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Abstract

In this paper we explore the logic of biodiversity offsetting, focusing on its core promise: the production of 'equivalent natures'. We show how the construction of equivalence unravels the environmental contradictions of capitalism by exploring how and why it is achieved, and its profound implications for nature-society dialectics. We focus on the construction of an ecological equivalence between ecosystems, the construction of ecological credits that are considered equivalent in

monetary terms, and, finally, the construction of an equivalence between places. The existing critical literature, in some cases implicitly and unwittingly, assumes that biodiversity offsetting creates value. In contrast to this argument, we draw on Marx's labor theory of value to conclude that in the majority of instances offsetting does not create value, rather it is an instance of rent. We also draw on Marxist analyses on the production of nature and place to show that biodiversity offsetting radically rescripts nature as placeless, obscuring the fact that it facilitates the production of space, place, and nature according to the interests of capital while emphasizing that at the core of offsetting lie social struggles over rights and access to land and nature. Biodiversity offsetting's dystopian vision for the future makes it an important focus for all critical scholars seeking to understand and challenge the contradictions of the capitalist production of nature.

Keywords

Neoliberal conservation, production of nature, biodiversity offsetting, labor theory of value, theory of rent, biodiversity markets

Introduction

> 'The door refused to open. It said, "five cents, please". He searched his pockets.
>
> No more coins; nothing. "I'll pay you tomorrow", he told the door.
>
> Again, it remained locked tight. "What I pay you", he informed it, "is in the nature of a gratuity; I don't have to pay you". "I think otherwise", the door said. "Look in the purchase contract you signed when you bought this conapt[1]". …He found the contract. Sure enough; payment to his door for opening and shutting constituted a mandatory fee. Not a tip.
>
> "You discover I'm right", the door said. It sounded smug'.
>
> Ubik, Philip K. Dick (1969)

Biodiversity offsetting is based on the simple and simultaneously quixotic idea that losses to biodiversity in one place can be adequately compensated by creating 'equivalent' gains elsewhere. Potential ecological gains are represented as 'credits' that can be exchanged across space and time to 'offset' losses (Apostolopoulou and Adams, 2017a) so that development can be achieved with No Net Loss of biodiversity (commonly shortened to 'NNL').

[1] 'Conapt' here means an apartment building.

The incorporation of biodiversity offsetting into conservation and environmental planning strategies worldwide is emblematic of a widespread turn to market-based solutions to biodiversity loss under the rubric of the 'green' economy (Corson et al., 2013) and 'green' capitalism (Prudham, 2009). Biodiversity offsetting typifies the neoliberal turn in environmental policy and the increasing neoliberalization of nature conservation (e.g. Corson et al., 2013; Brockington and Duffy, 2010; Büscher et al., 2012). It involves the deregulation and market-friendly reregulation of environmental and planning legislation to facilitate development, the extension of the monetary valuation of nature, an increased involvement of the private sector (Quétier and Lavorel, 2011) and market-based approaches to conservation (ten Kate et al., 2004), and a broader reliance on private means of sustaining social reproduction.

Since 2009, there has been a rise in national government legislation requiring biodiversity offsets (Bennett et al., 2017; The Biodiversity Consultancy, 2013) which has coincided with the intensification of the neoliberalization of nature and the expansion of neoliberal conservation (Apostolopoulou and Adams, 2015), reproducing the 'environmental backlash' that followed the 1973 economic crisis (Bonneuil, 2015). In the face of parallel calls for reversing biodiversity loss and stimulating growth to deal with the 2008 financial crash, the potency of the idea of offsetting was that land used for development could be traded off against land protected for conservation facilitating the relocation of environmental compensation across space and time in line with the interests of developers. This brought together major industries (particularly housing, mining, infrastructure, construction, oil and gas), governments, environmental brokers, investors, and NGOs (Bennett et al., 2017; ten Kate et al., 2004).

Biodiversity offsetting involves the reconstruction of conservation around the measurement of a putatively quantified economic value of nature. Historically, the concept of biodiversity created a standardized and abstracted language to encompass living diversity at all scales from genes to ecosystems, and through this levelling of difference it facilitated the management and control of nature (Wilson and Peter, 1988; Takaks, 1996). Biodiversity offsetting extends this managerialism, attempting to represent habitats, species and ecosystems through priced credits, further and fundamentally changing the way non-human nature is represented, mapped, managed, and experienced. It implies that by establishing the 'proper' metrics, different pieces of land and different natures and places can be rendered equivalent. The underlying assumption of nature as 'movable' and 'interchangeable' has the potential to transform nature-society relationships by enabling a profound social and eco-spatial rearrangement of socionatures.

At the core of biodiversity offsetting's logic lies the concept of ecological 'equivalence' allowing the process to be portrayed as one of keeping an overall 'balance' between ecological losses and gains through the idea of *trading* in biodiversity. The creation of equivalence has been criticized from the technical conservation and ecological perspective (e.g. Bull et al., 2013; Quetier and Lavorel,

2011; Gibbons and Lindenmayer, 2007; Gibbons et al., 2018), and by critical scholars, who have mainly focused on the role of equivalence in the creation of new abstractions and values from nature (e.g. Bracking et al., 2014; Dauguet, 2015; Sullivan, 2014, 2013; Robertson, 2012), in many cases drawing parallels with work on carbon offsetting (Lohmann, 2010; MacKenzie, 2009).

