and functions that underpin their operation' (NCC 2013: 10). 'Nature' as 'natural capital' is thus framed in environmental and ecological economics and associated policy contexts as physical stocks of

'nature', both renewable (i.e. living) and nonrenewable (i.e. 'fixed', as in stocks of mineral wealth), that produce 'natural resources' as definable 'goods', 'services' and 'values'.

As argued by Åkerman (2005: 37, 39), however, the polysemic metaphor of nature-as-natural-capital is analytically weak whilst metaphorically strong and heuristically powerful. This enables its use to perform different work for different groups of people in diverse contexts, permitting its disparate mobilisation so as to act in the world with varying effects. Indeed, in its inauguration in both environmental and ecological economics it already meant contrary things, and was used for varied ends and with diverse outcomes (Table 2). Åkerman (2005: 36) thus states that in environmental economics 'the accountant's view of nature' was underlined through an emphasis on 'natural capital' as value-generating 'environmental assets', while in ecological economics 'ecosystem processes and ecological knowledge', informed by 'the ecosystem modeller's view of nature', provided the underlying focus (Wackernagel and Rees 1997).

Insert Table 2

Popular environmental literature and media are increasingly embracing and publicising versions of the metaphor, indicating an accelerated and accepted framing of nature in these terms, as well as the growing reach of this metaphor into popular domains (see, for example, Daily and Ellison 2002). Noticeable in this popularisation is an increasing association and even elision between 'natural capital', 'finance capital' and accounting. Former Friends of the Earth director Tony Juniper, in *What Has Nature Ever Done for Us? How Money Really Does Grow on Trees*, thus states that '[t]he ecosystems that naturally renew themselves, and which supply us with the huge range of commercially valuable services and benefits, are sometimes seen as analogous to financial capital, and are increasingly referred to as "natural capital"' (2013: 268). And in his foreword to Juniper's text, HRH The Prince of Wales refers to 'what is known in the jargon as "natural capital" … a set of economic assets which … can produce dividends that flow from these assets indefinitely' (Juniper, 2013: xi).

In these statements, then, the metaphorical functioning of 'natural capital' is working to extend both an environmental economics preference for calculative practices of accounting for nature, and an elision between 'natural' and 'financial' spheres of capital. As discussed below, a normalising conception of 'nature' as a dividend-generating capital asset is coming further into focus through initiatives that seek to account for this asset and materialise its 'dividends'. This legibility and leveragability of 'natural capital' has arguably been boosted through a parallel history of the term that conceives 'nature' more systematically as 'a bank of natural capital'. It is to this history that I now turn.

'Nature' as a 'Bank of Natural Capital'

The post-WWII era has been marked by social movement and policy critique regarding the detrimental effects on environmental parameters of extractive and industrial production and consumption practices. Linked in part with the treatment of environmental aspects as 'externalities' in conventional economic models, a number of international meetings and policy statements – from the UN Stockholm Conference on the Human Environment in 1972, to the 1980 *World Conservation Strategy* of the World Wide Fund for nature (WWF), IUCN and the Food and Agricultural Organisation (FAO) – drew attention instead to the limits to economic growth posed by environmental parameters, and thus to the need for a 'sustainable development' that more consciously and systematically combines economic agendas with environmental means.

In the years since, these proposals for limits to economic practice and production have been re-choreographed as a 'green economy' agenda that is placing corporate and financial leaders at the forefront of environmental policy and practice, and reinventing sustainability as a new frontier for

economic growth. This has become possible not so much by a reskilling of business leaders as ecologists and natural scientists, as by the remaking of nature as 'natural capital' (cf. Corson et al., 2013), through which environmental parameters can be known, technically approached and embedded within economics and accountancy spheres of knowledge production.

