AFTER THE GREEN RUSH? BIODIVERSITY OFFSETS, URANIUM POWER AND THE 'CALCULUS OF CASUALTIES' IN GREENING GROWTH

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Abstract

Biodiversity offsets are part of a new suite of biodiversity conservation instruments designed to mitigate the impacts of economic developments on species, habitats and ecosystems. Led by an international collaboration of representatives from companies, financial institutions, governments and non-governmental organizations (NGOs), the Business and Biodiversity Offsets Programme (BBOP) of the market-oriented Forest Trends group, has created a global framework through which principles and standards for biodiversity offsets are being established. These enable the apparently unavoidable harm caused by development to be exchanged for investment in conservation activities both at different geographical locations and in the future. Offsets can also be traded via bespoke markets for environmental conservation indicators. Given a globalizing 'green economy' discourse that conservation can be a profitable enterprise if guided by market-based mechanisms and the entwining of ecological with economic spheres, biodiversity offsets are becoming key to current entrepreneurial interest in biodiversity conservation. The 'green rush' of my title refers to both this interest in conservation activities that can be marketized, and to an associated appetite in business and financial sectors for incorporating biodiversity offsets as part of a strategy for 'greening' the environmental harm caused by developments. I illustrate the uses to which biodiversity offsets are being put, through a case study connecting the extraction of uranium in Namibia for the generation of nuclear power in the UK. Biodiversity offsets are invoked to satisfy requirements for off-site mitigation of environmental harm at points of both extraction and 'consumption' of uranium in this case. I highlight some of the (anti-)ecological assumptions guiding calculations of complex ecological assemblages so that they can become biodiversity offsets, and draw attention to the intensified distributions of new environmental values with which biodiversity offsets may be associated.

Key Words: biodiversity offsets, uranium, nuclear power, Business and Biodiversity Offsets Programme (BBOP), Hinkley Point (UK), barbastelle bats, Namibia, Electricité de France Energy (EDF), Areva, calculative technologies, green growth

¿Después de la Ola Verde? Compensaciones para la Biodiversidad, Energía Nuclear y el 'Cálculo de Daños' en el Crecimiento Verde

Resumen

Las compensaciones para la biodiversidad son parte de un nuevo paquete de instrumentos de conservación de la biodiversidad desarrollados para mitigar el impacto del desarrollo económico sobre especies, hábitats y ecosistemas. Gobernado por un grupo internacional de colaboración entre compañías, instituciones financieras, gobiernos y ONGs, el Programa de Negocios y Compensaciones para la Biodiversidad (BBOP según sus siglas en inglés) del grupo pro-mercado Forest Trends ha creado un marco para el establecimiento de los principios y estándares de compensaciones para la biodiversidad. Esto permite que el daño medioambiental aparentemente inevitable del desarrollo sea intercambiado por inversiones en actividades de conservación en diversos lugares y a futuro. Las compensaciones también pueden ser comercializadas en mercados *ad hoc* de indicadores de conservación medioambiental. Dado el discurso de la economía verde que dice que la conservación puede generar ganancias si está guiada por mecanismos de libre mercado, y la fuerte interrelación entre las esferas ecológica y económica, las compensaciones se están volviendo fundamentales para los intereses privados en conservación de la biodiversidad. La 'Ola Verde' de mi título se refiere a los intereses en actividades de conservación que pueden ser marquetizadas y a la avidez de los sectores financieros y de negocios por incorporar las compensaciones para la biodiversidad como parte de la estrategia para 'ecologizar' el daño ambiental causado por el desarrollo. En este artículo identifico los usos que se le están dando a las compensaciones a través de un estudio de caso sobre la extracción de uranio en Namibia para la generación de energía nuclear en el Reino Unido. En este caso, las compensaciones para la biodiversidad (hechas en lugares distantes) son utilizadas para satisfacer las demandas de mitigación de daños medioambientales en los puntos de extracción y consumo de uranio. Aquí explicito algunas de las creencias (anti-)ecológicas en las que se basan los cálculos de complejos ensamblajes ecológicos para tornarlos en compensaciones para la biodiversidad, y enfatizo los nuevos valores ambientales a los que las compensaciones para la biodiversidad están asociadas.

Palabras clave: compensaciones para la biodiversidad, uranio, energía nuclear, Programa de Negocios y Compensaciones para la Biodiversidad, Hinkley Point (Reino Unido), murciélago barbastelle, Namibia, Electricité de France Energy (EDF), Areva, tecnologías de cálculo, crecimiento verde

The 'Green Rush'?

In 2008, Zac Goldsmith, former editor of *The Ecologist*, member of the Goldsmiths merchant banking dynasty, and current Conservative MP for Richard Park and North Kingston in London, gave an interview in *Times Online* entitled 'The green rush'. In this he valorizes the market's ability to effect positive environmental change. He states that "other than nature itself, there is no force more powerful in terms of changing things than the market," but that "the market doesn't yet understand or truly value the natural world" (Lavan 2008). He notes that it is precisely the *scarcity* created by destructive marketized nature extraction that is fostering an emerging high value for conserved nature. This view is energizing creation of new markets in monetized measures of an increasingly scarce, and therefore valuable, nature health,[1] giving rise to a critical literature highlighting the primitive accumulations effected by neoliberal creation and capture of these new 'green' values (see, for example, Robertson 2004; Lohman 2006; Sullivan 2010a, 2012a and b; and the volumes introduced by Arsel and Büscher 2012 and Fairhead et al. 2012).

More recently, Olivier de Schutter, the United Nations (UN) Special Rapporteur on Food, uses 'The green rush' as the title for a long paper published in 2011 in the *Harvard International Law Journal* (de Schutter 2011). 'The green rush' here is constituted instead by current land-grabbing in developing

1 See, for example, the websites http://www.ecosystemmarketplace.com/, http://www.speciesbanking.com, Mission Markets Earth Platform at http://mmearth.com/, and the UK's conservation credit trading platform at https://environmentbank.mmearth.com/login.

country contexts, particularly in Africa, for farmland for intensified food and biofuel production. De Schutter emphasizes ways in which current perceived scarcity in food production, coupled with volatility in prices of agricultural commodities, is pricing out the poorest farmers from escalating markets for land rights. He expresses concern that various communal and collective forms of land tenure are being displaced by formalized leasehold exchanges between governments and corporate investors for newly privatized tracts of land. The effects of this 'land-grabbing' are to erode long-established mixed food production systems that feed cultures variously embedded in rural areas.

In this paper I explore aspects of both these framings of 'the green rush.' I emphasize the current celebration of market-based policies and mechanisms to incorporate environmental harm into development activity and thereby turn conservation strategies into profitable enterprise; at the same time as expressing concern for the possible displacement effects of these strategies for 'valuing,' capturing and trading what is deemed 'green.' My title 'After the green rush' invokes Neil Young's enigmatic song of 1970 entitled 'After the gold rush.' This is a poignant evocation of the social and ecological displacements effected by the historical frontier *rush* for gold on the west coast of North America. I am using it here to draw attention to the possible distributive effects and fallouts associated with new mechanisms for incorporating environmental health and harm into development agendas and market-like exchanges; as well as to ask questions of what exactly is transferred forward into the future through these mechanisms (cf. Holland and Rawles 1996).

