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On ‘Natural Capital’, ‘Fairy Tales’ and Ideology

Sian Sullivan

Dieter Helm, *Natural Capital: Valuing the Planet*. London: Yale University Press, 2015. 277 pp. £20 hardback, £12.99 paperback.

Natural Capital: Valuing the Planet (2015) by economist Dieter Helm (Professor of Energy Policy, University of Oxford), makes accessible his work as Chairman of the UK’s Natural Capital Committee, an independent advisory committee advising the UK government since 2012 ‘on the sustainable use of natural capital’¹. The book’s dust cover claims the text is ‘the first real attempt to calibrate, measure, and value natural capital from an economic perspective’ so as ‘to outline a stable new framework for sustainable growth’. As such, and given the author’s position at the helm (pun intended) of one of the most significant contemporary initiatives oriented around the idea of ‘natural capital’, the book is an important and timely intervention.

Helm’s text promotes a ‘natural capitalism’ that aspires to incorporate all aspects of valued external nature within accounting practices compatible with contemporary market economy — to put ‘the environment at the heart of the economy’, as the preface states (p. vii). The book’s key arguments are thus consistent with a ‘green growth’ development paradigm asserting the necessity of economic growth for environmental sustainability and *vice versa* (p. 244). As such, it is a resolutely ideological text, conforming to an instrumentalizing ethic that approaches ‘nature’ as a ‘set of assets’ that ‘can be valued in economic calculations’ (p. 6). Market frames are thereby privileged in which natural entities are fabricated such that they can be counted, and thereby valued, in capitalist market economic terms (Ch. 4 and 6).

First, unnumbered footnote

This review essay is dedicated to the memory of my father, development economist Gerard Sullivan. I will miss our conversations.

I am also grateful to the Leverhulme Trust (RP2012-V-041) and the AHRC (AH/K005871/2) for supporting the research informing this review essay, and to Mike Hannis and Aurora Fredriksen for comments on an earlier draft. Any errors in interpretation are mine alone.

¹ www.gov.uk/government/groups/natural-capital-committee (accessed 6 June 2016).

In this review essay I follow finance sociologist Donald Mackenzie 2008: 25) in asserting the importance of a civil conversation regarding markets and market valuation, given the seemingly intractable divide wherein '[s]ome are convinced that markets are sources of human freedom and prosperity; others believe markets to be damaging generators of alienation, exploitation, and impoverishment'. Here I want to ask a few questions of both the worlds being made as counting and calculative practices conjure the metaphor of 'natural capital' into manifest existence in the world, and of the exclusions, marginalizations and particular readings on which the rationality of these practices rests (also see Sullivan, 2014, forthcoming). I share with Helm concerns regarding the economic status quo and associated implications for environmental health — the 'challenges' facing us, as detailed in Helm's chapter two. These shared anxieties as well as areas of disagreement can be a starting point for respectful dialogue regarding critical economic-environmental issues that affect us all. At the same time, we differ markedly both in our diagnoses of the causes of these challenges, and in our hopes and suggestions for routes towards redress and recovery.

I speak from an environmental anthropologist's concern that diversities are lost in the world-making mission to fashion and fabricate the entire planet as an abstracted plane of (ac)countable, monetizable and potentially substitutable natural capital. In the vein of much natural capital thinking, Helm seems to assume, or perhaps to desire, that we all inhabit a world that is rationalized, experienced and accessed in the same way. This perspective displays little appreciation either of the historical conquests shaping capitalism's particular truth regime, within which natural capital thinking is set (Chakrabarty, 2000); or of the significant alienations of peoples from natures that established the privileges and enclosures under which captured 'natural capital assets' have been depleted (Federici, 2004). I find the relative absence of such contexts alarming. It minimizes and depoliticizes the moral relevance of a world structured by neoliberalism and destabilized by the equality-preventing dominance of rentier capitalism (Piketty, 2014; Storm, 2013; Vitali et al., 2011). Moreover, and as discussed further below, new proposals for investable natural capital conservation seem set to enhance rather than curtail the ability of a few to monopolize property and profits. These concerns are among the reasons why suspicion and resistance have greeted the depoliticized 'pragmatism' (Helm, 2014) of incorporating numbers representing 'natural capital' into balance sheets accounting for costs and benefits under capitalist economic structures.²

The terrain of natural capital(ism) is thus also a terrain of ideological struggle. On the face of it Helm is concerned about some of the environmental consequences of current economic structures and their implications into the future. At the same time, his proposed solutions often seem designed to shore up these same economic structures. This leads him to

² See, for example, <http://www.globaljustice.org.uk/resources/great-nature-sale>. For academic critique written from disciplinary bases in economics, philosophy and anthropology see: Coffey, 2016; MacDonald and Corson, 2012; Nadal, 2016; O'Neill, 2007; Read and Scott Cato, 2014; Spash, 2009, 2013; Spash and Aslaksen, 2015; Spash and Clayton, 1997; Sullivan, 2009, 2012, 2013a, 2014; Wilshusen, 2014.

regard as unworthy of consideration ‘environmentalists’ who do not share his enthusiasm for the environmental problem-solving possibilities either of accounting or of markets. The result is that a text devoted to ‘green’ concerns is also a text that frequently delegitimizes a diversity of ‘green’ views and voices. Environmentalist critique is pilloried throughout the book as promoting a simplistic ‘utopian’ and ‘fairy-tale world’ of lowered consumption, wealth redistribution, autonomous common-pool management arrangements, robust regulative frameworks and recognition of diverse forms of value. I lost track of the number of times Helm dismisses ‘environmentalists’ as ‘green fundamentalists’, although since he rarely cites sources on this point, it is difficult to see either who he is dismissing or what their specific concerns and suggestions might be. I return below to some reasons why this exclusion is unhelpful. But first, I want to introduce some different, indeed perhaps rather ‘other’, starting points as routes into reflection on the *particular* assumptions currently making the world in the image of natural capital.

DEALING FROM A DIFFERENT DECK? – A STARTING PLACE³

There are perhaps three things I have learned through working on and off for more than twenty years as an anthropologist in a context of ‘incomplete’ modernization and industrialization, namely the landscapes of west Namibia, southern Africa. Here, I have researched the changing lives, livelihoods and lifeworlds of mostly Damara / ≠Nūkhoen inhabitants living through conditions of colonialism, apartheid and neoliberalism. Latter decades have been particularly shaped by a neoliberal model of resource conservation, relying heavily on enhancing the economic values of the indigenous fauna and flora of this ‘wilderness’ landscape through improving access by global tourism and trophy-hunting markets (see Sullivan, 2006).