Two global moments stand out in this financial and corporate institutionalising of nature as 'natural capital'. The first is the establishment of the WBCSD, at the first United Nations (UN) Earth Summit in Rio de Janeiro in 1992. This network was initiated by millionaire Maurice Strong, formerly an entrepreneur in the Alberta oil patch and president of the Power Corporation of Canada, in his capacity as Secretary General for the 1992 Earth Summit (and previously for the 1972 UN Stockholm Conference on the Human Environment). One of the first key assertions of nature as akin to a 'bank of natural capital' can be traced to this powerful player in global environmental governance. In various speeches in the early to mid-1990s[7], he asserts repeatedly that: '[i]n addressing the challenge of achieving global sustainability, we must apply the basic principles of business. This means running "Earth Incorporated" with a depreciation, amortization and maintenance account'. This sentiment has rapidly become almost a truism in environmental governance. It has been used, for example, as a marketing hook by private sector organisations such as the US-based Environmental Consultancy Agency[8] and the global investment fund Eko Assets Management[9] (discussed further in Sullivan, 2010, 2013a), and echoed directly by former UNEP official Don de Silva (2008). More recently, Caroline Spelman, as Environment Minister for the UK's Conservative coalition government, launched DEFRA's 2011 Natural Environment White Paper *The Natural Choice: Securing the Value of Nature* by stating that: '… if we withdraw something from Mother Nature's Bank, we've got to put something back to ensure that the environment has a healthy balance and a secure future'.[10] The UK's Prince of Wales, similarly asserts that '[t]he ultimate bank on which we all depend, the bank of natural capital, is in the red' (Stubbs 2014: online). This metaphor of nature as 'a bank of natural capital' is presented in rather literal form by the celebrated TEEB programme, through its *Bank of Natural Capital* website[11] in which nature's stocks and flows are depicted such that they accord with the format of a standard online current bank account.

A second key moment in the instituting of this nature-as-a-bank-of-natural-capital discourse occurred with the UN Rio+20 Earth Summit on 20-22 June 2012. At this event, and amidst an array of interventions resisting a corporate-led 'green economy' orientation, powerful networks (including the WBCSD) and institutions issued a 'Natural Capital Declaration' (NCD) as a private sector finance initiative signed by the CEOs of financial institutions and committing the financial sector to mainstream 'natural capital' considerations into all financial products and services.[12] This was followed in June 2013, by publication of the NCD 'Roadmap' providing further details and advice regarding implementation of the commitments made in the declaration (Mulder et al., 2013). An objective of this roadmap is to '[d]evelop practical tools and metrics to integrate natural capital into all asset classes and relevant financial products' so as to increase the visibility of 'natural capital' 'on the balance sheets of financial institutions' (Mulder et al., 2013: 4). An indication of the ways that this is done is the focus of the following section.

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[7] See, for example, http://www.mauricestrong.net/index.php/speeches-remarks3/34-asia; http://www.mauricestrong.net/index.php/speeches-remarks3/79-korea-economic-policy; http://www.mauricestrong.net/index.php/speeches-remarks3/46-scenarios

[8] http://www.slideshare.net/Denette/denettes-international-alliance-presentation, slide 2

[9] http://ekoamp.com/who/

[10] http://www.defra.gov.uk/news/2011/06/07/natural-environment/

[11] http://bankofnaturalcapital.com

[12] http://www.naturalcapitaldeclaration.org/

4. Accounting for 'nature' as 'natural capital' – Or, 'accountants will save the world (sorry, civil society)'[13]

A series of connected endeavours to account for nature-as-natural-capital on corporate, national and international accounts is now underway (see Mulder et al., 2013: 38). These extend an older social accounting and 'full cost accounting' impetus to account for those social – and now environmental – costs that conventionally have been external to financial transactions (see discussion in Milne, 2007). In the run-up to the Rio+20 event in 2012, significant global interventions thus were publicised for more robust and transparent (cf. Turnhout et al. 2014) 'green accounting' that incorporates non-manufactured environmental elements. The WAVES (Wealth Accounting and Valuation of Ecosystem Services) initiative of the World Bank Group (WBG), for example, is a key element of the Bank's new 'Environment Strategy', comprising a methodology for incorporating 'natural capital' and ecosystem measurements into national 'wealth accounts', in part 'to establish the true value of biodiversity' (World Bank Group, 2012a: 48, 51; WAVES, 2012). WAVES is set within the context of a substantially energised System of Environmental-Economic Accounting (SEEA), agreed in 2012 by the UN Statistical Commission as an international standard for combining economic and environmental data, including 'ecosystem services' and 'natural capital', into a single global accounting system (EC et al., 2012; UN, 2012; WAVES, 2012: 10). At a national level, the Green Accounting of Indian States Project, funded by Deutsche Bank India, Centurion Bank of Punjab and Green Indian States Trust and co-authored by TEEB's director, affirms, for example, that 'biodiversity should be treated as an asset and its loss should be adequately represented in the national accounts', at the same time as functioning as 'natural capital' that can represent 'genuine net additions to the national wealth' (Gundimeda et al., 2006: 3, vii). In the corporate world, the WBCSD (2011) urges 'Corporate Ecosystem Evaluation' (CEV), whilst natural capital accounting is also being mobilised to demonstrate the extent to which economic activities create costs in the form of running down the capital value of natural capital (e.g. Trucost Plc and TEEB for Business, 2013).