Proposals for offsetting environmental 'bads' with environmental 'goods' elsewhere, rely on the application of calculative accounting methods (Mackenzie and Millo 2003; Callon and Muneisa 2005; Callon 2006) to devise 'metrics' for making environmental health and harm in different places equivalent to one another (see discussion and critique in Robertson 2006, 2011; Sullivan 2009, 2010b, 2012a and b; Corson and MacDonald 2012). Through offset exchanges and trading mechanisms environmental harm is provided with the appearance of being environmentally good, or 'green' in such a way as to also enhance economic value. As such, environmental crisis is being transformed into a 'shock' that invigorates, rather than limits, economic expansion (Sullivan 2009; Žižek 2009 after Klein 2007; Fletcher 2012), thus also attending to the crisis-driven imperative of economic growth to generate 'green growth' (cf. UNEP 2011). In the following section I highlight some significant design features of biodiversity offsets as a key element of this possibility of trading environmental health and harm. In particular, I focus on the development of offsetting metrics by the Department for Environment, Food and Rural Affairs (DEFRA) in the UK. The DEFRA metrics can be seen as an iconic 'calculative device' (cf. Callon and Muneisa 2005) through which the value of biodiversity is being calculated and created so as to become legible for offsets exchanges. The following section is constituted by a case study worked through in this paper, and which investigates proposals for biodiversity offsets to mitigate environmental impacts at different nodes of the uranium value chain (cf. Crang et al. 2012). In this case biodiversity offsets are invoked so as to 'green' uranium associated industries at sites of both nuclear power generation in the UK and extraction in Namibia. I close by reflecting on some of the conceptualizations of nonhuman nature that make offsetting mechanisms viable, noting the 'calculus of casualties' (cf. Jensen 2006: 65) – of individuals, populations, species, places and societal associations with these – that are disavowed by biodiversity offsets as a paradoxical, but empowered, conservation technology for creating new green values.

Biodiversity Offsets: Calculating Nature for Conservation Value

Variously marketized forms of environmental offsetting now constitute a prominent methodology for resolving contradictions between economic development and nature health, so as to enhance 'green infrastructure' (European Commission 2010) while sustaining economic growth. Such exchanges between localities of environmental health and harm require the presence of measurable conservation and/or ecological restoration indicators associated with material nature, including threatened species, biodiversity, and carbon sequestered in the biomass of forests or soils. Valued indicators of ecological health in turn need supportive land-based localities where they can be situated and accounted for. Places where such nature wealth is located and enhanced are becoming termed 'banks.' In the presence of impact offsetting mechanisms they can become accredited so as to offer conservation units that may be exchanged with development impacts elsewhere. Conservation banks and associated offset trading mechanisms currently include wetland mitigation and species banking in the US and emergent habitat banking and biodiversity offsets in the UK. For further discussion on US wetland mitigation banking see Robertson (2004, 2006, 2011) and Robertson and Hayden (2008); on US species banking see Fox and Nino-Murcia (2005) and Pawliczek and Sullivan (2011); on UK biodiversity offsets see Briggs et al. (2009) and Hannis and Sullivan (2012).

As the papers referenced above indicate, conservation banking and associated markets manifest in different ways in different contexts. Nonetheless, they share a few core design features, directed towards the stated ideal of 'no net loss' of the implicated environmental indicator. This means that the outcome of an offset trade in environmental harm and health should lead to the maintenance, or even enhancement, of the environmental measure that is affected and offset. Below I highlight five key design features facilitating emergence of conservation offset exchanges (see also BBOP 2009), focusing particularly on the development of ecosystem metrics that calculate and account for nature aspects so as to create the appearance of legitimate exchangeability and fungibility.

1. *The Mitigation Hierarchy*

The mitigation hierarchy, depicted graphically in Figure 1, derives from Environmental (and Social) Impact Assessment (EIA) assumptions and methodology (see, for example, Carroll and Turpin 2009). EIAs are a planning requirement proposing that some sort of independent scoping of the environmental and social impacts of a development project should occur prior to the approval and implementation of an intervention, so as to prevent, minimize and/or mitigate significant predicted environmental (and/or social) harms. It asks developers to consider how harm might be avoided and minimized, and how the ecology and landscape of a development site might be restored, perhaps after the lifespan of the development, so as to rehabilitate and reinstate remaining unavoidable harm. 'Offsets,' including biodiversity offsets, are the last resort of the mitigation hierarchy (cf. Vatn et al. 2011: 55-69), but nonetheless are increasingly significant as a mitigation tool because it is rare that all harm can be mitigated on-site. Offsets are defined in the *Biodiversity offsets design handbook* of The Business and Biodiversity Offset Programme of Forest Trends (BBOP), as "measures taken to compensate for any residual significant, adverse impacts that cannot be avoided, minimised and / or rehabilitated or restored, in order to achieve no net loss or a net gain of biodi-

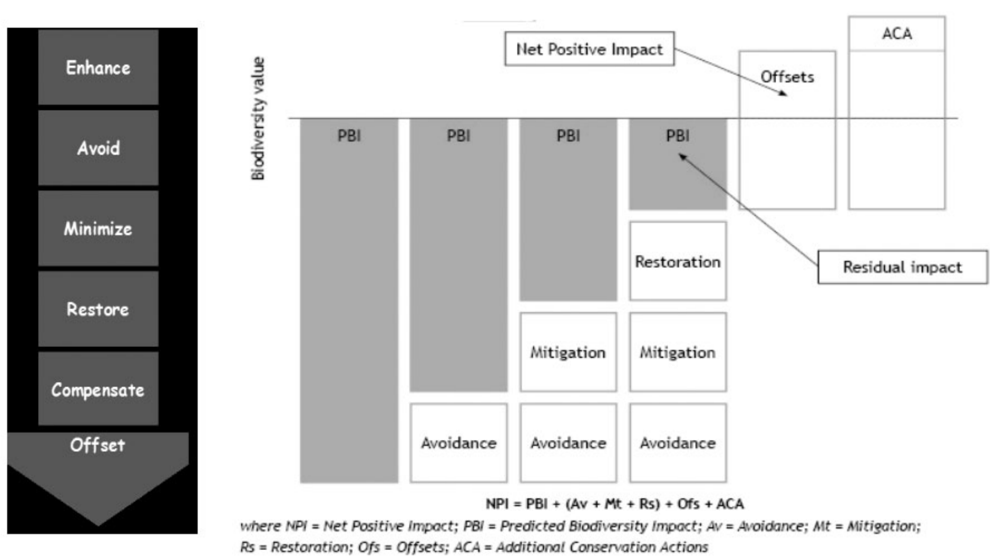


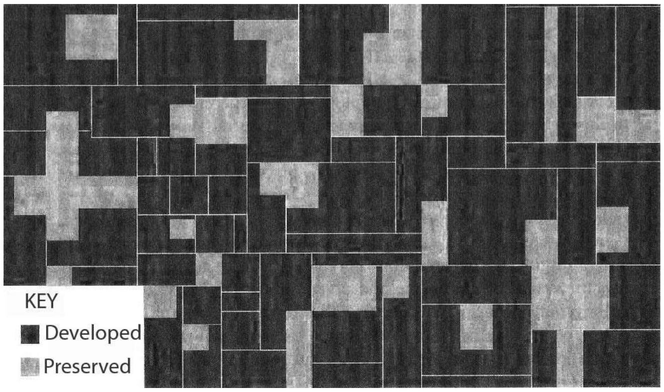
Figure 1. The mitigation hierarchy. Sources: Anstee 2008: 36 and Pricewaterhousecoopers, BBOP and UNEP FI 2010: 4

versity" (BBOP 2009: 3; also see ten Kate 2003; ten Kate et al. 2004, 9-10; and the recently published guidelines for the instituting of voluntary business standards for biodiversity offsets published in BBOP 2012a).