In this paper, we focus our analysis on the production of 'equivalent natures' in biodiversity offsetting, as both an ideology and a material practice and we pay particular attention to the valuation process behind biodiversity offsetting as primarily an ideological process attached to the politics of the value relation. We show how the construction of equivalence unravels the environmental contradictions of capitalism by exploring how and why it is achieved, and its profound implications for nature-society dialectics. We focus on three aspects: the construction of an ecological equivalence between ecosystems, the construction of ecological credits that are considered equivalent in monetary terms, and, finally, the construction of an equivalence between places.

Our analysis is distinct from the existing critical literature on biodiversity offsetting, and environmental markets more generally, which draws heavily on post-structuralism, actor-network theory and Polanyian approaches (e.g. Bracking et al., 2014; Sullivan, 2014; Büscher et al., 2012; MacKenzie, 2009; Robertson, 2000). In particular, we draw on Marxist analyses of the production of nature, place and space under capitalism (e.g. Smith, 2010; Katz, 1998; Lefebvre, 1991) as well as on Marx's labor theory of value and on the theory of rent (e.g. Swyngedouw, 2012; Burkett, 2006; Harvey, 2006; Fine and Lapavitsas, 2000; Marx, 1894, 1887) and we aim to show their relevance to the analysis of biodiversity offsetting.

A Marxist approach and critique allows an explanation of the historically specific conditions that have shaped the rise of biodiversity offsetting which would operate under the capitalist relations of production. In this, we draw on Smith's (1998, 2010) analysis of the production of nature which, by following Marx's logico-historical methodology (Smith 2010, 52), embeds production in social and economic relations (Smith, 1998; Lefebvre, 1991; Marx, 1887) and approaches nature-society relationships as mediated by the capitalist relations of production and reproduction (Katz and Kirby, 1991). The production of nature thesis emphasizes that social labor lay at the heart of our comprehension of the social relation with nature (Smith, 1998). Moreover, we emphasize the importance of distinguishing between rent and value. In doing this we extend the arguments of scholars working on carbon offsetting (e.g. Jones, 2009; Felli, 2014), by showing the importance of the distinction in the specific context of biodiversity offsetting and ecosystems. We also embrace recent efforts to reinsert Marx's theory of value and rent into political ecology, acknowledging the increasing importance of rent extraction in contemporary capitalism (Andreucci et al., 2017).

Finally and relatedly, we aim to highlight the class aspects of biodiversity offsetting in search of a theoretically-informed and socially rooted critique that is

relevant to conservation politics. We thus aim to engage more directly with the ecological, social, economic and cultural implications of biodiversity offsetting and open up the possibility of a discussion of a radically different production of nature that can transcend the confines of academia.

Biodiversity offsetting: History and meaning of the term

Even though biodiversity offsetting mechanisms, in the form of habitat and species banking, were formally put in place in the 1990s, their origins can be traced back to the US Clean Water Act (1972) and its section 404 which required mitigation for development projects that would have significant impacts on wetlands (Bayon et al., 2008; Bonneuil, 2015). Importantly, the adoption of biodiversity offsetting followed the neoliberal turn in environmental policy from the early 1970s, which attempted to dismantle environmental regulations adopted after World War II (ibid). Biodiversity offsetting shares many features with carbon offsetting, also established from the 1990s as a strategy to mitigate climate change through the creation of new 'markets' for carbon and its derivatives (Bond, 2012; Lohmann, 2012; Bumpus, 2011; Bumpus and Liverman, 2008).

A key moment in the mainstreaming of biodiversity offsetting internationally was the establishment of the 'Business and Biodiversity Offsets Program' (BBOP) in 2004 by the American non-profit organization Forest Trends[2]. BBOP is an international partnership of more than 80 organizations and individuals including companies, government agencies, financial institutions, service providers, and civil society organizations, who are members of its Advisory Board[3]. Its sister initiative, the Ecosystem Marketplace[4], a web-based information platform, was launched at the same time (Madsen et al., 2010). BBOP defined biodiversity offsets as 'measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken' (BBOP, 2012, 13). This definition has subsequently been widely adopted. Biodiversity offsetting was conceived as a 'last resort' in a 'mitigation hierarchy', to be done only after all measures had been taken to avoid and minimise development impacts and to rehabilitate or restore biodiversity on-site (BBOP, 2009).

By 2011, at least 72 countries already had or were developing biodiversity offsetting. Policies were most developed in North America and Australia, and expanding in Africa, Asia and Europe (Madsen et al., 2011). More recent estimations show a rapid expansion across the globe especially during the last decade (Ives and Bekessy, 2015). In a report published in 2017, Bennett et al.

[2] https://www.forest-trends.org
[3] http://bbop.forest-trends.org/pages/about_bbop
[4] https://www.forest-trends.org/ecosystem-marketplace/about-ecosystem-marketplace/.

identified 99 active offset and compensation policies around the world as of 2016. The authors argue that an estimated $4.8 billion in mitigation bank credits and financial compensation was transacted in 2016. The largest markets were in the US, Australia, Germany and Canada.