Space does not permit an exhaustive survey of how exactly nature-as-natural-capital is calculated so as to become legible in these accounts (a topic ripe for in-depth research), although Table 3 provides detail from three examples that give a flavour of the technical and calculative practices being promoted to account for 'living natural capital'. The accounting procedures illustrated in these examples can be distilled into two key layers of abstraction (cf. Castree, 2003; Robertson, 2006; Kosoy and Corbera 2010; Pawliczek and Sullivan 2011; Sullivan 2012: 8-9). First, they apply numerical assessment tools and devices to conceptually cut nature up into individualised units that can be represented and scored numerically. These numbers are then vested with the power to act as surrogate or proxy measures that represent the productive nature aspect under consideration. Numerical representation acts further to create the appearance of transparent equivalence and commensurability between different aspects of nature, between different locations and times, and between different categories of capital. As such it is permitting the corresponding emergence of 'offsetting' mechanisms between sites of environmental harm and sites of environmental health and conservation (see discussion in Robertson 2006; Sullivan 2013c), as well as the possible stacking of the different environmental 'credits' that thereby become legible (see discussion in Robertson et al. 2014).

Insert Table 3

Once symbolised as numbers, it becomes conceptually relatively easy for these units to be further denoted and commodified as monetised entities, and thus to become conceived and treated as capital and as tradable assets. This is the second layer of abstraction. Monetised values for 'natural

[13] Peter Bakker speaking at the inaugural World Forum on Natural Capital, Edinburgh, 20-21 November 2013, personal notes.

capital' and 'ecosystem services' tend to arise through methods such as contingent valuation, involving estimates of 'willingness to pay' for specified aspects of nature, or 'benefit transfer', whereby valuation is projected from unit values (dollar estimates of economic value on a per-unit basis) derived from particular use and non-use values measured at specific different sites (for overviews of such techniques, see Pearce et al., 1989; Pearce, 1998; WBCSD, 2011). These accounting and valuation techniques generate numbers for nature units that are in monetary terms, and thus can be made to work for cost-benefit analyses and cognate economic and accounting models. As such they make possible the enfolding of diverse, self-regenerating natures into the particular value sphere of money. Accounting and valuation methodologies, however, may also produce monetary values that are *ad hoc*, unreliable and even deceptive (see discussion in Wackernagel and Rees 1997: 5; Robertson, 2006; Spash, 2008; Plummer, 2009; Fourcade, 2011). As Castree (2003: 285) states, 'monetary values placed on things like ecosystem services are completely arbitrary and unable to deal with their "real" ecological value'. This is in part because a foundational category error is being made by treating immanent, material and living natures as if ontologically they are the same as the simple numbers used to (ac)count in monetary terms. Nonetheless, by virtue of the enactment of these abstractions that become 'a process of "definition" or social construction in a substantive sense' (Fourcade, 2011:e 1769), 'living nature' can indeed be made legible, and thus also become leveragable, as a 'bank of natural capital'. The next section outlines the emergence of some ways in which this legibility of nature-as-natural-capital is being translated into capital leveragability through the emerging asset class of 'forest bonds'.