The offsets part of the mitigation hierarchy is currently receiving great attention, in part because it is this that permits the rationalization of aspects of both development and the residual environmental harm thereby caused as *unavoidable*. This is creating development-led demand for environmental offset exchanges, and these exchanges potentially can be marketized. As such, it is the apparently unavoidable element of the mitigation hierarchy, denoted in Figure 1 as the "residual impact," that permits the transformation of, and possibility of trade in, measures of environmental health and harm that can act as offsets.

2. *Off-site Mitigation*

The possibility of *off-site mitigation* permits any 'unavoidable' residual harm left after working through the mitigation hierarchy to be offset through an exchange of what is to be lost on a development site with a conservation investment somewhere else. Developers thus can offset their environmental impacts by investing in or purchasing apparently appropriate conservation measures elsewhere (i.e. off-site), as opposed or in addition to creating conservation options on the same site as the development. It is maintained that this will consolidate rather than fragment areas of ecological value (see, for example, White 2008). Figures 2a and b provides a schematic representation of how such consolidation is envisaged. The planned development area indeed is consolidated and expanded in Figure 2b, with conserved habitat also consolidated to a narrow linear band cutting through the center of the development. Whether or not more environmental conservation value is present here than in the mosaic of developed and conserved areas depicted in the so-called unplanned development of Figure 2a is another question.



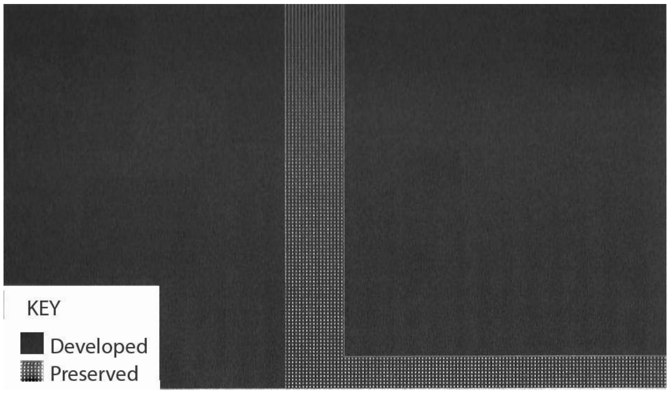


Figure 2. Schematic representations of planned off-site mitigation of development impacts. Source: White 2008: 35-36

3. *Ecosystem Metrics to Calculate Nature for Exchangeability*

The third design feature explored here is the necessity of constructing some form of *ecosystem metrics that account for and calculate nature so as to permit exchangeability* (cf. Robertson 2006, 2011). This is between both the locations of development impact and conservation activity and between different temporal moments, such that development impact might be traded with the future conservation value of a designated offset area. It is this constructed commensurability between places and times that allows for both off-site mitigation of development-related environmental harm and for temporal delay in offset provision, as outlined further below. The application of ecosystem metrics to permit exchangeability requires conversion of the affected nature aspect into a symbolic numerical signifier that can serve as an abstraction of ecosystem aspects in different places and in different times, such that these abstractions become conceptually commensurable with, and substitutable for, one another. This conversion into numerical units creates the potential for an offset exchange to also be monetized and marketized (Sullivan 2012b).

The current UK context provides a good example of the work that needs to be done to facilitate equivalence creation between places and times to support offset provision. Here, from April 2012, a series of biodiversity offset pilot areas have been established in Devon, Doncaster, Essex, Greater Norwich, Nottinghamshire, and Coventry, Warwickshire and Solihull (DEFRA 2012a). These are to follow DEFRA guidelines regarding application of a standardized metric that will permit the conceptual substitution of development impact into area replaced through habitat offsets (DEFRA 2012b). This requires the assessment and standardization of 'habitat value' in the development and offset localities, so as to facilitate an exchange (cf. Sukhdev 2010: xxv). The process requires that development sites are "mapped and divided into habitat parcels" (DEFRA 2012b: 7) which are pre-assigned to one of three habitat type bands[2] scored for condition and biodiversity distinctiveness, with good condition and high distinctiveness (incorporating aspects such as rarity and endemism) scoring more highly. This particular calculative device (Callon and Muneisa 2005) allows for the possibility that conservation investments might be in measures of environmental health for habitats that are different to, and geographically distant from, the habitat that is being impacted by a development intervention. For different examples of the ways in which development impacts are scored to equate with conservation measures see Morgan Robertson's detailed work on US wetland mitigation banking (e.g. Robertson 2004, 2006), and recent work on US species banking (Pawliczek and Sullivan 2011).

Table 1 reproduces an often-referenced example of the DEFRA scoring matrix to be used to numerically convey exchangeable habitat 'value'. In this, habitat condition and biodiversity distinctiveness are scored using a scale of 1 to 3 for poor to good condition and 2 to 6 for biodiversity distinctiveness (DEFRA 2012b: 7). High scores in both habitat condition and biodiversity distinctiveness would indicate a habitat of high conservation priority, and an equivalent number of high value credits of a suitable habitat would thus be required to offset any 'unavoidable harm' to such a locality. Scoring habitats in this way thus permits habitat exchanges to be guided by their numerical values such that like scores can be exchanged with like scores, and the ratios of exchanges can be seen to favor conservation by encouraging the exchange of poorer scoring habitats with higher scoring ones. For example, if an impacted habitat scoring six overall is offset with one of the same area that also scores six, then this would be a compensation ratio of 1:1. The replacing of one hectare of a habitat scoring six with only half a hectare scoring 12 would also mean a compensation ratio of 1:1. According to the DEFRA guidelines, this means that a developer in theory can transform a larger area of land than the area purchased to offset their development.[3]

		Biodiversity distinctiveness		
		Low (2)	Medium (4)	High (6)
Habitat condition	Good (3)	6	12	18
	Moderate (2)	4	8	12
	Poor (1)	2	4	6

Table 1. Habitat scoring system, UK. Source: DEFRA 2012b: 7

In addition to the possibility of exchanging the scores of impacted habitats with those that are geographically distant, it is proposed that impacted habitats may be exchanged with the scores that are predicted to accrue in the future for an offset locality. In this, positive habitat scores (or credits) would be sold *after* sites have been confirmed as a conservation bank or offset site, but *prior to* being able to demonstrate ecological performance compliance (as is the case in US wetlands mitigation banking, Robertson and Hayden 2008). This situation is possible because ecosystem values have been transformed into

2 This has been reduced from four habitat bands in earlier proposals (e.g. DEFRA 2011: 4; GHK and eftec 2011: 16).

3 Note that the Business and Biodiversity Offsets Programme explicitly advise against the offsetting of unit areas that are smaller than the area to be impacted by development (e.g. BBOP 2012b).

numerical ones, which enables an array of additional scoring numerical multipliers to be added into the metrics mix so as to address (numerically at least) varied sources of risk. So, for example, multipliers can be introduced to account for a time lag if the offset is created after the impact has occurred (Robertson and Hayden 2008: 11; Vatn et al. 2011: 69), a situation that assumes rather predictable, linear successional dynamics for habitats. In instances where a delivery lag is built into the manifestation of the appropriate offset for a development impact, financial insurance is proposed such that the offset provider could take out financial insurance against their possible failure to deliver the right number of units (cf. Vatn et al. 2011: 9, 11). This is particularly relevant if a "portion of a project's mitigation credits are typically released before the physical work is complete" (Kett 2011).