Diversity and Technologies of Enchantment

The first thing I have learned is that there is significant contemporary cultural, as well as individual, variation in the ways that people understand, know and (desire to) enact their relationships with ‘nonhuman natures’ (Sullivan and Low, 2014; Sullivan, 2016a, 2016b). People clearly consume aspects of the natures with which they live. But relationships with entities-beyond-the-human are also mediated, negotiated and managed through diverse knowledges, values and practices (Aiyadurai, 2011; Descola, 2013; Ingold, 2000; Kohn, 2013; Lewis, 2008; Singh, 2013; Tsing, 2005; Viveiros de Castro, 2004). Often these

³ This review essay develops a shorter blog posted on 19 November 2015 to coincide with the second World Forum on Natural Capital in Edinburgh on 23–24 November 2015. See www.futurepasts.net/#!Notes-on-%E2%80%98Natural-Capital%E2%80%99-and-%E2%80%98fairytales%E2%80%99/cay8/1

practices express registers of care, including care for the sustenance of future abundance, that are affective and embodied as opposed to calculative.

Elders I work with in west Namibia, for example, experience the broader landscape as a zone of uneven potencies, requiring appropriate ritual behaviours that connect people now with ancestral agencies, who act in the present to shape outcomes (Sullivan and Hannis, 2016). They have deployed exuberant ‘technologies of enchantment’ (Lewis, 2015; after Gell, 1999) that reinforce connections with places and events, often associated with specific animals, plants or landscape characteristics found there. People remember a long list of */gaines* — celebrated leaders of potent */gais* songs played ‘for the heart’ in dances that lasted through the night. Accompanied by complex clapped rhythms and collective polyphonic vocal arrangements, the songs allow(ed) participants to recursively and affectively (re)experience places and events expressed in the songs. In working with people to map and recover places from which they have been uprooted in the recent past, evictions occurring in the course of creating and conserving formerly dwelled-in landscapes as a ‘first-class pristine wilderness area’,⁴ it has not been unusual for me to hear someone spontaneously break into a song specifically connected with a place we are encountering. These songs and dances affirmed connection with and care for places, events, natures, cultural knowledges and relationships. People arguably perceived themselves as serving these other-than-human contexts, rather than only *vice versa*, as forms the basis for much current ecosystem services rhetoric (critiqued in Comberti et al., 2015; Plumwood, 2006; Sullivan, 2009). The unwelcome and often forced displacement of people from these places has reduced their ability to continue such care. It has created loss described as heartbreak, and disaffection through alienation from ‘their’ lands and associated natures, now ‘valued’ instead through global tourism markets.

Sharing Creates Abundance

The second thing I have learned is that landscapes currently highly valued for their biodiversity and other so-called ‘natural capital assets’ frequently occur in places inhabited (at least until recently) by surviving non-western ‘indigenous’ cultures. It is not romantic to assert that long-term consumptive and other engagements with natures in such contexts have often been effectively guided by direct relationship and tending practices under common property management arrangements, without recourse to measurement or numerical abstraction. Nor is it romantic to assert that the existence of norms and values limiting material acquisition need not be due to perceived scarcity, but can instead be underpinned by an assumption of abundance that militates against grabbing and hoarding (Lewis, 2008). I have repeatedly observed and heard about sensitive harvesting practices, framed both in terms of appropriate distribution — of sharing ‘resources’ equitably both between people, and

⁴ As described, for example, in www.expertafrica.com/namibia/damaraland/palmwag-lodge/in-detail (accessed 28 February 2016).

between humans and relevant nonhuman entities — and in terms of pragmatically managing for future abundance (Sullivan, 1999).⁵ A legacy of environmental value practices aimed at ‘sustainable futures’ is evidenced by current identification of many such cultural landscapes as highly valued ‘biodiversity hotspots’ (Gorenflo et al., 2012). Transformation of such practices into ones monetized under structuring assumptions of individual self-interest seems instead to ‘crowd out’ other motivations for care (see, for example, Frey and Jegen, 2001), whilst simultaneously creating a series of perverse incentives both to grab what might be paid for, and to cheat on making payments that may be due. What I have observed, then, seems to contradict Helm’s contention that it is an absence of prices that contributes to over-use of entities from the natural world (as argued in his Ch. 6, and discussed further below).

Capitalism Turns Commons into Open Access Resources

The third thing I have learned is that the commons of diverse cultural landscapes globally have been connected over the past few hundred years through their meeting with the particular expansionary economic system associated with merchant capitalism, and the ensuing capital accumulations permitting the multiple radical transformations caused by industrialization. Consolidated initially in Europe by repeated ‘grabbing’ of lands previously managed under various common property (as well as feudal) arrangements (Fairlie, 2009; Federici, 2004), and coupled with a new way of thinking that elevated mind over body and culture over nature (see discussion in Sullivan 2013b, 2016a), this culture often rode roughshod over the peoples and natures it encountered, both ‘at home’ and elsewhere. As this culture expanded into landscapes progressively conceptualized, and thus emptied, as *terra nullius*, it treated the ‘resources’ found there as available under open access to whoever could grab them first.

Namibia constitutes a good example of an imperial ‘frontier’ for capital accumulation. The history whereby the lands and peoples of the territory that became Namibia (ultimately through independence from South African administration in 1990) is one of layers of systematic asset stripping and land grabbing. Whaling for oil off the Namibian coast was conducted by New England whalers from the 1770s, after decimating these creatures in New England waters (Kinahan, 2000). In 1796, the British administration of the Cape Colony claimed exclusive rights to catch whales and seals in Namibian waters (du Pisani, 1986: 13). These ‘rights’ were later deployed in an 1840s ‘guano rush’ on islands along Namibia’s coastline that exhausted this resource in around four years (Watson, 1930). The acquisition of Namibian guano by hundreds of British ships permitted this southern source of fertility to support intensifying agricultural production in northern contexts, a process facilitated by multiple enclosures of previously commonly used lands. Current restricted distributions in Namibia of high-value species such as rhino remain a legacy of excessive hunting with

⁵ For a diversity of cultural histories of sustainability from multiple geographical contexts see the chapters in the volume edited by McAnany and Yoffee (2009).

firearms associated with early European incursions into the region (as evidenced in Alexander (1838/2006); Galton 1853/1890), as well as with the export of ivory, skins and ostrich feathers to European markets (Kinahan, 2000: 18–19). Diamonds found in a concession-to-prospect ‘acquired’ for the Pomona Mining Company in 1856 from ‘a local Nama headman’ (Chief David Christian) in southern Namibia fuelled rapid development of a German colonial mining sector in the early 1900s (du Pisani, 1986: 13). Colonial policies and policing worked hard to generate an African labour force for this sector, not least through impoverishment and taxation following a genocidal war, coupled with the establishment of a rapidly expanding European settler economy in central Namibia that grabbed land from indigenous Africans. Germany has now recognized that its land-grabbing massacre of Herero and Nama in the early 1900s constituted genocide (Muraranganda, 2015). In recent years a ‘uranium rush’, fuelled globally by arguments for the low carbon energy potential generated through nuclear power (Lynas, 2012; Monbiot, 2011), has brought diverse international corporations and investments to west Namibia to mine uranium for export to world markets (MME, 2010; discussed in Sullivan, 2013c).