5. Leveraging natural capital – the case of 'forest bonds' (or, '[y]ou know what I mean by a bond? Something that binds?'[14])

Accounting for nature in terms of monetary significations and values is creating innovative possibilities for materialising and leveraging non-manufactured nature as 'natural capital'. Bond structures that bind to investors nature that has been thus accounted for are featuring in this leveragability, and bonds secured on monetised signifiers of environmental health are proliferating. Climate Bonds and Green Bonds 'frontload' future funds by encouraging government borrowing from investors with the debt secured on the future economic and environmental (especially climate) benefits predicted to flow from these investments (Climate Bonds Initiative, 2009: 2, 4). The World Bank Treasury currently issues a variety of bonds secured on climate-related goals, including 'Cool Bonds'[15], 'Eco Bonds'[16] and 'Green Bonds'[17]. In the UK 'environmental bonds', including 'green investment bank bonds, green infrastructure bonds, and woodland creation bonds' issued by either the government or the private sector, are being encouraged as a means of linking investment to pledges of environmental improvement by bond issuers (Ecosystemmarkets Task Force, 2013). These bonds target an emerging class of investors in sustainability, interested in investing in companies whose 'sustainability performance' may be linked to financial ratings indices that include environmental proxies.

Environmental bonds are also being promoted as vehicles for direct investments in nature. In the UK, a recent report on *Opportunities for UK Business that Value and/or Protect Nature's Services* suggests that environmental bonds might be invested by '[c]orporate industries wishing to purchase bonds as a means of offsetting their residual environmental impacts through the supply chain' (Duke et al., 2012: 32). Through this '[a] number of asset classes such as biodiversity, water, carbon, which are co-located on the same area of land, could be "stacked" and an environmental bond created, *providing a stable investment return*', although it is not clear exactly what will

[14] From Pullman (1997: 187).
[15] http://treasury.worldbank.org/cmd/htm/CO2LBond.html
[16] http://treasury.worldbank.org/cmd/htm/Eco3PlusNoteInaugural.html
[17] http://treasury.worldbank.org/cmd/htm/WorldBankGreenBonds.html

generate this return (Duke et al., 2012: viii, also 57-58, emphasis added). These 'asset classes' of 'nature' are framed here 'as components of ecosystem markets' that 'provide the natural capital on which society depends' (Duke et al., 2012: 32), with 'conservation bonds' (as termed in the report) capitalising this natural capital to produce a new range of 'green asset classes' that can generate competitive rates of return on investments. It is advised that the investibility of these new asset classes might be subsidised by government, such as through the UK's Green Investment Bank[18] established to accelerate 'transition to a green economy' (Duke et al., 2012: 22).

The creation of investible financial products based on the natural capital values calculated for standing nature is now occurring so as to leverage landscapes of conserved and/or restored nature in the global south as the underlying collateral for capital-releasing loans. These loans would be bonded with the calculated monetary value and projected income-generating capacity of the 'natural capital' supported by these landscapes. The online report from a 'high-level workshop' on held in 2011 on 'Unlocking Forest Bonds' thus proposes 'forest bonds' as a means of financing tropical forests as 'ecological infrastructure' (Cranford et al., 2011). The report provides an indication of the proposed structure of such bonds, as well as the institutional assemblage of conservation NGOs and financial institutions supporting their design. The workshop was hosted by non-governmental organisations WWF, the Global Canopy Programme and the Climate Bonds Initiative, with the global investment banking and securities firm Goldman Sachs and the Swiss private bankers Lombard Odier as financial partners. As above, the workshop report proposes that public-sector funds and incentives such as tax breaks be used 'to support private-sector investment in forests', in return for government issued bonds based in part on the monetary value adhering in the 'natural capital' of tropical forests (Cranford et al., 2011: 5; also see Cranford, Parker and Trivedi, 2011; Duke et al., 2012: 56 on 'sub-national rainforest bonds'. It is advised that 'the investment proposition needs to be large and liquid to attract the largest investors', and that multilateral donors might 'play an additional catalytic role by issuing a forest bond themselves and helping to pump-prime the forest bond market' (Cranford et al., 2011: 5).

Through this 'EcoSecuritisation' (Forum for the Future and EnviroMarket Ltd, 2007), tropical forests and other landscapes of valued 'natural capital' would be made financially 'material' as capital, such that these landscapes and associated socioecosystems would be incorporated as leveragable in global capital markets. The intention is to create an attractive new investment frontier that frontloads funds needed for a developing country's economic transition to forest-friendly eco-entrepreneurial activity, rather than destructive land uses such as oil palm, soya and cattle-ranching. Issuers of a 'forest bond' such as the governments of forest-rich countries of the global south would thereby raise 'large-scale finance now that will be repaid by existing and anticipated future income' from the forests thus invested (Cranford et al. 2011: 6).