In biodiversity offsetting, ecological gains and losses are represented by numerical scores. This allows the damage to ecosystems at one site (the development site) to be compared against gains at another site (the offset site), thus establishing an equivalence between them. Such calculations provide the basis for the creation and exchange of conservation 'credits' (reflecting the accumulation of positive changes through investment in potential offset sites). This, in turn, allows the possibility of 'habitat' (Madsen et al., 2011), 'conservation' or 'biodiversity' banking (Eftec and IEEP, 2010). A conservation or mitigation bank supplies 'credits', consisting of a site (or a suite of sites) where habitats or/and species are restored, established, enhanced and/or preserved (Madsen et al., 2010). These can be sold to developers to offset the impacts on biodiversity that result from their projects. Biodiversity offset sites can thus be turned into 'assets', creating a market for developers' compensation liabilities (Eftec and IEEP, 2010). Even though biodiversity offsetting can be exercised without being linked to banking (see e.g. project-specific offsets and in-lieu fee schemes), the two are often created together (Tucker et al., 2013). Thus for example North America, where offsetting is extensive, hosts the largest number of conservation banks worldwide (Bennett et al., 2017). Similarly, in the EU, the NNL initiative[5] favoured the establishment of biodiversity offsetting in conjunction with banking.

In what follows, we draw on specific examples of biodiversity offsetting discussed in the literature, including the BBOP (BBOP, 2009, 2012), wetland and species banking in the USA (Department of Defense and EPA, 2008; Fish and Wildlife Service, 2003), BioBanking in state of New South Wales Australia (DEC, 2006, 2007) and biodiversity offsetting in England (Defra, 2013). We selected these programs based on their influence in shaping biodiversity offsetting policies globally and in Europe, their implementation history, and literature availability. Our goal is not to analyse them in depth but to use them as indicative examples for showing offsetting's logic in both theory and practice.

Biodiversity offsetting and the production of equivalent natures

The construction of ecological equivalence

As mentioned above, in biodiversity offsetting, ecological losses and gains are calculated through numerical scores, for example a number of biodiversity 'units' in England (Defra, 2013) or 'credits' in Australia (DEC, 2006). In contrast with carbon offsetting, where a single metric of CO_2 equivalency exists (based

[5] http://ec.europa.eu/environment/nature/biodiversity/nnl/index_en.htm

admittedly on quite complex calculations of radiative forcing and atmospheric residence time), no single metric underpins the discussion on biodiversity trading. It is far from settled among ecologists what exactly should be measured to comprise a metric (e.g. species diversity, ecosystem functions or ecosystem services, Bull et al., 2013; Gardner et al., 2013). Disputes over the suitability of different metrics (Tucker et al., 2013), exchange rules (BBOP, 2009) and methodologies to establish equivalence (Quétier and Lavorel, 2011) still persist. This absence of accepted measures along with the fact that biodiversity exists in spatially explicit combinations makes biodiversity currencies even more controversial that they already are for carbon (Apostolopoulou and Adams, 2017a; Lohmann, 2012; Bumpus and Liverman, 2008).

Biodiversity offsetting is not about *literally* achieving NNL or ecological equivalence, since both words are rather used as euphemisms. The policy aims to identify suitable 'currencies' (or 'metrics') to calculate *selected* attributes of nature lost and gained and quantify 'surrogates' or 'proxies' (e.g. habitat variables) that can be combined into such metrics and taken as representative of 'overall' biodiversity. Most ecologists accept that surrogates used as currencies are crude simplifications of ecological relations and non-human nature (Maron et al., 2016) and that, as even the BBOP (2009, 13) concedes, the genuineness of representatives 'may be difficult to demonstrate'. Indeed, until recently, US wetland mitigation offsets were based on land swaps measured by area, i.e. a given area of a habitat type destroyed equals another area of the same habitat type either preserved or restored (Quétier and Lavorel, 2011). Simple habitat area ratio based metrics have been also used in Germany, although critiqued as reductionist and unreliable (Tucker et al., 2013). BBOP's (2009, 43) proposed method was primarily based on a combined 'area x quality' approach, using a 'habitat hectares' metric, based on that used in Victoria, Australia. This method has also been adapted for use in England, where biodiversity units are calculated in terms of the product of a distinctiveness score, a habitat condition score and habitat extent (Defra, 2013). Even though this metric is considered advanced, however, its ability to adequately describe biodiversity is still highly debatable (Tucker et al., 2013).

The reductionism of biodiversity offsetting metrics is compounded by the use of 'multipliers' to address issues not covered by the metrics. These might increase the offset area due to the distance between development and offset sites (IEEP, 2014), or uncertainty about future ecological change, time lags between environmental destruction and offset delivery (BBOP, 2009), or to take account of the loss of irreplaceable or hard-to-restore biodiversity, like for example the loss of ancient woodlands in the new HS2 rail line in the UK (HS2, 2013). Such multipliers are by necessity quite arbitrary and reflect the desire of the analyst to make a conservative calculation rather than any underlying ecological logic.