Indeed, one reason for current concern regarding natural capital thinking and accounting practices is that this paradigm may tether newly accounted capital values for ‘standing natures’ more closely to new possibilities for the *accumulation* of ‘surplus value’ generated from commodities associated with these increasingly scarce natural capital assets — think, for example, of tradable carbon offsets coupled with conserved forest carbon, or ‘ecosystem services’ for which payments may be extracted. Just over 100 years ago, Rosa Luxemburg (2003/1913: 10) observed that the fabrication of commodities is ‘not an end in itself’, but ‘a means to the appropriation of surplus value’. Following this line of thinking, the concern here is that in making ‘nature’ legible as a commodity to be paid for (see below), any surplus value thus generated will (once again) become accumulated by those with the financial capital able to capture ‘natural capital’ as a commodity-generating asset. Appropriation of ‘standing natural capital assets’ as these become investable would thereby simply continue the historic dynamic of accumulation described above. Again, this is a point to which I will return below. But first, I consider some of the specific arguments made in Helm’s mission to ‘value the planet’ as ‘natural capital’.

THE FACT(ISH) AND FALLACY OF ‘NATURAL CAPITAL’

The UK’s Natural Capital Committee (NCC), led by Helm, is one of many current initiatives designated with the noun ‘natural capital’. These initiatives include the World Forum on Natural Capital, described as ‘the world’s leading natural capital event’; the Natural Capital Declaration (NCD), committing the financial sector to mainstreaming ‘natural capital considerations’ into all financial products and services; the global Natural Capital Protocol (NCP), bringing together leaders in the business community to create a world where business both enhances and conserves natural capital; and the Natural Capital Financing Facility

(NCFE), a financial instrument of the European Investment Bank and the European Commission aiming ‘to prove to the market and to potential investors the attractiveness of biodiversity and climate adaptation operations in order to promote sustainable investments from the private sector’.⁶ The International Union for the Conservation of Nature (IUCN) is developing ‘a substantial policy position’ on the theme of ‘Natural Capital’ (IUCN, 2014: 4–5). Motion 63 proposed for debate at the IUCN’s World Conservation Congress in September 2016 advocates development of a ‘natural capital charter’ as a framework ‘for the application of natural capital approaches and mechanisms’.⁷ All these initiatives apparently take ‘natural capital’ as an exterior ‘matter of fact’, sharing definitions along the lines of that sanctioned by the UK’s NCC that ‘natural capital’ consists of ‘our natural assets including forests, rivers, land, minerals and oceans’.⁸

Capital, in this statement, is an ‘asset’. Complications in conceiving of ‘nature’ metaphorically as ‘capital’ enter, however, when we understand that the category ‘capital’ is incommensurably plural, even when considering only physical and economic capital.⁹ Capital exists variously as: i) heterogeneous and not fully commensurable or substitutable physical factors of production (including goods such as machinery, as well as land-as-property as a fixed capital asset), that on accounting balance sheets also constitute liabilities with maintenance costs; ii) the medium (i.e. money) through which factors of production may be valued, bought and sold and thus fabricated as substitutable through markets; and iii) interest-bearing assets (which can range from physical property to currencies to financialized securities) that in a capitalist economy can generate flows of financial dividends (Nadal, 2016; Read and Scott Cato, 2014: 155), which can be further leveraged through credit/debt and securitization mechanisms.

Although rarely explicitly foregrounded, then, framing and thus conceiving nature-as-natural-capital (Lakoff, 2010) always raises the question of whether the focus of attention is on maintenance costs, possibilities for substitution, or dividends. The first two of these seem favoured by Helm (see pp. 90-94, pp. 50-54). The third is celebrated by another popular writer on natural capital. In *What Has Nature Ever Done for Us? How Money Really Does Grow on Trees*, Juniper (2013: 268) writes 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

⁶ For information, see <http://naturalcapitalforum.com/>, <http://www.naturalcapitaldeclaration.org/>, <http://www.naturalcapitalcoalition.org/natural-capital-protocol.html>, <http://www.eib.org/products/blending/ncff/index.htm> (accessed on 7 June 2016).

⁷ See <https://portals.iucn.org/congress/motion/063> (accessed 29 August 2016).

⁸ <https://www.gov.uk/government/groups/natural-capital-committee> (accessed 29 August 2016).

⁹ That is, without extending the term to ‘human’, ‘social’ and ‘cultural’ domains, as delineated by Bourdieu (1986) in his use of ‘capital’ as ‘a surrogate for [accumulations of] power’, as well as more normatively in multiple development and corporate models (see discussion in Wilshusen, 2014: esp. 140–5; also critical exploration of the performative application of the capital metaphor to social life in Devadason, 2011).

as “natural capital””. Such optimism regarding the ecosystem services ‘dividends’ forthcoming from ‘natural capital stocks’ is a hallmark of collaborations between financial institutions and environmental organizations which seek to use the income streams potentially forming these ‘dividends’ to leverage large-scale return-seeking conservation finance (see, for example, Credit Suisse and McKinsey Center for Business and Environment, 2016; Credit Suisse, WWF and McKinsey&Company, 2014; Cranford, Parker and Trivedi 2011; The Nature Conservancy, 2016).

As such, ‘natural capital’ does not exist in any simple, objective form. It is a chimerical new exterior ‘Nature-whole’ (Asdal, 2008) being conjured into being through diverse practices of conceiving, measuring and valuing the so-called natural world. Through these practices natural capitals are becoming increasingly fetishized ‘objects’ in the world, charged technically (through calculation) and socially (through institutionalized expert agreement) with authoritative, objective power. Bruno Latour (2010) calls such constructs ‘factishes’, emphasizing both the human investments through which these modern fetishes become able to act in the world, and the excessive or even irrational commitment they inspire. The fact(ish) of natural capital is thus being fabricated in the world through repetitive utterances, treated as truisms, that from different perspectives (including some of those mentioned in the previous section) may also be understood as fallacies. Consider the following three propositions shaping Helm’s text.

You Cannot Manage What You do not Measure

This statement was asserted so often by Pavan Sukhdev — the banker that led the recent UN and EU programme on The Economics of Ecosystems and Biodiversity (TEEB)¹⁰ — that it became something like the defining slogan for that programme. In Helm’s book it is also asserted repeatedly. Helm’s fourth chapter ‘Accounting for natural capital’ thus opens with the statement that ‘[w]hat is measured tends to be what matters’ (p. 79).

Measurement of what exists is seen as key to rational and efficient management, whilst counting, calculating and pricing things are seen as purely technical practices that are beyond ideology. This view contrasts significantly with a growing understanding of practices in economics and finance as indelibly entwined with, rather than merely reflecting, the market and value phenomena that thereby come into being in the world (as analysed in detail in Mackenzie, 2008). As such, numbering, (ac)counting and (economic) modelling practices can be seen to make or *perform* the world that is thus counted, as opposed to simply capturing a picture of a world that exists (Callon, 1998). Calculative economic and accounting practices can be seen to contribute the building blocks for an ideological construction of the world that serves particular interests and frames out others. Max Weber (1930/2010) clarified this

¹⁰ <http://www.teebweb.org/> (accessed 7 June 2016).

connection between calculation and ideology some decades ago, in asserting the close relationship between capitalist accumulation and calculative rationality: thus '[w]here capitalistic acquisition is rationally pursued, the corresponding action is adjusted to calculation in terms of capital' (p. xxxii), such that this 'calculating rationality' embodies 'the specific and *peculiar rationalism* of [Protestant] Western culture' (pp. xxxvii-xxxviii, emphasis added).