Servicing rainforest bonds

But how exactly will the income materialise for servicing and repaying these? It is suggested that it will derive from forest carbon revenue, ecosystem service markets, sustainable timber and agriculture and taxes (Cranford et al., 2011; also Forum for the Future and EnviroMarket Ltd, 2007: 9; Duke et al., 2012: 33). I consider the first of these in some detail below.

Forest carbon revenue is a reference to the 'future streams of payments for expected emissions reductions' (World Bank Group, 2012b: 1) provided by the carbon contained in standing forests that will be 'unlocked' through measurement and accounting under REDD+, i.e. the UN programme for Reducing Emissions from Deforestation and Forest Degradation in Developing Countries[19]. The REDD+ programme encourages forests of the global south deemed to be under sustainable forest

[18] http://www.greeninvestmentbank.com/
[19] www.un-redd.org

management, and involving the conservation and enhancement of carbon stocks, to become tradable in global emissions offsets markets, to the extent that their carbon can be calculated, accounted for and conserved as well as monetised and monitored. As its name suggests, REDD+ is intended to reduce emissions of carbon to the atmosphere caused by governable reductions in tropical forest cover. At the same time, concern regarding carbon loss from southern tropical forests occurs in a context of unequal distribution in industrial fossil fuel emissions, making REDD+ akin to a giant global offsetting scheme whereby industrial emissions are maintained in part by linking such emissions with the maintenance of forests as stored carbon in the south.

Making southern forests ready for REDD+ means making the carbon value associated with these forests legible as a dividend-generating natural capital asset. The process involves significant and supervised monitoring and conservation work by local communities, and can require the giving up of alternative production practices. Nonetheless, this new asset class might then serve both as 'collateral to loans to finance the upfront investments in [REDD+] programs', in effect creating 'REDD+ bonds' through placing REDD+ credits onto the portfolios of investors (World Bank Group, 2012b: 1-2; UNFCCC Ad Hoc Working Group on Long-term Cooperative Action, 2012); and as the source of revenue streams for servicing interest payments on loans bonded to this value. Somewhat tautologically then, investment in forest bonds associated with REDD+ assists also with funding the creation of the future carbon revenues that will service the loans associated with these bonds (as demonstrated by rainforest bonds established by Bank of America Merrill Lynch, see Gilbert 2012).

An example of how this is now manifesting is offered by the Althelia Climate Fund, one of a handful of a group of investment funds raising capital to invest in REDD+ and Payments for Ecosystem Services markets (Abusaid 2011). Established and managed by asset management platform Althelia Ecosphere, and advised by Ecosphere Capital LLP and environmental NGO Conservation International, the fund is working through REDD+ accounting to bind the increasingly legible natural capital carbon value of standing tropical forests to investors from elsewhere, through 'creating new environmental assets that reflect the value of natural capital'[20]. Initial investments from the EIB amongst others totalled $80 million in June 2013, enhanced by more than $130 million lent from the USAID in 2014[21]. The fund comprises 'a diversified portfolio of investments in Africa, Latin America and Asia that take the form of real assets (certified commodities and agricultural produce) and environmental services (verified emissions reductions and other ecosystem services [including carbon accounted for under REDD+])' that will deliver 'cash dividends to investors' (Althelia, 2013: 1). Althelia Ecosphere describes '[e]cosystem goods and services from Natural Capital' as 'worth trillions of US dollars per year' (2013: 3).

These examples illustrate how the increasing legibility of nature as natural capital is being translated into the literal leveraging as a monetary asset of the natural capital that becomes thus accounted for and 'valued'. As such, nature as natural capital becomes bound in new ways with financial domains, whilst simultaneously becoming 'unbound' (Brockington et al., 2008) from localities and other(ed) culturenature values through its marketised release as leveraged and circulating financial assets. The associated mantra is that all 'stakeholders', including forest-dwelling peoples of the tropics, should benefit appropriately. At the same time, proposals for bonds based on natural capital values and revenues generate concerns regarding the sovereignty of these units as they become bound to investment portfolios. In particular, clarification is needed regarding the specific mechanisms that translate tropical forest carbon into monetary income for investors elsewhere, as well as what may happen to the natural capital 'collateral' in cases of default on these payments.