It seems relevant to note here that what is exchanged through these offsetting mechanisms are the numerical indicators proposed by metrics such as those described above. These may or may not provide a 'good fit' with the material natures they represent, and thus may or may not adequately represent the ecological measures being lost through development in specific places. Ecological theory and common sense suggest that offsets over large spatial and temporal distances are likely to fit less closely with specific impacts than those that are distance-near and with close temporal (i.e. successional) correspondence with impacted localities. Of course, no offset can fully replace the specific spatial and temporal ecological qualities of that which is harmed through development, making offsets a technology that creates biodiversity casualties even as it proposes biodiversity conservation.

The accounting of nature aspects as numerical scores that become health and harm equivalents and that can be associated with monetary payments, enables the creation and 'performation' of markets for conservation indicators. Through this, application of the metrics bring forth new markets that, as they take shape, also shape the (biodiversity) entities that are being traded, as well as the ecological and institutional contexts within which trade occurs (on the performativity of economics, see Mackenzie and Millo 2003; Callon and Muneisa 2005; Callon 2006). To establish and service these new markets, voluntary market exchanges for environmental conservation measures are being created by nature brokers and environmental-financial entrepreneurs, which themselves also shape trading possibilities and create pathways for those able to capture newly traded green values (for examples of nascent market exchanges see footnote 1 plus discussion in Hannis and Sullivan 2012, and Sullivan 2012b). Offset metrics thus create the promise of offset markets. In offset markets, numerical scores for nature aspects become purchased and exchanged as commodities bearing monetary value, with financial expertise required for the brokering of exchanges and capital required for market entry.

4. *Additionality*

The fourth principle is that of *additionality*, which affirms that the conservation activity would not have occurred in the absence of the offset arrangement. In conservation banking markets a conservation activity tends to be considered additional if it is thought that it would not have occurred in the absence of an offset arrangement for which a payment has been made (Bennett 2010: 419). Payment here is thus deemed to have directly caused the measurable conservation effect, and therefore to have generated conservation additionality. In practice conservation additionality in association with offsets can be difficult to demonstrate. In part this is due to the inherent difficulty of ascertaining the difference between what has happened *with* an offset designation, and the 'counterfactual,' i.e. what would have happened (in environmental conservation terms) without the designation (Hodge and Adams 2012: 2). It is also because to date many conservation banking and offsetting schemes designate localities of existing relatively untransformed or conserved habitat (as for US species banking, see Pawliczek and Sullivan 2011), although this can be explicitly prohibited, as is the case in UK policy regarding biodiversity offsets. Entwining conservation activity with payments can also generate perverse incentives. They can displace environmentally caring activities by reducing such practices to a monetary value, thus creating a context where such practices may cease to exist in the event that they are not paid for (as discussed in Curry 2011).

5. Enabling Policy and Governance Frameworks

Finally, conservation banking and offset establishment and exchanges, even if voluntary, can only come into being if they are accompanied by an *enabling policy and governance framework*. This means that although a primary impetus in conservation banking is the maintenance of nature health through the institution of money-bearing privatized market exchanges, government regulation and public resources remain essential for both the creation and sustenance of these exchanges (cf. Foucault 2008 [1979]; Vatn et al. 2011, viii). How this manifests is diverse. In the US, the role of the Fish and Wildlife Service (US FWS) is quite prominent in the allocation of species credits in species banking (discussed further in Pawliczek and Sullivan 2011), whereas the UK currently has a system of more voluntary exchanges within planning recommendations set for development projects by local authorities. Following Žižek (2009, 145), although the logic of biodiversity offsets and associated markets 'is de-regulatory, "anti-statal," nomadic, deterritorializing, and so on, its key tendency to the "becoming-rent-of-profit" signals a strengthening role of the state whose regulatory function is ever more omnipresent.' Indeed, as Arild Vatn and colleagues note, 'transaction costs are high and there are reasons to expect them to be largely borne by the public sector' (Vatn et al. 2011, ix; also see Fletcher and Breitling 2012). The public sector thus is mobilized in part so as "to impose the … legal conditions for extracting rent" (Žižek 2009: 145), in this case through creating the regulatory contexts that raise rents for an increasingly scarce biodiversity reconfigured in economic terms as an element of bankable and tradable 'natural capital' (Sullivan 2012a).

Case Study: Invoking Biodiversity Offsets in the Greening of Uranium Power

The above delineates significant design features infusing the new conservation technology of biodiversity offsets. I now move to a case-study illustrating some ways in which biodiversity offsets are invoked to 'green-stamp' the environmental harms caused by specific development impacts. I focus on a commodity circuit connecting the production of nuclear power at the site of Hinkley in North Somerset, UK, with uranium extraction in Namibia, southern Africa (also see Conde and Kallis 2012). I highlight proposals for biodiversity offsets to mitigate associated environmental harms at both of these nodes. Biodiversity offsets are contributing to a 'greenwashing' (cf. Rowell 1996; C. MacDonald 2008) of both nuclear power and uranium extraction, thereby disavowing damages to biodiversity whilst intensifying radioactive threat at these different nodes of the commodity circuit. As such, this case study is pertinent for investigating the socionatures prefigured by biodiversity offsets, and the power relations and interests that are thereby supported.

My analysis is based on the study of two policy and planning documents which appear to be disconnected but are not. They both include proposals for using biodiversity offsets to mitigate the impacts of the site preparation works preceding the establishment of a new-build nuclear reactor in the UK and an extraction locality for the fuel needed to supply this new reactor. The two documents analyzed here are:

1. the 2011 West Somerset Council (WSC) *Officer's Report for the Application for Planning Permission, ref. 3/32/10/037*, which considers proposals by Electricité de France Energy (EDF) for site preparation works in West Somerset prior to the construction of a third nuclear reactor at Hinkley Point;[4]

4 Available online at http://www.westsomersetonline.gov.uk/hinkleypoint.

2. the 2010-11 *Strategic Environmental Impact Assessment (SEA) for the Central Namib Uranium Rush*, commissioned by Namibia's Ministry of Mines and Energy (MME), executed by the South African Institute for Environmental Assessment, and funded by the German Federal Ministry for Economic Cooperation and Development, to consider the combined implications of the current "uranium rush" in Namibia, southern Africa.[5]

Offsetting Nuclear Impacts in the UK so as to support 'Green Energy'

On 27 January 2012, the French corporation EDF Energy was granted permission by West Somerset Council (WSC) to begin the necessary site preparation works for the proposed construction of a new generation nuclear power station at Hinkley Point in West Somerset. Regardless of the environmental effects of the construction and operation of a new nuclear power station at this site or the impacts of any possible contamination through the further import and concentration of radioactive material, the site preparation works themselves will produce significant habitat harm. They involve:

> … site clearance (including fencing, vegetation removal, demolition of existing structures, and creation of alternative footpaths); earthworks (including soil stripping and storage, site levelling, spoil screening/storage for re-use on-site); … deep excavations; provision and relocation of drainage infrastructure …; [and] site establishment works (including layover facilities, car parks, haulage roads, site access points and roundabouts) (WSC 2011: 3).