To illustrate this 'peculiarity', I will return to the Namibian context in which I conduct field research. In 1850, Francis Galton, later recognized as the father of eugenics, travelled to south-west Africa (Galton, 1851/1890). Whilst there he was driven to distraction by what he perceived as the inability of the 'natives' he encountered to count things (echoing Alexander, 1838/2006: 165). In his controversial later work on eugenics and the inheritance of traits, he used his opinions of African numeracy to justify placing Africans at the bottom of the human hereditary tree (see discussion in Gillham, 2001: 81). Nonetheless, and as observed for pastoralist peoples the world over, these same apparently innumerate people knew in material terms the identities and characters of every single animal in their herds of livestock, which could amount to several hundred head and more. Knowledge appropriate for tending these herds and sustaining them into the future arguably relies less on numeracy and calculation, and more on direct observation, familiarity, and acknowledgement of the particularity of each 'head' making up the herd, in connection with detailed understanding of broader environmental contexts (Homewood, 2008).¹¹

Indeed 'management' benefits from information from all the senses. Gardeners might sense through observation, smell and touch when plants need water, shade, planting out, or pruning. These are tending practices that philosopher Isis Brook (2010) affirms as amplifying environmentally virtuous behaviour. The sorts of responsive and relational care practices associated with gardening and direct tending practices are at least as relevant as measurement and modelling, as skills that attend well to the materialities of diversely embodied other-than-human natures. Abstraction through counting and numbering practices may in fact reduce the awareness and ability needed to practice such embodied attunements, whilst at the same time reinforcing calculative disconnections that encourage the sorts of ruthless instrumentalizations of both human and nonhuman bodies underscoring much contemporary environmental decline.

¹¹ Similar observations have been made for complex and sustained indigenous agricultural organization in contexts without writing. Archaeological research into O'Odham agriculture in the American south-west thus reveals the engineering of 'hundreds of miles of canals with precise slope and elevation calculations' and the communal coordination of 'the opening of gates and barriers to direct water flow at proper intervals' (Wilcox, 2010: 118–20). This complex and longstanding agricultural system was dismantled in the 1800s through US government policy including diversion of water from O'Odham lands upstream to serve settler agriculture.

Substitution and Offsetting between Different Natural Capital Assets Need not Imply a Net Loss in Aggregate Natural Capital

The fulcrum on which Dieter Helm's arguments for natural capital accounting pivots is what he calls the 'aggregate natural capital rule' (see especially Ch. 3). This rule states that it is maintenance of measured natural capital *in the aggregate* that counts. A key intention of national natural capital accounts, then, is to calculate total stocks of nature-as-natural-capital in such a way as to support maintenance of measured elements above relevant thresholds (echoing Boulding, 1966: see discussion in Spash and Clayton, 1997: 145). This calculative enterprise is complemented by the conceptual possibility of substitutability between the calculated values for different types of capital, as well as between different types of 'natural capital', so as to maintain productivity and economic growth overall. Thus, for example:

[r]enewables can be depleted, and hence substituted for by other forms of capital, *up to the threshold*. Non-renewables can be substituted for *entirely*. ... all that is needed is to identify the thresholds and concentrate on keeping renewable populations above this level, while creating an intergenerational fund from the economic rents generated by depleting non-renewables to ensure an equitable distribution of the benefits between the generations (p. 51, emphasis in the original).

Strangely, Helm's advocacy of this 'natural capital aggregate rule' follows immediately from his vehement discrediting of an aggregate rule as deployed by Keynesian economists. He asserts that a treatment of 'consumption and investment' as 'just different types of aggregate demand' in macroeconomic terms — such that '[i]t is the aggregate, not the composition of the aggregate that matters' — is 'highly suspect' (p. 86). Yet it is precisely an aggregate rule that discounts many aspects of the composition of the aggregate that Helm proposes for natural capital, notwithstanding different treatments for 'non-renewable' and 'renewable' natures/capitals.

What Helm's aggregate natural capital rule means is that destruction can occur for one 'element' of 'natural capital' as long as this is somehow substituted or compensated for. In the new world of carbon emissions management, for example, this approach supports the mitigation of industrial emissions through purchase of offset credits signalling sequestration or reduced emissions somewhere else. In the management of habitat and biodiversity destruction through development, biodiversity offsetting — a controversial compensatory mechanism (Sullivan and Hannis, 2015) — is advocated for the mitigation of biodiversity loss due to economic development (pp. 152–4). The aggregate rule is thus a frame (as per Lakoff, 2010) that conceptually permits different natures in different places and times to be exchanged for each other, as long as some aggregate measure apparently remains intact and 'valuation methodologies' can be established to assist with calculating and improving the aggregate line (p. 90).

Figure 1 represents this view in schematic form, as conveyed by the UK's Natural Capital Committee that Helm chairs. The graph depicts current levels of national aggregate 'natural capital' in the UK as the already greatly depleted level that should be sustained and improved so as to generate 'no net loss' of natural capital into the future. Establishing 'a set of properly maintained and enhanced natural assets' (Natural Capital Committee, 2015: 1) is associated here with the attribution of monetary value for these assets, estimated in 2014 by the UK's Office of National Statistics to be approximately £ 1.6 trillion in aggregate (ONS, 2014).

INSERT FIGURE 1 AROUND HERE

This aggregate approach emphasizes a neoclassical instrumentalist economic view that 'nonrenewable resource depletion still allows sustainable development because economic output can be maintained or even increased via substitution' (Spash and Clayton, 1997: 145). It is facilitated through a Promethean faith in technological progress that will facilitate substitution (pp. 244–5; also Lynas 2012; and especially the *Ecomodernist Manifesto* by Asafu-Adjaye et al., 2015), as if this progress is able to be enjoyed by everyone more or less equally, and as if technological innovation and production does not itself require significant environmental extractions, transformations and consumptive growth. An affirmation of aggregate national capital(s) and substitutability has been critiqued by economists both for discounting the intrinsic non-substitutability of *man-made* capital(s) (see Nadal, 2016; Spash and Clayton, 1997: 146–7; Read and Scott Cato, 2014) and for extending this discounting into a seemingly 'anti-ecological' skepticism towards the values-in-themselves embodied by elements of 'natural capital' and their interrelationships into the future (Spash and Clayton, 1997: 154). Also of concern is that the socio-economic causes of ecological decline (as depicted in Figure 1) seem little addressed in aggregate natural capital thinking. Instead, reward structures are proposed for current producers and landowners to shift their practices into green growth renderings (of which biodiversity offsetting is one). Scant attention is paid to the ecological debt and inequities experienced by broader society, debt which has been generated through historical productive and appropriation practices variously associated with many of these same actors (discussed further in Sullivan and Hannis, 2015).