[20] http://ecospherecapital.com/
[21] http://ecospherecapital.com/usaid-announce-new-partnership-with-althelia/

Proposals for rainforest bonds are based on an underlying assumption of a secure future income stream arising from payments for the carbon stored in forests of the global south. Nevertheless, a broader context of crisis in carbon markets such as the European Union's Emissions Trading Scheme (EU ETS) and the recent dramatic fall in the price of tradable carbon (Carrington, 2013), introduce cracks in the certainty of this assumption. Given that massive foreclosure of capital securing loans is an important strategy for governing failing repayments in other sectors (Langley 2009), it seems appropriate to ask what might happen to the natural capital assets securing future dividends to investors if those dividends fail to materialise. The documents cited here are opaque on this point, asserting, that '[i]f for any reason … earmarked cash flows did not arise, the issuer would draw on other [unspecified] financial resources to meet its obligations' (Cranford et al., 2011: 14). This invokes the possibility of a further transfer of public resources, and perhaps also of natural capital, to lenders/investors.

The complexities percolating through these examples suggest that increasing the legibility and leveragability of nature-as-natural-capital and as the asset class of the future might present something of a double-edged sword in terms of the socionatures aspects that are thereby amplified. A consideration of how the metaphor of natural capital might cut both ways forms the focus of my next and final section.

6. Conclusion: a double-edged sword?

The above examples trace some ways in which conserved, restored and non-manufactured natures are being productively conceived, normalised, instrumentalised and incorporated within market economics as natural capital. From a more-or-less pertinent and useful metaphor (depending on perspectives) operating in the domain of the virtual and to which the 'real' of nature increasingly is made to conform (cf. Corson and Macdonald, 2012: 159), 'natural capital' is becoming a fetishised factual category – or 'factish' as Bruno Latour (2010) might put it. Nature as natural capital is being constituted as having a perceived objective ontological status (cf. Corson et al., 2013): a 'solidity that seem[s] to make it independent of the accidents of belief and history' (Feyerabend, 1999: 67). It is becoming a naturalised fact that is folding the behaviours and desires of diverse peoples around its sustenance and productivity so as to act in the world as what Actor Network Theorists term a 'black box': a 'naturalising' designation 'contain[ing] that which no longer needs to be reconsidered, those things whose contents have become a matter of indifference' (Callon and Latour, 1981: 285).

Such a systematic (re)framing of nature, however, begs enquiry and carries an attendant urgency for further empirical research to investigate how the interlinked proposals are being operationalised and with what effects (cf. Lakoff 2010). Particular questions include what sort of understanding of 'nature' is promoted by consolidated practices for accounting-for-nature-as-natural-capital? What sorts of natures (and peoples) are thereby also privileged and performed? And what are the spaces for intervening with different knowledges, frames and valuations and associated practices?

It seems important to ask these questions as from the analysis above a few things do seem clear. One is the privileging of calculative expertise and 'measurementality' (Turnhout et al., 2014) in natural capital accounting as the most relevant way of knowing and managing nature. This may frame out ecosystemic qualities of nonlinearity, interconnectedness and autopoesis, thereby systematically undervaluing those aspects of nature that confer resilience and vitality (Wackernagel and Rees 1997). It may also discount the qualitatively different ways of knowing and evaluation practices that tend to be associated with those dwelling closely with the natures fast becoming numbers in natural capital accounts, thus diminishing cultural, as well as biological, diversity (Sullivan 2009).

A related point is that framing material and immanent natures within the human created diverse category of capital, whilst done to assist rhetorically with notions of saving nature as a stock of capital assets, may also send some different signals. This is due to the growing conceptual and material elision between natural and financial capitals, which seems paradoxical since in finance it in fact is *debt* that tends to constitute banked capital assets, and that also creates the possibility for businesses to innovate and expand through investment. Banks are sustained by and associated with a variety of practices that split actual stored capital so as to create more financial value and thus greater liquidity or flow of money in the system over all. These practices include: fractional reserve lending, in which the total value commanded by a bank is a vast multiplication of the value it actually houses; the splitting of debt into complex tradable packages that turn it into assets on the portfolios of 'securities' managers; and the management of large virtual funds of money through betting on ultimately unpredictable market probabilities (see, for example, descriptions in McNally 2011; Graeber 2011; G Sullivan 2011). These are problematic models for conceptualising and managing the fleshly, relational and dynamically varying entities, populations and phenomena that constitute 'real nature' as opposed to 'natural capital'. They suggest some counterproductive aspects to making nature's security dependent on its visibility and financial leverageability as 'a bank of natural capital'.