The local authority planning permission for these preparation works is controversial because it was granted *prior* to the application to the Infrastructure Planning Commission (IPC) for approval to construct a third reactor at Hinkley, Hinkley C. In other words, the site preparation works will cause massive landscape disturbance for a reactor that in theory may not actually be built.[6] Early in 2012, the case received substantial media attention in the UK press for several reasons, but not least because it is a key component of a much publicized 'landmark agreement' for cooperation on civil nuclear energy between Britain and France (Press Association 2012; Utility Week 2012).

The proposed Hinkley C station heralds investment in a new wave of nuclear power stations, controversially claimed as "green," "low-carbon," or even "zero carbon" by the corporations involved, the UK government, and high-profile environmentalists (Lovelock 2004; Monbiot 2011; Lynas 2012; also see debate between George Monbiot and Theo Simon in Vidal 2012). It will require large-scale landscape transformation and, of course, will increase the volume of radioactive material in the UK prior to the full decommissioning and making safe of the previous generation of nuclear power stations and their significant radioactive outputs (see Connor 2012), including the two reactors already at Hinkley (of which Hinkley A is defunct and in the process of decommissioning and Hinkley B is still operational). The proposed station and the planning process are contested.[7]

Critically, the application for the site preparation works rests on the promise that "in the event that Hinkley Point C is not consented all structures would be removed and the site *reinstated*," as reported in the agenda of the WSC Planning Committee Meeting, 28 July 2011 (WSC 2011: 3, emphasis added). EDF, however, would only be required by WSC to submit a detailed reinstatement plan in the event that the generating station is not approved. The organizations consulted in the site preparation works planning application, which include English Heritage, the Area of

5 Available online at http://www.saiea.com/uranium/.

6 Indeed, as this paper was going to press it was reported that EDF have postponed their decision to build at Hinkley until April 2013 (Carrington and Macalister 2012).

7 See http://stophinkley.org/. Three films documenting recent aspects of the Stop Hinkley campaign and associated policing, including an injunction served by EDF to prevent protest activities, can be viewed at: 1. http://www.youtube.com/watch?v=PfW-Kv6IWEI&feature=relmfu; 2. http://www.youtube.com/watch?v=lKtlcCUA3Q8&feature=relmfu; and 3. http://www.youtube.com/watch?v=j66IgLJRTlo.

Outstanding Natural Beauty (AONB) service for the Quantock Hills, Natural England, Somerset County Council Spatial Planning and Historic Environment Service, the Royal Society for the Protection of Birds (RSPB) and the Somerset Wildlife Trust (SWT), all provide evidence of their dissatisfaction that this can be achieved in practice (WSC 2011).

As expressed by interested and concerned parties, the site preparation works and the proposed development itself will have significantly transforming effects on the site locality, associated habitats, and species populations. Projected 'unavoidable' impacts generate a requirement for mitigation or compensation of some sort in accordance with European habitats regulations (the Conservation of Habitats and Species Regulations 2010, as noted in the Habitat Regulations Assessment in WSC 2011). EDF and WSC have proposed voluntary offsetting measures to satisfy this. Among the species and habitats affected, particular concern is that the site preparation works will prove disruptive for the barbastelle bat, *Barbastella barbastellus*. This species is considered "rare" and "near-threatened" under the designations of the International Union for the Conservation of Nature (IUCN)[8] and is also protected under the European Habitats Directive.[9] Populations of the species have long foraged and roosted on a diversity of habitats on the proposed Hinkley C preparation site, including mature woodlands, ancient hedgerows, and grasslands. The barbastelle bat thus receives a lot of attention in the site preparation planning application and Council responses. As stated in the Natural England comments on the planning application, "[w]e would expect to see a no net loss in the local population status of bats, taking into account factors such as population size, viability and connectivity – a robust mitigation strategy is required to be submitted," particularly, and as noted by the SWT, because the barbastelle bats represent "a qualifying feature" of the nearby Quantocks Special Area of Conservation, from which they travel to forage in the Hinkley site (WSC 2011: 65, 87). The SWT notes additionally that:

> [w]hilst the provision of compensatory bat boxes will assist in mitigating the impacts of some roost loss, the bigger issue is arguably the loss of foraging on site. There is a notable quantity of woodland and open habitat proposed to be lost through site clearance, and a question remains as to whether there is sufficient habitat of suitable quality to support displaced bats (in WSC 2011: 87).

Since these consultations, proposals have been made for species-led biodiversity offsetting to mitigate the impacts on barbastelle bats of the proposed Hinkley site preparation works. It is instructive to trace these through as an example of emergent development-related offsetting thinking, both in the UK context and as part of a growing global discourse on the use of biodiversity and other environmental offsets as a means of mitigating, and perhaps trading, the 'unavoidable' harm associated with economic development. The following is based on proposals compiled by a Somerset County Council ecologist, included as an Appendix to the officer's report on the planning application by EDF (Burrows 2011). In this, the proposed offsets required to maintain the bat population with no net loss are based on ascertaining the Habitat Units (HU) required to offset the loss of each habitat. These are calculated as the product of the 'Habitat Suitability Index' (HSI) (comprised here of numerical scores for the habitat quality and habitat area [i.e. quantity]) of each existing bat habitat. In this case, a panel of three barbastelle experts was independently asked to score the suitability of the main habitats on the site, although the location of the site was not given and this was done in the absence of a site visit. As indicated in Table 2, the HU used in the final offset calculations frequently modifies the average score given by the independent experts, in a downward direction overall. This results in a third fewer recommended HU hectares requiring offsets (37.2 instead of 60. 4).[10] In these calculations a 2:1 compensation ratio is used.

8 See http://www.iucnredlist.org/apps/redlist/details/2553/0, Accessed 30 March 2012.

9 See http://eea.eionet.europa.eu/Public/irc/eionet-circle/habitats-art17report/library?l=/datasheets/species/mammals/mammals/barbastelluspdf/_EN_1.0_&a=d, Accessed 30 March 2012.

10 Nb. these figures exclude arable land because the expert panel did not comment on this habitat.

Habitat type	HSI (#1) average scores from panel of experts (n = 3)	HSI (#2) score used in final calculation	Habitat hectares to be lost	Habitat Units (HU) (in hectares)		Recommended offset hectares with compensation ratio of 2:1	
				#1	#2	#1	#2
Semi-natural broadleaved woodland	1	0.75	3.6	3.6	2.7	7.2	5.4
Semi-natural broadleaved plantation	0.9	0.5	3.8	3.4	1.9	6.8	3.8
Dense scrub	0.6	0.7	1	0.6	0.7	1.2	1.4
Native species-rich hedgerow	0.9	0.8	2.4	2.2	1.9	4.4	3.8
Species-poor intact hedgerow	0.6	0.6	1	0.6	0.6	1.2	1.2
Poor semi-improved grassland	0.53	0.2	17	9.01	3.4	18.02	6.8
Improved grassland	0.33	0.2	30	9.9	6	19.8	12
Calcareous grassland	0.66	0.3	4.6	3.04	1.4	6.08	2.8
Standing water	0.53	0.2	0.02	0.01	0	0.04	0.02
Watercourses	0.9	0.3	0.7	0.63	0.2	1.26	0.4
				Total recommended offsets (hectares):		**60.4**	**37.2**

Table 2. Calculations of biodiversity offsets for the mitigation of damage to barbastelle bat populations due to proposed site preparation works for EDF Energy's Hinkley C nuclear power station. Key: HSI = Habitat Suitability Index (0.1 – 1.0, low to high); HU = Habitat Units in hectares (HSI x habitat hectares). Source: Burrows 2011

When arable land habitat is included in the calculations, the total amount of relevant bat habitat unit hectares reported as subject to damage through the site preparation works is 47.4 (Burrows 2011). EDF propose that they will create, enhance or restore relevant habitats *on-site*, to the tune of 38.7 hectares reported by Burrows (2011) and 45.3 reported in the subsequent Habitat Regulations Assessment (HRA) (in WSC 2011, it is unclear why there is a discrepancy in these figures). It is difficult to know what the bats should do during the time lag between habitat impacts and on-site habitat creation. Burrows' figures imply that an appropriate 8.7 habitat unit hectares will also need to be acquired *off-site* so as to offset the habitat impacts left after the 38.7 hectares have been created on-site. It is these hectares that, in theory, might be supplied through a biodiversity offsets trade with, perhaps, one or more habitat banks. Again, whilst these may supply appropriate bat foraging habitat and perhaps even be within the foraging range of the current bat population (their possible location is not specified), it is difficult to know how this will benefit the actual population of bats that currently forage on-site.