It is, therefore, clear that the quantified equivalences at the basis of biodiversity offsetting are not supported by a consensus within the natural science community; this lack of consensus is meaningful at a more general level, as it

exposes how artificial quantifications may be and, simultaneously, how vital to the capitalist valuation system (Greco, 2015). The problem of quantification and abstraction in such calculations is not of course unique to biodiversity offsetting. Similar problems emerge in the case of measuring ecosystem services whereas critics of carbon offsetting (e.g. Lansing, 2012; Lohmann, 2012; Bumpus, 2011; MacKenzie, 2009) have also drawn attention to the calculative practices involved in processes of stabilization of complex categories such as 'forest'.

So why are these calculations important? Most of the existing critical literature underlines that the use of biodiversity offsetting methodologies to construct equivalence is a key moment in the creation of new 'commodities' and 'markets' (e.g. Bracking et al., 2014; Dauguet, 2015; Sullivan, 2013; Robertson, 2012). Offset metrics are placed at the centre of these analyses because their role as valuation and calculation tools is considered fundamental in producing 'abstractions' and creating new 'value(s)' from nature. Coming from a wide array of theoretical positions, what most authors who criticize the construction of equivalence in both carbon and biodiversity offsetting have in common is a focus on the politics of measurement, valuation and calculation. As Robertson and Wainwright (2013, 900) put it: 'in contesting measure, we challenge the logic by which something becomes a bearer of value in capitalist society; that is, becomes capable of circulating as a means to an end'. A shared view in the above approaches is that the measurement and calculation of biodiversity units is 'performative' in the sense of 'performative economics' (see MacKenzie, 2009[6]). The shaky and contested tools to measure these units are theorized as calculative devices or 'dispositif de calcul' (drawing on the work of Callon, see Callon, 2007; Callon and Muniesa, 2003) which, through their performativity, create value (MacKenzie, 2009). This theoretical focus on valuation has recently justified claims that 'valuation studies' is to become a new disciplinary field in its own right (Helgesson and Muniesa, 2013). In this literature, broadly inspired by 'actor-network' theory (Latour, 2005), value is deemed to originate from the performative action of a biodiversity (or carbon) unit, simply because that unit will attract a price. Scholars who explicitly draw on this tradition understand value as something that can be 'made' by a socio-technical arrangement, a configuration of people, institutions and technologies which conducts the performation of markets through calculative devices (see e.g. Bracking et al., 2014). The theoretical focus lies, therefore, on the performativity of valuation tools, without which equivalent natures could not come into being, and of what Tsing calls the 'economy of appearances' (Tsing, 2000).

Despite the fact that this literature rightly questions the creation of ecological equivalence and opens up a necessary critique of hitherto dominant technical analyses, the role imputed to calculative mechanisms and valuation

[6] For a critique of ANT and the economic performativity literature see Fine, 2005.

technologies to the creation of value leaves little space for engagement with the historical-material reality behind appearances – the political, economic and social structures that validate and naturalise the value system of capitalism, of which biodiversity offsetting is just an expression. This lack of theoretical understanding of what value is has led to important limitations.

The first limitation is a conflation of what capital sees as value (abstract value) with the myriad, heterogeneous quality of use values - thus missing out the fundamental theoretical difference between use value, exchange value and value. While biodiversity as such has various use values, the biodiversity units elaborated by offsetting's calculations have very tenuous and far from self-evident use values.

Crucially, the tools used for nature valuation and for the creation of equivalent natures are rarely analysed as socially and historically specific structures. Because of this, capital and class politics (and their historical and political origins) do not figure among the factors at play. Analyses that attribute the creation of 'value' to the application of offset metrics tend to distance themselves from a critical political economic perspective, including the Marxian labor theory of value, because *they do not relate value to capitalist social relations*. They thus fail to offer a historically concrete explanation of why offset markets emerge, who benefits and who loses from them, how they relate to capitalist commodity production and what role they play to capital accumulation.

But let's return to our original question: *why are offset calculations important?* Offset metrics as valuation tools aim at portraying a complex reality as if it conformed to a single, self-evident and specific understanding of value. By doing so, the underlying conception of value, and how this relates to the wider economic and social structures, is not spelled out, but rather left implicit. We suggest that the specific understanding of value imputed upon new entities - in this case, biodiversity offsets - is neither natural nor neutral. It emerges from the historically specific relations created by capitalism as a value system, based on capitalist class relations. In this sense, offset metrics and the equivalences supporting them are performing an ideological function, which is that of naturalizing the process of concrete abstraction (Sayer, 1986) on which value in capitalism is based. In a capitalist society, value appears as the social expression of wealth in its most abstract form and it emerges from the extraction of surplus value in the labor process. This measure, thus, is historically specific and depends on the socially necessary labor time of commodity production. Crucially, while value originates from the labor process, it can be appropriated in several different ways (see next section).