Consider too what has happened to the management of carbon under a similar aggregate rule, also enacted so as to sustain the 'natural capital' of a climate conducive to life more or less as we know it. In managing carbon budgets, aggregate levels have been set (i.e. 'caps') within which trades can occur between carbon emitters and those who act so as to reduce emissions beyond an ultimately unknowable counter-factual scenario. The 2015 Paris Agreement of the Conference of Parties to the United Nations Framework Convention for Climate Change thus strengthens notions of global 'net zero-carbon' and 'net carbon neutrality', providing for international carbon trading that balances carbon emitted with equivalent amounts sequestered or offset, within an aggregate or 'net' global carbon budget (see review in Reyes, 2015). A great deal of research and documentation, however, now

indicates that this ‘solution’ is a fantasy, perhaps even a ‘fairy tale’. Carbon markets have failed to do what they say they do, i.e. to reduce aggregate carbon emissions through the purchase and trading of emissions credits tied to carbon reductions and/or storage (Lohmann, 2009, 2014). Indeed, in segments of carbon markets perverse incentives have stimulated emission of millions of tonnes of greenhouse gases more than what might have happened *without* a market for carbon credits (see in-depth review by Schneider and Kollmus, 2015).

The ‘aggregate natural capital rule’ takes such structures onto extremely shaky ground. ‘Nature’ is unpredictably emergent, relational, variable, path-dependent and unique — it is not comprised of separate and substitutable ‘bits’ or ‘units’ (p. 96; see discussion in Maier, 2013). Each part plays a role in generating a whole that is dynamic, sometimes unpredictably so, and thus making a ‘bit’ in one place cannot replace a loss in a different context. What we are left with instead is not a gain but a loss in one place, plus investment in something different somewhere else (Sullivan and Hannis, 2015). From an ecological perspective, then, it seems very strange to advocate the natural capital aggregate rule. We are already faced with path-dependent time lags in ecological decline due to historical transformation of habitats globally, and the nonlinearities effected by the relational and connected ‘nature of nature’ mean that the full consequences of past and present losses are not possible to factor with accuracy into any offsetting calculations. In addition, contexts of broader climate change make predictable restorations and creations of future habitat increasingly difficult to enact with any certainty (see, for example, Maron et al. 2012).

As economist Herman Daly (2014, online) writes, natural stocks have a physical basis that is not fungible. He asserts further that ‘[e]xchanges of matter and energy among parts of the ecosystem have an objective ecological basis. They are not governed by prices based on subjective human preferences in the market’ — a point which leads well into consideration of the next proposition.

A Price has to be Put on Nature

In much natural capital thinking, markets are considered to generate efficiency and stability in the allocation of scarce resources (p. 117). This argument is used to support monetary valuation of previously unpriced ‘natural capital assets’ and ‘ecoservices’, so that they can be made visible as units in cost-benefit analyses and permit the allocative efficiencies of markets to do their work. As Helm asserts, ‘[t]he trouble is that most (but not all) renewable natural capital has no market and hence no price’ (p. 110): ‘a price has to be put on nature’ (p. 116), and ‘[r]efusing to price or place an economic value on nature risks environmental meltdown’ (p. 4).

The assumption that pricing unpriced natures will improve allocation seems, however, to flow both from a misplaced faith in the objectively technical, rather than negotiated,

recommendations of cost-benefit analyses (see discussion in Lohmann, 2009; G. Sullivan, 2011), as well as from a rather vanilla view of markets. Regarding the latter, other perspectives emphasize the volatility of prices, wild fluctuations in both stock and commodity prices, unpredictable discontinuous changes in values that render agreements regarding costs as imprecise, and the ways in which ‘real-world’ market prices are resolutely complex constructions, even for more conventional commodities (see analyses in Mackenzie, 2008; Mandelbrot, 2008). These are all empirically-observed realities that tend to be discounted and detached from the assumptions informing economic and financial models — models which are themselves also observed to act so as to shape markets. What exactly, then, are ‘natural capital assets’ and ‘ecoservices’ and the natures these concepts represent being exposed to, when they are further ‘revealed’ to the ‘price mechanism’?

Helm illustrates the implications of a lack of prices signalling the cost of use of an asset through recourse to Garrett Hardin’s highly-cited 1968 paper positing a ‘tragedy of the commons’ (p. 102). In this paper, Hardin (1968) argued that given a pasture open to all, self-interest will drive cattle accumulation strategies that benefit individuals at the expense of the grazing they rely on. But as students of Anthropology 101 will know, Hardin’s ‘commons’ was not a commons at all — it was an open access situation. As noted above, commons in diverse contexts globally have been managed with varying degrees of success as common or collective property, through an array of institutions and procedural practices designed to utilise, distribute and sustain ‘resources’ (Hardt and Negri, 2009; Ostrom, 1991, 2012; Sullivan and Homewood, 2004). The individualistic and selfish grabbing and conversion of resources so as to support accumulation of financial profit have instead repeatedly treated commons and their peoples as if they are open access, and it was this sort of situation that Hardin was describing. Worryingly, Helm seems to simply see ‘open access’ and ‘commons’ as describing the same tenure and allocation situations: thus in referring to the ‘open access–commons’ approach (p. 192) he both removes key differences between these two types of tenure, and discounts any optimism for communal forms of organization, management and allocation. Economist Elinor Ostrom won a Nobel Prize in economics for her work on how communities around the world co-operate so as to share and manage common pool resources (Ostrom, 1991, 2012; also Amin and Howell, 2016; Hardt and Negri, 2009). This work receives scant attention by Helm. Is this because it leads to markedly different conclusions regarding optimistic possibilities for equitable deliberative management of used and valued ‘resources’?¹²

Helm digs in his version of irrational resource users eating themselves out of house and home under the ‘giant party’ of supposedly common property regimes by invoking Jared Diamond’s (2005) similarly flawed analysis of the dramatic decline of Easter Islanders in his popular book *Collapse* (p. 87). Helm notes in a footnote that this interpretation is controversial (p. 253), but neglects to inform his readers why this is so. I used to draw on this

¹² Helm’s bias here is revealed by the book’s index, in which ‘commons’ simply redirects to ‘problem of the commons’ (under which there are numerous entries).

controversy when teaching a class on ‘science, power and political ecology’ for an undergraduate module on ‘Environment and Development’. Even if this controversy is only mentioned in passing in Helm’s text, it seems worth clarifying why it is so problematic to call uncritically on Diamond’s ‘tragedy of the commons’ narrative as a cautionary tale of ‘ecocide’ (that is, ‘ecological suicide’).