In summary, biodiversity offsets are invoked here to 'green' a substantial transformation of habitat(s) associated with development through proposing that these will produce 'no net loss' of environmental value. But it remains hard to envisage how this will manifest in practice in this case, given the disruption to specific place-based habitats and mobile species caused by this intervention.

For EDF, the current Anglo-Franco agreement on civil nuclear energy production is additionally celebrated for providing 'unprecedented opportunities' for its supply chain partners (EDF 2012). This connects the Hinkley-offsets story with a very different landscape where biodiversity offsets are also invoked so as to make nuclear energy development green. EDF's delivery of the nuclear supply stream is through the French company Areva, with whom a Memorandum of Understanding (MOU) has been signed for the provisioning of Hinkley C.[11] Areva source their uranium from countries such as Niger and Namibia, and Namibia is listed as a source country for UK's uranium by British Energy (itself part of EDF Energy).[12] It is to Namibia in southern Africa that this story now moves.

Offsetting the 'Uranium Rush' in Namibia - the making of 'Green Uranium'

In the last few years Namibia's central Namib desert has been subject to a veritable "uranium rush," as termed by the Namibian Government and advisors (MME 2010-11; Conde and Kallis 2012). This involves companies from China, India, Russia, Japan,

11 This might further indicate that from EDF's perspective approval for the power station is considered a done deal, even prior to the IPC application process.

12 http://www.british-energy.com/pagetemplate.php?pid=453 Last accessed 7 October 2012. As Conde and Kallis (2012: 601) note, Areva is "active in the whole uranium commodity chain, being [a] major player... in mining, enrichment and nuclear plant construction and operation".

Korea, Australia and Canada as well as the French corporation Areva, all seeking to capitalize on recently high uranium prices, although these have fallen since the Fukushima reactor meltdown in Japan in March 2011. Thirty-six Exclusive Prospecting Licenses (EPLs) were granted for nuclear fuels in Namibia's west-central Erongo Region, with thirty more granted elsewhere in the country, until a moratorium on new licenses was instituted at government level in 2007 (MME 2010-11: ES-1, 1-1). This is in a context of a similar 'uranium rush' in other countries, with Niger issuing more than 100 exploration permits and Botswana issuing 138 between 2008 and 2010 (MME 2010-11: 4-1). The Uranium Stewardship Council (USC) of the Namibian Chamber of Mines seeks to maintain Corporate Social Responsibility (CSR) standards, and has collaborated with the Namibian Stock Exchange (NSX) such that the NSX only lists companies with "good standing on the USC" (MME 2010-11: 1-2). Nevertheless, exploration and operating licenses are located in and impacting on a landscape considered by biologists to be an arid land biodiversity 'hotspot', notable for a high incidence of endemism. EPLs have been granted within two of Namibia's iconic National Parks, namely Namib-Naukluft and Dorob (MME 2010-11, ES-11, 14; Speciesbanking.com 2012). The industry will also impact the numerous archaeological sites in the region (MME 2010-11, 7-91-100). These are illustrative of layers of cultural landscape history, including extant cultural practices, and are irreplaceable.

Areva, EDF's uranium supplier in the UK, has been a key protagonist of this 'rush,' with its CEO signing an industrial partnership with the Namibian Minister of Mines and Energy in the presence of Namibian President Hifikepunye Pohamba on 5 May 2009 (Areva 2009). It has established the third of Namibia's three currently operating uranium mines at Trekkopje (MME 2010-11, ES-9). Trekkopje is "poised to become the largest [uranium mine] in southern Africa and the tenth largest in the world," with an estimated mine life of 12 years.[13] Production here was in fact suspended recently in the wake of recent uranium price declines and the realization that the ore is of lower quality than previously thought, but the intention remains that production will resume when prices rise (Duddy 2011),[14] perhaps in conjunction with the operation of new build nuclear reactors elsewhere such as in the UK. Uranium mining in Namibia tends to be open-pit, resulting in the digging up of large swathes of landscape. To provide an indication, the proposed uranium mine at Etango, formerly the popular tourist location Goanikontes (whose name is indicative of the much older but displaced indigenous KhoeSān history in the area), is projected to be approximately six kilometers long by one kilometer wide, with a depth of up to 400 meters below the surface.[15]

Uranium mining also requires a host of supportive industries and infrastructure. Areva has built a desalinization plant at Wlotzkasbaken on the Skeleton Coast to provide the massive quantities of water required in the extraction process, and which may be expanded to assist with supplying other mines as they become established (MME 2010-11, ES-9). Construction of an emergency diesel power plant and a coal or gas-fired power station of 400 megawatts or above is proposed to support the energy requirements of the industry.[16] Combined with the impacts of greatly increased road traffic to service the industry, this seems contrary to assertions in the UK context that nuclear power is 'zero-carbon' (as in Lynas 2012).

In addition, there is the planned construction by the South African Gecko Group of Companies of three chemical production plants to produce the acid reagents required for leaching the metal from the ore. This will affect some 4,000 hectares, causing acid fogs devastating to local coastal ecologies (MME 2010-11, ES-3, 7-72).[17] The proposed location of the plants in

13 http://www.british-energy.com/pagetemplate.php?pid=453 Accessed 24 February 2012. http://www.mining-technology.com/projects/trekkopje-mine/ Accessed 24 February 2012.

14 http://www.wise-uranium.org/upnatrk.html *Accessed 24 February 2012.*

15 http://www.wise-uranium.org/upna.html Accessed 9 February 2012.

16 http://www.wise-uranium.org/upna.html Accessed 9 February 2012.

17 Also see http://www.wise-uranium.org/upna.html Accessed 9 February 2012.

Walvis Bay has significant implications for the Walvis Bay Wetland, "considered the most important coastal wetland in Southern Africa and one of the top three in Africa" (The Namibian 2011). The Walvis Bay Wetland is recognized as of International Importance under the intergovernmental Ramsar Convention on Wetlands, to which Namibia has been a signatory since 1995.[18] Such effects have been contested by environmentalists to responses by Gecko that they are "pitying prophets of doom who lack the insight to grasp the spectacular future that lies ahead for this incredible country," suggesting that concerned environmentalists "should quietly move aside to allow those who have the vision, both in the public and private spheres, to grow Namibia to its real potential."[19] As the surely/hopefully ironically named company goes on to say, "*you ain't seen nothin' yet*."[20] This statement seems rather crass in relation to the Gecko Group of Companies' namesake, of which there are some 13 endemic species found in the Central Namib (Integrated Coastal Zone Management Project 1999), with three species, Bradfield's Namib Day Gecko, Namib Ghost Gecko and Banded Barking Gecko, of conservation concern (MME 2010-11, 7.74). The proposed operations of the Gecko Group of Companies will almost certainly impact negatively on individuals and populations of the host of creatures coopted as their brand name.