This leads us to the second limitation of the existing literature, which is the blindness towards the difference between value and rent. One of the many ways to appropriate value produced elsewhere in the economy is rent appropriation. On this point, we agree with Felli (2014) on the fact that offsetting does not involve the creation of a new commodity – which would imply the erasure of a myriad of

heterogeneous, non substitutable and non quantifiable use values of biodiversity entities, to sell them and in this way make them circulate as abstract value (see also Andreucci et al., 2017).[7] It is, instead, a process of rent extraction, which means that the value here is rather extracted from other sector(s). In fact offsetting policies are often dependent on subsidies (Greco, 2015) and the valuation tools which make biodiversity offsetting possible have been elaborated by public agencies (e.g. for the case of England see Apostolopoulou and Adams, 2017b; Carver and Sullivan, 2017). This also explains why offsetting would be impossible without state intervention: it is the state that is in charge of defining the regime of property rights and enforcing the laws that allow for rents to be extracted.

Crucially, as mentioned earlier, the function of these valuation tools is primarily ideological in the sense of reaffirming and naturalizing the current capitalist class relations as inevitable and natural, rather than subject to change, socially determined and transient (Greco, 2015). We argue that science has not been immune to these influences and that biodiversity offsetting as valuation tools are one of the results of the colonization of science by economics and thus play an important ideological role in defending neoliberal principles within conservation science. Indeed, a class understanding of knowledge and ideology (Levins and Lewontin, 1985; Marx and Engels, 1970) can reveal that offsetting's calculations reflect capitalism's understanding of non-human nature as a 'stock' of resources that has to be measured and whose value can be captured by price. The methodological axioms of positivist science (Smith, 2010) - mechanistic reductionism at its extreme (Levins and Lewontin, 1985) and a wholly external conception of nature - that lie at the core of offsetting's logic are a product of capitalism's specific, socially determined relation to nature. They result from 'its exploitative use and the development of natural forces as mere material conditions of capital accumulation' (Burkett, 1997, 168) and even though they reflect how

[7] While applauding the invitation to refocus on rent in political ecology (Andreucci et al., 2017), we have some reservations on the two conceptual innovations put forward by the authors, namely value grabbing and pseudo-commodity. The latter term was coined by Felli (2014) who defined pseudo-commodity any commodity with exchange value which, at least in part, cannot be (and has not been) produced. This includes most natural resources. Although the authors fully distinguish it from Polanyi's 'fictitious commodity' definitions, we still maintain that the concept of pseudo-commodity can easily (mis)lead the reader into thinking that these entities do not 'behave' as fully–fledged commodities, while in fact they do (see Harvey, 2006, chapter on rent). Similarly, the second concept - the term 'value-grabbing' – which aims at making more visible and politicize the increasing importance of rent appropriation in contemporary capitalism - can potentially obtain the opposite effect of what its authors probably wish for, (mis)leading readers to minimize the distinction between value and rent in Marx's theory by calling 'value grabbing' the process of rent appropriation.

capitalist commodity production subjugates use value to exchange value, they do not prove whether ecological 'commodities' produce value.

The construction of biodiversity offsetting markets

The construction of an equivalence between biodiversity units in monetary terms, as for example when the Ecosystem Marketplace equates destroyed wetlands calculated to be worth $1.8 billion with restored or conserved wetlands elsewhere also deemed to be worth $1.8 billion and registered in a 'wetland bank' in the USA, raises various issues of fundamental theoretical, empirical and political importance.

As discussed in the previous section, the existing critical literature on biodiversity offsetting mostly argues that ecological equivalence sets the base for the creation of new markets, commodities and value(s) (e.g. Dauguet, 2015; Sullivan, 2013; Robertson, 2012, 2000). This literature, in line with wider research on environmental markets (including work on carbon offsetting and payments for ecosystem services), tends to characterize offsets as commodities without, however, clarifying the nature of the commodity produced or the social relations expressed therein. The 'value' of biodiversity offsets is often taken as an undefined 'economic' value, and understood in terms of the subjective 'value' of events, occurrences, and services. While preventing the identification of the deeper social reality captured by value (Fine and Lapavitsas, 2000), these approaches also tend to assume that biodiversity offsets necessarily support capital accumulation (e.g. Corson and MacDonald, 2012; Robertson, 2012).

As already pointed out we argue that the implications of creating an equivalence in monetary terms between biodiversity credits can be more adequately explained by drawing on Marxist political economy, and particularly on the labor theory of value and the theory of rent (Swyngedouw, 2012; Harvey, 2006; Smith, 2006; Burkett, 2003; Foster, 2000). According to Marx, 'value' is defined as the 'socially necessary labor-time' objectified in commodities, namely the labor-time required to produce any use-value 'under the normal conditions of production, and with the average degree of skill and intensity of labor prevalent at the time' (Marx, 1887, 28). Therefore something has value 'only because human labor in the abstract has been embodied or materialised in it' (Marx, 1894, 28) and what determines value's magnitude is the amount of the socially necessary labor time for its production (Marx, 1887, 28). In capitalist society, value presents itself as the generalised, social expression of wealth. One of the functions of money is thus to be the symbol of the universal equivalents which supersede the endless variety of heterogeneous, and riotously incommensurable, use values. The Marxist distinction between use value, exchange value and value (Burkett, 2006; Marx, 1887), and value's definition as capitalism's specific form of economic valuation[8], whose

[8] This definition of value distinguishes Marx from the physiocrats and the contemporary nature valuation debate (Burkett, 2006).

substance can be found in abstract labor (Burkett, 2006; Fine and Lapavitsas, 2000), is crucial for distinguishing price from value, value from rent, and commodities (products of human labor) from 'commodity forms' - objects that are not products of labor and which even though may have a price they do not have value (Harvey, 2006, 18; see also Marx, 1887, 102, 197).