Diamond (2005: 20, 118) asserted that ‘[t]he history of Easter Island..., is as close as we can get to a “pure” ecological collapse’, ‘... uninfluenced by either enemies or friends’, such that ‘Easter’s isolation makes it the clearest example of a society that destroyed itself by overexploiting its own resources’. The controversy is due in part to the existence of historical documentation of both the apparent health of the indigenous Easter Island population when encountered by Europeans in 1722 (Peiser, 2005: 518), and the subsequent severe impacts on the indigenous Easter Island population of ‘blackbirding’, that is, slave trading, combined with whaling and guano extraction. These incursions meant that dozens of European vessels landed at Easter between first European contact in 1722 and the Peruvian slave raids of 1862, bringing disease as well as physically removing significant numbers of people to supply labour demands elsewhere (Peiser, 2005: 532–4; also Hunt and Lipo, 2009). In other words it was a rapacious capitalist and racist *market* encountering Easter Islanders only as a source of valuable commodities — whale oil, guano fertilizer and human labour — that instigated the now iconic Easter Island ‘collapse’. Here, then, Helm invokes a ‘fairy tale’ — that of ‘ecocide’ — to support his affirmation of the necessity of market prices in instituting efficient distribution and management of resources, when instead it was capitalist market structures that stimulated and sanctioned genocidal practices leading to societal collapse.

As such, it is not necessarily exposure to prices and markets that will improve the treatment of an apparently open access resource by encouraging the internalizing of the shared costs of over-exploitation. Recognition of and support for institutions and procedures that foster distributive and procedural mechanisms for holding and sharing resources in common, might instead be more likely to create abundance, through agreeing use practices that adjust harvesting activity in response to the health of populations that are thus utilized. This, I believe, is one of the reasons why there has been protest in the UK over the proposed privatization of forests and woodlands.¹³ The outcry was not so much because people were concerned that the private sector might do a worse job than the public sector of caring for forested land, as argued by Helm (p. 195). It was more to do with protecting the principle of public ownership for the common good, as well as contesting the neoliberal zeitgeist in which the state facilitates the movement of public assets into private and corporate hands (Sullivan, 2012: 8–9). Proposals that the UK’s ‘natural capital’ be managed via a utilities model (pp. 184–93) that generalizes ‘across the natural capital assets’ and includes a ‘National Nature Reserves Utility’ (p. 191), may generate similar concerns that this will constitute a step

¹³ See <http://saveourwoods.co.uk/> (accessed 7 June 2016).

towards the privatization of ‘natural capital infrastructures’ — as has occurred under neoliberal governance regimes for many formerly public utilities.

FUNDAMENTALISMS? AND FUTURES . . .

As noted above, Helm peppers his book with dismissals of environmentalists as naïve ‘green fundamentalists’, whilst neglecting to reference sources, making it hard to see who it is he is dismissing or what their arguments are. By working so hard to dismiss the fundamentalist-utopian-fairy-tale thinking of environmentalists, recognition of the capital-centric and market fundamentalism — even utopianism — of his own thinking is avoided.

This is unfortunate. There is much in Helm’s text as well as other natural capital work that is in agreement with so-called ‘green’ perspectives. This includes acknowledgement of the urgent need for change; assertions that there is ‘a limit to the credibility of the assumption that the next generation can or will pay’ (p. 86); support for a Norway-style sovereign wealth fund, especially so as to build public rather than private wealth from the continued exploitation of non-renewable resources (p. 14, 87); emphasis on the way that GDP numbers ‘fool ourselves about our real wealth’ and ‘may be actually making things worse by positively encouraging behaviours that are detrimental to the next generation’ (p. 96); and concern regarding perverse subsidies (p. 228). ‘Greens’ would probably balk at assertions that ‘natural capital’ exists simply as an input to economic production processes (p. 81) and to sustain levels of consumption into the future (p. 88), and would perhaps emphasize both the maintenance of so-called ‘natural capital assets’ *and* the necessity of curtailing exploitation through consumption. They may be bemused by the comment that land hardly accounts for much of Britain’s wealth (p. 88), a response to which might be that if this is the case then perhaps some of it could be redistributed to those who would value an acre or two. And they might also be frustrated at an analysis blaming consumers as the ‘ultimate polluters’ (pp. 161–2, 178) for polluting activities associated with commercial production, without mentioning the budgets spent by corporations on marketing so as to stimulate consumer demand by attracting and manipulating consumer preferences. But they would probably agree with Helm’s assertions that we are living beyond our means (p. 222), and that there is sense in precautionary strategies of risk aversion (pp. 223, 225).

Given a stated concern to protect and restore environmental health, it is sad that ‘greens’ are not seen by Helm as allies in this mission. Of course, a barrier to collaboration is a widespread squeamishness on the part of ‘environmentalists’ to approaches that fetishize numerical representations and economic terms and metaphors in describing ‘nature’. This resistance rests on relevant ecological concerns, as noted above. At the same time, it also derives from an intuition that the move to enrol nature(s) more completely into the sphere of capital effects a problematic reduction of ways of thinking about, relating with and valuing all those entities, places and ecologies we (can) know as ‘nature’; as well as opening possibilities

for financial instruments that treat new ‘standing natural capital’ values as potentially leverageable assets.

I think these intuitions are legitimate. In the last few years it is noticeable that financial institutions, with the backing of large environmental organizations such as IUCN, are investing in the design of products that would attract scaled-up conservation investments from institutional investors and (Ultra-)High Net Worth Individuals ((U)HNWIs), that is, the super super-rich. Such would be linked in part with the surplus value projected as forthcoming from newly saleable commodities generated from conserved natures – for example, forest carbon offset certificates and commoditised ‘ecosystem services’ (Huwlyer et al., 2014; see also Credit Suisse, Credit Suisse and McKinsey Centre for Business and Environment, 2016; The Nature Conservancy, 2016; WWF and McKinsey&Company, 2014). Of course, such investors loaning finance to projects associated with conservation also expect market-rate returns to compensate for investments considered to conserve, restore or rehabilitate ecosystems and associated ‘services’ (Credit Suisse, Climate Bonds Initiative and Clarmondial, 2016: 1). As Helm (2016: 3) states in a text offering cautious support for such debt-based, return-seeking financing for natural capital assets, ‘any investor in equity or debt is going to want an answer to the question: where is the money coming from to make the public environmental dimension into a defined revenue stream and hence make the project privately investable?’ In the documents referenced above, returns are projected to materialize in part from new markets in the potentially monetizable ‘dividends’ of ‘standing natural capitals’ represented, for example, by ecosystem services and carbon (discussed in Sullivan, 2013a). Investor risk is proposed to be reduced through mobilizing such newly legible and leverageable assets, as well as the ‘land or usage rights’ from which they derive, as underlying collateral (see, for example, Credit Suisse and McKinsey Centre for Business and Environment, 2016: 17).