As noted above, in 2009 a Strategic Environmental (Impact) Assessment (SEA) was commissioned by Namibia's MME, executed by the South African Institute for Environmental Assessment, and funded by the German Federal Ministry for Economic Cooperation and Development. The intention is to propose a common approach towards the management of the 'uranium rush' such that the 'Namib Uranium Province' "will be a living example of how mining can contribute to the achievement of sustainable development" (MME 2010-11, ES-2). Under the most likely scenarios projected in this SEA, it is considered that in the near future Namibia will produce around a third of global uranium supplies. This will significantly enhance "the country's reputation in the mining world," but will also cause cumulative direct habitat loss due to mines and associated infrastructure of perhaps beyond 500 kilometers[2] (MME 2010-11, ES-15, 7-85), depending on which scenario unfolds. A large proportion of this damage is due to "the large areal extent of the Trekkopje mine" established by EDF's suppliers, Areva (MME 2010-11, ES-8, 7-85).

Cognizant of the environmental implications of such an extractive industry, the SEA makes a range of recommendations so as to enable Namibia to "position itself *to capitalise on a 'green' brand of uranium*" (MME 2010-11, 10-1, emphasis added). Various measures thus are proposed to mitigate anticipated and actualizing environmental harm. These include giving specified biodiversity, tourism, and heritage sites 'Red' or 'Yellow Flag' status that will make them off-limits to mining, although with the proviso of "unless an extraordinary mineral deposit of national importance occurs in the area" (MME 2010-11, ES-11). The areas and locations conferred with such status overlap significantly with actual and proposed mining areas. Already, in fact, the Etango uranium mine, to be run by the Australian company Bannermans Ltd., will be constructed in Red and Yellow Flag areas because its size means that it is of greater national economic importance than the protected landscapes already there (ASEC and ERM 2012: viii). Of further concern is a weak legislative structure with, for example, the recently passed Environment Management Act of 2007 including no requirement for companies to construct Environmental Management Plans (EMP) to guide their operations (MME 2010-11, ES-13; regarding the lack of restrictive environmental regulations in Namibia, also see Conde and Kallis 2012; 603). The MME thus asserts that:

> It is clear that the developments considered in the three scenarios will be unable to avoid priority biodiversity areas and as there are limited mitigation measures that can be implemented in the desert and because restoration of arid ecosystems is essentially

18 The list of recognized Ramsar wetlands can be viewed here: http://www.ramsar.org/cda/en/ramsar-about-sites/main/ramsar/1-36-55_4000_0__#, Accessed 1 April 2012.

19 http://www.gecko.na/corporate/namibia.php Accessed 9 February 2012.

20 http://www.gecko.na/corporate/namibia.php Accessed 9 February 2012, emphasis in original.

untested, *a large residual impact on biodiversity is expected. For this reason it will be essential to include the establishment of sustainable offsets... for many of the proposed developments* (MME 2010-11: 7.89, emphasis added).

Through invoking the mitigation hierarchy, and the principles and standards recommended by BBOP (see above), biodiversity offsets are proposed as a means of compensating for the 'unavoidable' direct loss of species due to projected landscape disturbance, as well as indirectly due to "habitat loss, degradation and fragmentation" and through the proliferation of other related infrastructure such as roads (MME 2010-11, ES-14-15).[21] Thus, "[b]ecause certain impacts are unavoidable, offset areas will be set up and supported by the mining industry" (MME 2010-11: 7-86), with 'aggregated offsets' proposed where mining companies pool rather than individualize their offset investments.

Unlike the Hinkley case above, these have yet to be worked out for specific cases, but already it is hard to see how such offsets could meet additionality criteria. In part, this is because of the very large habitat areas that potentially will be lost due to the direct effects of mining and supporting industries. It is also because the proposed offset locations (which include the Brandberg, Messum Crater, Spitzkoppe and surrounding inselbergs and Namib areas in north-west Kunene) already exist as areas of high ecological and conservation value. As such, their designation as offset areas for the significant environmental harms produced by uranium extraction and accompanying industries will not constitute added environmental and/or conservation value, and certainly not to a degree commensurate with the harms caused.

To bring this 'down-to-earth' a little, let's consider a handful of the life-forms that are being harmed by proposed and current mining developments in the Central Namib desert, in the course of extracting uranium to supply global demands for uranium power, including at reactors such as the proposed Hinkley C in Somerset. There are the endemic plants, *Adenia pechuelii*, known in English as Elephant's Foot for its unusual growth-form, and the succulent *Hoodia pedicellata*, found in the coastal Namib. The latter is a species already under threat due to intensified harvesting in the wake of the commercialization of associated *Hoodia* species for their appetite-suppressing qualities. There is *Rhoptropus gecko,* one of the gecko species endemic to the central Namib; and the extraordinary plant *Welwitschia mirabilis*, an ancient gymnosperm constituting the only genus in the taxonomic order of Welwitschiales. Some *Welwitschia* individuals may be over 2,000 years old, and many are over 1,000 years (Bornman 1978). *Welwitschia* occurs only in the Namib desert areas of Namibia and southern Angola. There are the Tenebrionid beetles, a constellation of endemic beetles whose innovative adaptations to the specific challenges of their Namib Desert home are the stuff of which natural history legends are made. Twenty-six species of Tenebrionid beetles are endemic to the central Namib, all considered 'threatened.' Finally, and to join company with the threatened barbastelle bat affected by the site preparation works for Hinkley C nuclear power station (as detailed above), is the endemic Namib long-eared bat, *Laephotis namibensis* (MME 2010-11: 7-75). Somewhat poignantly the IUCN Red Data list, which indicates the threat of extinction to known species, lists the Namib long-eared bat as in the category 'Least Concern' because "most of the range is within well protected areas" and "there are no significant threats".[22]

The MME states that through measures such as biodiversity offsets "companies stand to have a net positive impact on the ecosystems" (MME 2010-11: 7-89). Elsewhere it notes more candidly that "under any of the mining scenarios envisaged, … [economic] benefits will be at the cost of the biophysical environment which will be a net 'loser'" (MME 2010-11, ES-19). Given both the impacts of extractive industry, and the sleight of hand suggesting existing localities

21 Areva's Trekkopje mine, for example, affects the relatively undisturbed gravel plains of the Central Namib with concentrations of wildlife including springbok and ostrich, dense fields of the endemic succulent shrub *Sarcocaulon marlothii* Engl. (known colloquially as Bushman's candle), as well as one of the most important lichen areas in Namibia (MME 2010-11: 7-79: 7-81: 7-83).

22 http://www.iucnredlist.org/details/11137/0, Last accessed 18 December 2012.

of high biodiversity value can serve as offset localities for these impacts, it is hard to see how a net positive ecosystem value can in fact be the outcome of offsetting strategies in this case. It is additionally difficult to see how the projected environmental impacts of support industries such as the chemical reagent plants mentioned above, which will devastate local ecologies both through the production of acid fog and the dumping of production waste to sea,[23] can be offset to engender anything like 'no net loss.'

Offsetting Radioactive Biodiversity Futures?