The above distinctions are crucial if we want to see beyond the 'delusive appearance of things' (Marx, 1899, 54) and understand that under capitalism, equivalences are not established only between commodities. On the contrary, quantitative ratios are commonly established between commodities and the products, consequences, and results of all economic activity and thus social mechanisms for concentrating money can appear as 'markets' (Fine and Lapavitsas, 2000, 364-365[9]). It is here that the process of subjugation of use values to exchange value manifests itself as a process of abstraction which is concrete in its very nature – in that its concreteness brings about material, tangible effects (Sayer, 1987) - and violent at once, given its erasure of the qualitatively incommensurable dimensions of use values (Starosta, 2010). Distinguishing between the *form* (the exchange value, namely the quantitative ratio/equivalence of one commodity with another) and the *substance* of commodity value (abstract labor) is key in understanding that exchange value is frequently adopted by economic processes which may be *unrelated to value creation* (Fine and Lapavitsas, 2000), from which descends that valuation and calculation devices are not necessarily related to value.

So far this analysis can tell us that the construction of an equivalence between ecological credits that have been attributed a price is not enough for the creation of value. In order to move further let's see what exactly an offset is. The offset site constitutes a restored or conserved habitat (or species) which comes to be defined as a score of credits that has a specific price. Thus the unit traded in US mitigation banking, in NSW BioBanking and in biodiversity offsetting in England is a hectare of land under management or restoration or a 'habitat acre'[10]. Offset credits can be either bought in the context of a specific project or be available for sale 'off the shelf'[11] (Bayon et al., 2008). They can be sold to buyers in advance of

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[9] Acknowledging the *sui generis* of markets is not a formality, since the choice of what constitutes a commodity market is dictated by addressing the issue of commensuration of diverse concrete labors, namely the social relations of capitalist production (Fine and Lapavitsas, 2000, 364-365, 374).

[10] See http://www.ecosystemmarketplace.com. We do not consider here marine ecosystems.

[11] http://www.environment.nsw.gov.au/biobanking/

project approval, resold later if not used, or acquired to build a credit portfolio to offset future development (DEC, 2007; Fish and Wildlife Service, 2003[12]).

For Marx (1887), commodity production involves producing commodities that not only possess use-values (meaning anything that satisfies human needs) but, crucially, that can be sold as use-values for others. As rightly observed by Huber (2017), environmental economics do not recognize the inherent contradiction between use values and exchange value and thus allow 'the possibility of nature attaining value' (ibidem: 44), as the valuation process behind biodiversity offsetting shows. Once we acknowledge the inherent contradiction between use value and exchange value, this valuation project becomes impossible to postulate. Seen under this light, biodiversity offsets serve a double role: their *use value* for buyers (including diverse actors[13]) rests on either their use for internal mitigation (purchasing their right to degrade nature) or for profit from selling them to others (or both); they therefore also have an *exchange value*. The crucial question then is whether their exchange value bears any relation to labor, a question that needs to be addressed to make clear the issue of the origin of value. To address it, we have to consider that offsetting can be delivered in various ways with all manner of different implications.

In particular, according to the 'additionality' principle (BBOP, 2009), ecological gains from biodiversity offsetting should result from management interventions to restore an area, stop its degradation, or avert risks of future degradation and be assessed in comparison to a counterfactual scenario (Defra, 2013; Commonwealth of Australia, 2012). Thus producing biodiversity offsets in some cases requires human labor. This should be the starting point in discussing whether value is created (or not), yet the only reference we can find to this is Smith (2006)[14], who argued that surplus value could be harvested from habitat restoration or re-creation, an argument that directly derives from the production of nature thesis.

The issue of human labor expended on the production of biodiversity offsets is so far particularly important –and more obvious- in the global South (see e.g. Bridge, 2010; Corbera and Brown, 2010) where workers often contribute to restoration or management activities (see e.g. Dickinson and Berner, 2010 on the Ambatovy nickel and cobalt mine project in Madagascar) and offsetting is based on exploitative labor relations. In these cases, credit providers (including developers) may profit from managing or/and selling offsets and from exploiting both the

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[12] See also the 'Thames River Conservation Credits Bank' in England established by the Environment Bank in 2009 (http://www.speciesbanking.com/bank/thames_river_conservation_credits_bank).

[13] www.ecosystemmarketplace.com

[14] However, Smith (2006) considered the theory of rent as more relevant to the analysis of environmental markets.

development and the offset site. For example in Madagascar, Rio Tinto simultaneously destroyed nature with its mining operation and set aside conservation zones as 'ecotourism destinations' (Seagle, 2012).