What these financing proposals imply, then, is that countries of the global South with remaining high levels of ‘standing natural capital’, may become indebted to ultra-high-net-worth investors who will access returns on their investments from new income streams arising from these conserved tropical natures. Figure 2 presents two schematic diagrams redrawn from texts referenced here that indicate how these flows of value are envisaged to be ‘leveraged’ from natures made legible — that is, investable, as natural capital. These possibilities are perceived to be boosted through recent UNFCCC support for international compensation mechanisms that ‘balance anthropogenic emissions by sources and removals by sinks of greenhouse gases’ (UNFCCC Paris Agreement 2015, Article 4.1). Such mechanisms are expected to release new long-term sources of additional funding (Credit Suisse and McKinsey Centre for Business and Environment, 2016: 12). At the same time, however, debt-based financing structures for natural capital conservation may exacerbate processes whereby people, especially in tropical contexts, become forced from land and livelihoods as standing ‘natural capital assets’ become able to generate monetizable ecosystem service and carbon ‘dividends’ in these contexts (as documented in Cavanagh and Benjaminsen, 2014; Dunlap

and Fairhead, 2014).¹⁴ It is also unclear in these contexts, some of which may be perceived as managed under common property arrangements by those living there, who or what the ‘firm’ is that would be able to sell bonds representing natural capital value for the receipt of private investment.

FIGURE 2 AROUND HERE

In these examples, then, we see a key potential outcome of natural capital economics. This is to bring the object(s) of ‘natural capital’ into visibility in ways that concur with neoliberal possibilities for private capture of both public natural capital assets (i.e. valued ‘standing natures’), and of public environmental finance (including, for example, public spending on the development of new offset schemes). As with other processes of propertied asset creation and capture, these proposals for creating investable natural capital assets out of conserved natures *in situ* open possibilities for the capture of new forms of ‘surplus value’ by high-net-worth individuals and institutional investors, through which investors are additionally also able to assert ‘virtual ownership’ of large blocks of newly investable ‘stocks’ (Mackenzie, 2008: 4). Such moves, nascent and clunky as they may be (Dempsey and Suarez, 2016), generate well-founded concerns that the natural capital thinking promoted by Helm and others may fail on distributive, procedural and recognition justice grounds (Martin et al., 2013), by sustaining capitalist trajectories that entrench highly inequitable relationships in both social and environmental domains.

‘BUT NOW COMES A COLOURLESS AGE’?

In order to situate the disagreements between Helm and ‘environmentalists’ more clearly it is worth understanding that this is perhaps an archetypal struggle. It is a struggle redolent of a poetic and philosophical concern for liberties associated with the immanent liveliness of human and beyond-human natures, pushing against a disciplining and transcendent control that bolsters accumulation and is strengthened by calculative abstraction and instrumentalization practices.

This dynamic has been present for at least several centuries, replaying itself through the particular aesthetic and ethical discourses of the day. William Blake’s reference to ‘dark Satanic mills’ in his epic poem *Milton* from the early 1800s¹⁵ has thus been linked with his concern for the destruction of playful human innocence and nature’s ‘natural noninstrumentality’ (Stephens, 2004: 88) associated with emerging industrial production, and

¹⁴ Recent fining of Credit Suisse for violating securities law and gaming markets through ‘dark-pool’ trading practices is unlikely to instill confidence in this company’s intentions in designing debt-based investment in the conservation of ‘standing natural capitals’ (*BBC News*, 2016).

¹⁵ See www.blakearchive.org/exist/blake/archive/transcription.xq?objectid=milton.a.illbk.02&term=satanic%20mills&search=yes (accessed 11 June 2016).

particularly with a repressive ideology linked with mechanization and quantification. Max Weber (1917/1946: 155, 154) famously described modernity's 'fate' as 'characterized by rationalization and intellectualization and, above all, by the "disenchantment of the world"', asserting an unbridgeable tension between 'the value-spheres of "science" and the sphere of "the holy"' (see discussion in Curry, 2016). In his prose poem *After Nature* (from which the title of this section is derived), the author W.G. Sebald (2003: 93, 95) wonders 'at the work of destruction' implicit in 'the truly boundless growth of industry'.

It seems, in other words, that the voices now proclaiming and contesting the value of natural capital thinking for 'valuing the planet' are connected with a repetitive struggle over the sources of value for human experience, the types of entanglement desired between human and nonhuman others, and who has the rights to decide these questions for others.

For my part, I will close this essay by invoking George Orwell's text *1984*, first published in 1949. Environmental philosopher Piers Stephens (2004: 80) maintains that this text 'shares with radical environmentalism a protest against the modern ethos of separation of subject and object, [and] of estrangement and disconnection from our fellow humans and from the natural world'. I happened to (re)read *1984* alongside Helm's text, whilst living in the latter months of 2015 in west Namibia in a small rural settlement of indigenous people. Not long previously these people had been served with a 'request to vacate land' led by externally-invested tourism businesses and local élites able to gain decision-making powers in the area's new business-oriented conservancy organizations (NACSO, 2014). Despite being able to assert some long habitation roots in this specific location, the presence of my hosts was now framed as an 'eyesore' that threatened the conservation-associated market values of the wilderness aesthetic of this landscape. The current powers of particular instrumental discourses of nature's capital values to exclude and impoverish others with different approaches to nature's values and sustainabilities are resonant with Orwell's dystopian vision of an oligarchic, technocratic and ruthlessly managerial society. It is these very prevalent instrumental powers that lead to my dismay at the technocratic 'fairy tales' perpetuated in Helm's text, and the (fore)closure of possibilities for valuing and celebrating both human and other-than-human potential that is thereby signalled.

Stephens (2004: 82) describes George Orwell's dystopian view of the future in *1984* as a powerful protest against 'intellectual dishonesty, the degradation of human feeling by reductive instrumentalization, and the dangers from absolute power of any type'. Of note in Orwell's account of the maintenance of power by 'the Party' in *1984* is the destruction of extraneous words so as to shape language into a 'Newspeak' that excises verbs and adjectives although 'there are hundreds of nouns that can be got rid of as well' (Orwell, 1949/2008): 59). The intention of the intellectual élite comprising 'the Party' is to reduce the capacity and possibility for independent thought, a goal achieved in part by erasure of the diversities of the past, so as to remove 'counterpoints' of awareness and inspiration that might encourage contestation of the present. In dramatizing the possible effects of such reductions, Orwell

thereby issues ‘a warning against totalitarianism’ that is ‘a critique of a particular sort of [technocratic] mentality and of its social results at their most extreme’ (Stephens, 2004: 83).¹⁶

Folding all of the living, breathing natural world into the discursive and calculative value-frame of apparently substitutable capital(s) seems to encourage a similar reduction of ways of talking about, thinking about and relating with cultural and natural diversities. It is perhaps this totalizing and ideologically predetermined tendency of ‘natural capital speak’ that saddens and alienates me the most. Philosopher Paul Feyerabend (1999) thought of this tendency as a *Conquest of Abundance: A Tale of Abstraction Versus the Richness of Being*, arguing that the totalizing processes of abstraction for instrumental efficiency leaves us far less erudite in relation to the relational entities comprising ‘nature’, the web within which we ourselves are held. The narrowing of biological, cultural and linguistic diversity into the colourless numbered world of natural capital accounts is thus complemented by a reduction in our ways of thinking and speaking about the differences, agencies and relationships comprising this diversity. Natural capital speak authoritatively collapses possibility in our ways of communicating about, relating with and valuing this variety.