The 'shifts' identified above are combining to produce what Deleuze and Guattari (1988[1980]) might conceive as a 'machinic assemblage': that is, a multiplicity of dynamically stable connections between bodies, scales, discourses and affects, which in combination are performing natures and peoples as formally economic to the exclusion of other valuation possibilities. Whilst entering the discursive and policy stage as rather depoliticised phenomena (cf. Ferguson, 1994) – whereby analysis is declared 'to be independent of choices, desires, [and] social tendencies' (Feyerabend, 1999: 72) – these shifts are also effecting an ideological intensification, through which 'nature' is being furthered entrained with, subsumed by, and created so as to work for a particular political economic system, namely capitalism. As Hawken asserts, 'capitalism cannot be fully attained or practiced [*sic*] until... we have an accurate balance sheet' that places 'natural capital' on 'on the balance sheets of companies, countries, … [and] the world' (1999: xiii). Capitalism, however, is a particular ideology associated with persistent and deepening inequality between rich and poor (Vitali et al., 2011; OECD, 2013), as well as with the various apocalyptic environmental change scenarios associated now with the Anthropocene. The strategic support of capitalism through making nature into the natural capital asset class of the future thus seems worthy of what Castree (2003: 275) calls 'systematic normative theorising' so as to generate diagnostically critical, and perhaps even resistant, analytical engagement. It is in this engaged spirit that I intend this paper.

Acknowledgements. I gratefully acknowledge support by the Leverhulme Trust (ref. RP2012-V-041).

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http://unfccc.int/resource/docs/2012/smsn/igo/71.pdf

Table 1. Correspondences between the 'shifts' highlighted in this paper and cognate analyses of practices of assemblage and policy orchestrations for aligning multiple interests with conservation and 'green economy' agendas conceptualising nature as 'natural capital'.
Note: The bracketed numbers in each column refer to the orderings of the framings used in each of the analyses referred to here.

Key 'shifts' identified in this paper	**Cognate analyses and framings**		
	Li (2007) on 'practices of assemblage'	**Corson et al. (2013)**	**Callon-inspired conceptual framework and research protocol for Leverhulme Trust funded research project on value creation for which I am a Co-Investigator (see www.thestudyofvalue.org)**
(1) Discursive	(3) Authorising knowledge	(1) Logics, as cognitive and interpretive schemes that provide a system of shared assumptions	(1) Discursive framings
(2) Institutional	(1) Forging alignments	(2) Systemic dimensions, produced by alignment and articulation, as well as homogenisaton of logics within institutional field	(2) Institutional assemblages, *dispositifs* (cf. Foucault 1980: 194), *agencements* (cf. Deleuze and Guattari 1987(1980)). Occurs through alignments of actors, labour and policy mechanisms through efforts of articulation and orchestration, so as to build market 'agencement' and facilitate institutional reproduction (also MacDonald and Corson, 2012)
(3) Calculative and accounting	(2) Rendering technical, which includes (5) 'anti-politics' or depoliticisation (cf. Ferguson 1994)	(3) Mechanisms, instruments and techniques, including the development of new metrics	(3) Calculative and market devices that *perform* i.e. bring into being, the entities that are thereby calculated. Thus it is important to delineate the metrics designed to work in the world, their assumptions and associated effects (also see MacDonald and Corson, 2012: 163). These devices contribute to and emphasise 'economization' (Çalişkan and Callon, 2009, 2010), such that the normative evaluative framework and/or calculative rationality (cf. Weber, 2010(1930)) becomes one based on an economic calculus that can marginalise other evaluative criteria (cf. Foster, 1992).
(4) Material	-	-	-

Table 2. ‘Natural capital’ tendencies in environmental and ecological economics, after Åkerman (2005).