The circuit traced here, that seems likely to connect nuclear power production in Hinkley, Somerset, UK with uranium extraction in the Namib Desert, southern Africa, would not be complete without mention of the increase in above-ground radioactivity with which this assemblage is associated. To summarize and simplify, radioactivity is amplified in this process at three stages. The extraction of uranium brings to the earth's surface radioactive material located naturally in the ground. Through application of toxic chemical agents, the ore is precipitated into a uranium radioactive 'concentrate' known as 'yellow cake,' leaving radioactive mine tailings and other toxic wastes at the sites of extraction, such as in Namibia, the potential effects of which are poorly known by local workers and communities (Conde and Kallis 2012: 605). This yellow cake then goes through an enrichment process elsewhere, so as to separate out the more radioactive uranium 235 fuel, producing uranium 238 as a key by-product. Although referred to as 'depleted uranium' (DU), Uranium 238 is also radioactive and has a very long half-life. It is itself a valuable commodity, because its denseness makes it useful in the construction of artillery shells that can penetrate armor. DU shells vaporize on impact, dispersing radioactive DU dust over wide areas. Recent deployment of DU artillery in the US and UK's war on Iraq has thus been associated with a devastating proliferation of cancers and extreme birth deformities (documented in distressing detail in Jensen 2006: 61-64). Finally, once uranium 235 fuel has been burnt in a nuclear power station such as at Hinkley, it leaves a radioactive cocktail of waste materials. One of these, plutonium, is used in the making of nuclear bombs, and as such is also a valuable commodity created through the nuclear power generation part of the uranium commodity assemblage. Indeed, it is perhaps pertinent to recall that it was the creation and production of plutonium for this very reason during the Second World War arms race that has driven the current legacy of nuclear power.

This amplification of above-ground radioactivity at all stages of the uranium commodity circuitry is of major significance for the cross-scalar flourishing of biodiversity. As well as committing countless future generations of people to finding ways to contain radioactive waste and contamination, the release of radioactivity through extraction and burning of uranium has conservation and evolutionary implications for the other manifestations of life that constitute our companions here on earth. In the case(s) documented above, biodiversity offsets are invoked so as to support the sustenance and expansion of this industry, by contributing conservation rhetoric and technology to ameliorate impacts on biodiversity, seemingly with little thought to the irreversible future pathways that the nuclear industry is committing all species to, including our own. There perhaps is a double perversity to this application of biodiversity conservation logic. It sanctions a reduced transferring forward of past biodiversity significance at sites that are offset, as well as supporting a development trajectory whose tragic consequences for life have already been amply demonstrated. How is it possible to offset such radioactive futures?

To Conclude: the 'Calculus of Casualties' in Greening Growth

As Caroline Seagle (2012) argues, partnerships between mining and conservation corporate actors are becoming heavily mobilized around biodiversity offsets such that mutual interests are satisfied, even as local biodiversity is lost, as is access to this biodiversity and other landscape qualities that are valued by local people (as documented in Conde and Kallis

23 http://www.wise-uranium.org/upna.html Accessed 9 February 2012.

2012: 605, 607). As such, biodiversity is being further caught within the calculative rationality associated with neoliberal governmentality, through which processes to be governed become characterised and 'valued' solely in technical terms, in part by screening out any refractory possibilities (Li 2007: 2-6, after Foucault 1991). Choices for offsetting that require development-related environmental harm thus are legitimized, even though they act to close off the options and values of other people (not to mention the individuals and populations of species affected on-site through development). It is thus relevant to understand the contexts, concepts, and power dynamics that serve such choices and to consider their associated socio-ecological effects. The instituting of biodiversity offsets in relation to development interventions clarifies the process whereby choices are made that will both affect and effect the continuing presence of biodiversity entities. They beg the asking of questions that are muted in the offsetting discourse, which at its most stark boils down to calculative judgments regarding how many individuals, populations, species, relationships, etc. are worth the maintenance of corporate mining wealth, the legacy of amplified above-ground radioactive material for management by future generations, the labor of untold workers, and the loss of diverse cultural values associated with these same species and landscapes.

In the "calculus of casualties" (after Jensen 2006: 65) that greens development in the case(s) documented here, individuals and populations of species, in combination with the places, relationships and cultural histories in which they are embedded, constitute some of the casualties, forcing confrontation with the loss of such diversities (cf. Yusoff 2012). As traced above, the calculative mechanisms and devices permitting biodiversity offsets are invoked so as to provide a sense that such interventions are environmentally friendly, even though they are causing significant and long-term environmental harm to long-evolved socio-ecologies of species and local knowledges connected with selected and affected places. The mitigation hierarchy and proposed offsetting mechanisms thus discursively reconfigure the place-based ecological (and social) casualties associated with specific developments, into positive environmental quantities entrained with the ideal of 'no net loss.' As Fletcher conveys, this strategy acts to foster the simultaneous acknowledgement and denial of real casualties in the *eco-socius*: it provides the ideologically useful fantasy that papers over the potentially disturbing gap between material and symbolic orders (Fletcher forthcoming; Glynos 2012). Derrick Jensen (2006: 65) makes the point more plainly in noting that "... in order for us to maintain our way of living, we must tell lies to each other, and especially to ourselves."

To look beneath the green 'no net loss' rhetoric and pay attention instead to both the offsetting logic and its effects, is to witness the extension of an array of foundational assumptions that seem intrinsically problematic for the sustenance of both biological and cultural diversities. As Carolyn Merchant (1980) detailed some decades ago, critical here is a conceptualization of the earth as a deadened and objectified abstract machine, a perceptual reality that hardened in conjunction with an increasingly industrialized mining endeavor justified intellectually by the elite European Enlightenment thinkers of the early modern era. This thinking is continued in an emerging mining-offsetting culture that conceives of life and land as numbers that can be exchanged through offsetting mechanisms. This very specific, yet universalizing, view of the world as a global ledger of equivalences between localities (cf. Brockington et al. 2008), fabricates exchangeability so as to effect an anti-ecological (and commodifying) deterritorialization of nature under the guise of enhancing environmental health. The accompanying commodification of new nature artifacts such as biodiversity offsets, – adding to what Karl Polanyi (2001[1944]) called 'fictitious commodities' - completes this new incorporation of nonhuman nature. Through such processes the entrepreneurial corporate world extends its dominion over both environmental health and harm as money-bearing commodities, creating new financial values for measures of environmental health even as it may also be enhancing scarcity in these very same measures (Seagle 2012: 468; Sullivan 2012b: 24-25).

Neil Young's song 'After the gold rush', from which I take the title of this paper, contains the evocative line, "Look at Mother Nature on the run..." This seems an apt thought to close with, although it appears to me more as if it is we hypermodern humans who instead are running from nature. In the examples considered here, 'nonhuman nature' and the entities and relationships of which 'it' is comprised are known only by proxy: as numbers, as scores, as interchangeable equivalences, as priced commodities, as resources to be radically transformed so as to conform with the apparently unavoidable dictatorship of economic growth and the market. The instrumentalized landscapes that are thereby created are lonely places. Nature may be 'on the run' from these; but nature's constituents are also being pushed out by contingently empowered decision-makers so as to enhance particular growths. A deepening separation from nonhuman species is being extended in the resultant calculating of nature in terms of numerical, interchangeable and monetized entities. This may indeed constitute an economically productive engagement with contemporary eco-catastrophe. At the same time, it feels to me to be rather far from the (re)calibrations of socionatures that are likely to compose long-term, democratic and relational flourishings of diversity.

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