Additional caution is perhaps called for to prevent ‘us’ from walking into, and thus making, an Orwellian labyrinth of natural capital ‘doublethink’. We are already embracing principles whose slogans — derived from the propositions above — might be something like:

Destruction is Protection
Loss is Gain
Homogeneity is Diversity
Numbers are Reality

Is this the future ‘we’ want? And is it the only one that is possible?

¹⁶ The potential dark side of technocratic efficiency and realist objectivity — of transforming reductions into ‘banal’ managerial decisions in terms of ‘economy’ — has perhaps been most provocatively explored by philosopher Hannah Arendt (1977).

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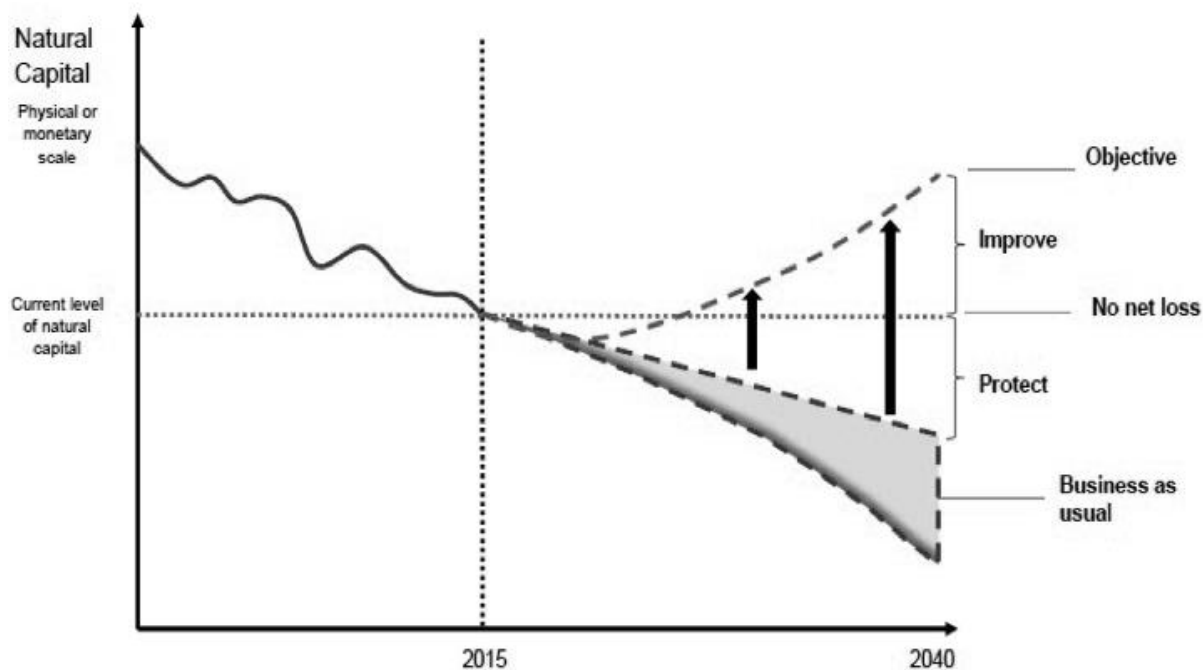
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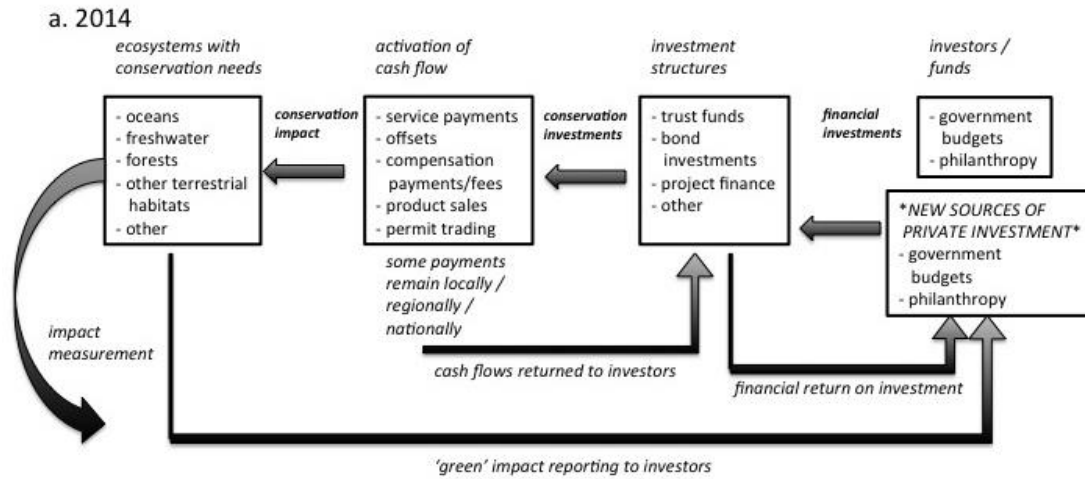
Sian Sullivan (s.sullivan@bathspa.ac.uk) is Professor of Environment and Culture at the College of Liberal Arts, Bath Spa University, United Kingdom. Her latest book (co-edited with R. Pellicer-Thomas and V. de Lucia) is *Law, Philosophy and Ecology: Exploring Re-Embodiments* (GlassHouse Books, 2016).

Figure 1. Schematic Representation of 'Natural Capital' Trends in the UK Leading up to 2015 and Thinking Forward Towards 2040.



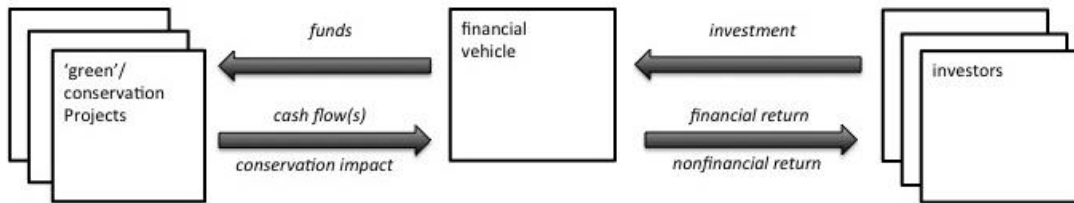
Source: Adapted from Natural Capital Committee (2015: 7).

Figure 2. Versions of Schematic Representations of New Forms of Private Sector Conservation Finance Proposed by Credit Suisse and Collaborators to be Leveraged in Association with Increasingly Legible Natural Capital Value Flows: a. 'Conservation Finance Framework' (2014); b. 'Demand and Supply Side of Conservation Finance' (2016).



Source: redrawn from Credit Suisse, WWF and McKinsey&Company (2014: 11).

b. 2016



Source: redrawn from Credit Suisse & McKinsey Centre for Business and Environment (2016: 9).