	Environmental economics	Ecological economics
Key original protagonists	David Pearce	Herman Daly, Robert Costanza
Key disciplinary influences	Neo-classical economics, natural resource economics	Ecosystem science, evolutionary systems theory, biophysical economics
Key calculative practices	Accounting, i.e. monetary valuation of environmental services, cost-benefit analysis, theory of externalities, intergenerational distribution of income given use of exhaustible resources, capital theory and monetary valuation	Ecosystems modelling, material and energy flows, ecological-economic joint modelling, biophysical valuation - nonetheless opened to market valuation
Versions of ‘sustainability’	‘weak’, i.e. maintenance of aggregate stock of capital required, but commensurability and substitutability between different forms of capital are possible, thus manufactured capital can replace natural capital	‘strong’, i.e. natural capital cannot be substituted by other forms of capital: ‘[n]atural capital can never be entirely replaced by any combination of human labor, wealth, and technology’ (Prugh et al., 1999, xvi)
Ecology and economics relationships	The accountant’s view of nature is underlined through an emphasis on value-generating ‘environmental assets’. Economic theory is shown as able to integrate ‘environment’ into its core	Focus is on ecosystem processes and ecological knowledge as informed by the ecosystem modeller’s view of nature
Goals	Preservation of ‘natural capital’ to solve other goals of ‘sustainable development’ such as interspecies rights and intragenerational equity in income distribution	Interdisciplinary bridge between economics and ecology; need to find new solutions to environmental problems; fruitful interaction with mainstream economics through developing common conceptual and analytical tools

Table 3. Examples of current policy approaches that calculate and account for nature as natural capital.

Organisation / source	**Calculative approach**	**Scale of operation**
UN System of Environmental-Economic Accounting (SEEA) (EC et al., 2012: 3; SEEA 2013)	• intends to include 'the perspective of ecosystems' in its accounting of national environmental assets; • will do this through Experimental Ecosystem Accounts (SEEA EEAs); • these will provide measures for the flow of benefits to humanity provided by ecosystems, and for environmental conditions in terms of the capacity of ecosystems as natural capital to societal provide benefits • these measures will facilitate the valuation of ecosystems in a manner consistent with market valuation principles	International governmental framework applied nationally
Wentworth Group of Concerned Scientists (2008: 8)	• intended as a model for National Environmental Accounts of Australia • Indicators for each environmental asset class are selected on the basis of their cost effectiveness in measuring the health of that environmental asset. • Once benchmarks have been established for all indicators, standard accounting practices are used to convert each indicator into a common metric (a scale of 0 to 1). • This creates a common currency to allow an unweighted comparison: - between environmental assets in each region; - between the same environmental asset in different regions; and - changes within and between each asset over time. • An environmental asset in each region would receive an: - A, where the data measures an indicator at or above the benchmark - B rating, for data at or above 84% of the benchmark; C rating, for data between 67% and 83% of the benchmark; D rating, for data between 50% and 66% of the benchmark; and an F rating, for an indicator less than 50% of benchmark. • In the same way economic ratings agencies use + and – to create finer categories, so too can the environmental monitoring scheme create sub-classes of A+, B-, C+, etc. • A positive change in condition, for example from a C+ to a B - would score a B - with a ... ☺ if it's getting better! If the condition changes in the negative, for example, from a C+ to a C, it would score a C with ... a ☹. No change, no smile: 😐	National
Corporate Ecosystem Valuation (CEV), WBCSD (2011)	• introduces a detailed accounting methodology to facilitate 'better-informed *business decisions* by explicitly *valuing* both *ecosystem degradation* and the *benefits* provided by *ecosystem services*', defined as flowing 'from natural capital' (page 4, emphasis in original); • offers 'a "value-based" lens through which associated environmental, social, economic and financial issues can be quantified, and the complex trade-offs between them compared' (page 4); • method is to convert 'ecosystem dependencies and impacts into a single (and influential) metric – money' (page 12); • CEV comprises a five-staged methodology (page 6, 47) 1. 'scoping', for identification of specific business goals and 'the preparation of terms of reference for ecosystem valuation'; 2. 'planning', for 'the implementation of ecosystem valuation' and 'determining the internal and external resources required'; 3. 'valuation', involving nine identified steps, including the monetization of changes to 'ecosystem services'; 4. 'application' of ecosystem valuation results so as to 'influence internal and external change'; 5. 'embedding', of 'the CEV approach' in 'existing companies and procedures'	Global corporate application