The possibility to consider permits produced by human labor expended on planting carbon sinks as a new repository of value has been also acknowledged by Jones (2009), who nonetheless argues that such cases are rare in the emissions trading market. In biodiversity offsetting literature, this issue has so far remained completely unaddressed (at least to our knowledge) and, therefore, it is impossible at the moment to evaluate whether labor is spent in offset creation (and at what extent). The latter is crucial if we aim to understand whether new value is actually created in biodiversity offsetting and what social relations of exploitation may be involved in the process and would require empirical work on specific offsetting programs. Two further clarifications are important here. Firstly, an in-depth discussion on the role of labor would require making a distinction between absolute and differential rents, and between differential rent I and II (see also Felli 2014, note 69). Secondly, given that not all labor undertaken in a capitalist economy necessarily results in value (Marx, 1887, 1894), research is needed to explore whether in biodiversity offsetting we have the material basis for the commensuration of diverse concrete labors characteristic of commodity production (see Fine and Lapavitsas, 2000, 364-365).

Let's now return to the relevance of the theory of rent and start by clarifying that the price that is given to biodiversity offsets is influenced not only by the work required to create, restore or manage them but also by land prices (Conway et al., 2013; DEC, 2006), since developers and/or offset providers often have to buy land for offset creation. Obviously, not just any land is suitable (Department of Defense and EPA, 2008), and land itself cannot be produced but only commodified and privatized through the creation of a land market and the institution of private property (Harvey, 2006). Through this process, land which is not the bearer of socially produced value, but of various use values arising from its innate condition, is turned into the bearer of a price – hence the source of rent. Under private property laws, landowners can thus acquire monopoly powers 'over definite portions of the globe, as exclusive spheres of their private will to the exclusion of all others' (Marx, 1894, 615). This creates a basis for the formation of a potentially powerful rentier class, which 'owns' and regulates access to land and nature (Harvey, 2014). In cases where landowners only sell their land but are not themselves involved in biodiversity offsetting, revenue accruing to them is an appropriation of a portion of the total surplus value extracted in the production process, and land rent is a drain on capital accumulation (see also Swyngedouw, 2012). By changing land uses and land access, biodiversity offsetting can also impact the level of rent and the profits generated through landownership, potentially furthering processes of land speculation. For example, land prices can reflect future rights to build as it has happened in many cases in England (Apostolopoulou and Adams, 2017b).

This means that biodiversity offsetting can have both positive and negative roles to play in relation to accumulation (see Harvey, 2006, 331) and severe socio-ecological conflicts can unfold between capitalists *qua* capitalists and rentiers (like land or ecological services owners), and between rentiers and users of the services these rentiers have exclusive rights to. As Andreucci et al. (2017) argue while the social relations of capital valorization in production develop through the capital–labor relation, the rent-based social relation unfolds through struggles over ownership of assets and the payment for the right and modalities of their use. This has been clearly reflected during the implementation of the biodiversity offset pilots in England where some landowners and developers perceived offsets as a new 'tax' and showed unwillingness to adopt the policy while others saw in it an opportunity for speculation - whenever the conditions set for land valuation allowed it. Moreover, in locations where land values have been increasing due to reasons independent of offsetting, acquiring land for offsetting can become prohibitively expensive, as showed by the case of central Brazil (Lourival et al., 2008). There is no univocal trend in this regard, given that the dynamics of rent are place and class specific.

Biodiversity offset providers can also register their land on platforms, such as the Environmental Markets Exchange in England (EME)[15], the BioBanking Public Register in NSW[16] or the global Speciesbanking[17], and assign prices to the credits their land parcels represent no matter whether any labor has been expended on them or not. Again, drawing parallels with Marx's analysis of rent (1894), we can argue that biodiversity offsets are held by individuals who are regarded as owners of the portions of the earth where offsets are located (Marx, 1894, 460-461). The surplus profit stems from controlling a limited natural resource which is transformed into ground-rent, that is, falls into possession of the owner of ecological credits (Smith, 2006; Marx, 1894). These credits can thus be considered as a 'condition of production' and rent as a payment for the developer's right to access these necessary conditions in order to use the land of the development site (see also Felli, 2014).

Finally, through conservation banking nature also becomes a speculation instrument for buyers aiming to gain from 'boom' conditions[18]. This means that it is the potential exchange value that matters and thus credits can become a 'personal ATM machine' (as Harvey, 2014 argues with respect to housing), boosting demand for biodiversity offsets. As noticed above, credits secure for their owner a claim to

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15 http://www.environmentbank.com/documents/EnvironmentBankNewsletterSpring2012_000.pdf

16 http://www.environment.nsw.gov.au/bimsprapp/BiobankingPR.aspx

17 http://www.speciesbanking.com

18 Literature on carbon credits offers ample evidence on the consequences of speculation and financial crashes (Bond, 2012; Lohmann, 2012).

receive annual rent (see Marx, 1894, 808) and thus any stream of revenue can be considered as the interest on some imaginary, 'fictitious capital' (Marx, 1894, 266). Thus, conservation banks can function as a particular branch of the circulation of interest-bearing capital, with nature treated as a financial asset whose control can be given to anyone having access to land or credit. As in all such forms of fictitious capital, what is traded is a claim upon 'future profits from the use of the land or, more directly, a claim upon future labor' (Harvey, 2006, 347). This analysis crucially differs from post-structuralist approaches by demonstrating that biodiversity offsetting does not necessarily create 'value' but mainly generates opportunities for rent.

The construction of 'equivalent places'

As it has been obvious from the previous sections, in biodiversity offsetting non-human nature is treated as a sum of habitats and species, extracted from their social-ecological context. Offsetting is, therefore, based on the presumption that place is extraneous. Geographies of carbon offsetting also create a 'constant dialectical tension' between international carbon 'markets' and local socionatural relations (Bumpus, 2011, 618). However, the localized specificity of biodiversity gives an additional place-bound dimension to the construction of the equivalence of place in biodiversity offsetting.

In biodiversity offsetting, the 'offsetability' of development impacts is mainly judged by the irreplaceability and the vulnerability of biodiversity (BBOP, 2012), meaning that numerical scores representing nature lost are higher for unique or rare nature, and lower for 'common' landscapes. Lower calculated biodiversity values can make green spaces and landscapes an easier target of development, despite their social and cultural importance, while potentially legitimize environmental destruction by portraying it as the driver of creating ecologically 'valuable' ecosystems[19]. Thus, for example, in North Tyneside (NE England), the biodiversity impacts of a housing development were framed in terms of a 'trade up', because the development site consisted of 'common' farmland and the offset site would be restored to lowland meadow (Apostolopoulou, manuscript; Environment Bank, 2014).

The above logic intensifies the division long established in conservation between 'common' and 'unique' nature ultimately denying social history to landscapes (Katz, 1998). The biodiversity of many ecosystems is associated with long-term human occupation and management (e.g. anthropogenic habitats such as limestone grassland or Ancient Woodland in the UK), and public understanding of nature can mean that areas of modest biodiversity, like open green spaces around

[19] Offsetting can also involve protected nature or ecosystems of high biodiversity value showing the ephemeral character of conservation under capitalism (see Apostolopoulou and Adams, 2015).

settlements, are strongly reclaimed by local residents because they offer important use values, like the enjoyment of fresh air and recreational space close to home. Biodiversity offsetting characteristically pays no attention to these claims as well as to serious livelihoods issues. Thus in the Akyem Gold Mining project in Ghana the authors of the BBOP report (Newmont Golden Ridge Limited, 2009, 12) despite the major social and economic impacts of offsetting argue that broader community impacts are distracting their analysis since they 'fall outside the sphere of biodiversity offsets'.

Framing the 'social' as irrelevant has been strongly attacked by critics of biodiversity offsetting (Sullivan and Hannis, 2015; Robertson, 2000). However, specific analyses of its class implications and the particular ways through which it reinforces a socially and geographically uneven production of nature are still scarce (for exceptions see Apostolopoulou and Adams, 2017b; Seagle, 2012; Ruhl and Salzman, 2006). Similarly, there has been limited attention to the fact that biodiversity offsetting is tightly interwoven with competition for (and speculation over) land. Critical literature, by underestimating the study of rent in biodiversity offsetting projects, has so far been unable to engage in a historical-geographical analysis that can account for the spatial organisation of capitalism and the various forms of social control it entails (Harvey, 2006). Land serves not only as a means of production but also as a 'foundation, as a place and space providing a basis of operations' and 'space is required as an element of all production and human activity', being a precondition of social reproduction (Marx, 1894, 774, 781).

In particular, biodiversity offsetting authorizes nature's radical 'rescripting' as *placeless,* obscuring the fact that it facilitates the production of space(s), place(s), and nature(s), according to the interests of developers. It is not therefore an 'asocial' policy that excludes from its calculations 'humans' in general; on the contrary, uneven development caused (or enabled) by biodiversity offsetting should be treated as the product of the unity of capital with nature rather than situated in the 'false ideological dualism of society and nature' (Smith, 2010, 50). Its impacts reflect the class character of land use change and the way landlords and the different sections of capital govern the uses of space and nature (Smith, 2010). This is exemplified by the fact that biodiversity offsetting has been so far used by the housing, mining and oil and gas industry as a way to legitimize and stabilize their development projects while at the same time furthering land dispossession and enclosure.

The increasing popularity of biodiversity offsetting after the 2008 financial crash has to be seen in the context of capital's need to constantly expand, a tendency that forces it to nestle, settle, and establish connections everywhere (Marx and Engels, 2002). Smith (2010, 116) described capital's attempt to 'emancipate itself from natural space only by producing certain absolute spaces of its own as part of the larger production of relative space' (see also Harvey, 2006). As a manifestation of an intensified social production of nature and space, biodiversity offsetting remakes places and further partitions land into legally distinct parcels in

both the development and offset sites. In the latter, this involves newly inscribed zones (places where nature is marked out only by its score against a metric), or zones subject to new management regimes (e.g. ecological restoration). In the development site, it involves the exploitation of land for various purposes. Not surprisingly, offsetting has been so far particularly attractive to public and private parties involved in major infrastructure and transport projects, such as highway construction, ports and airports expansion, and energy distribution systems (Bennett et al., 2017), to the housing industry (see e.g. Apostolopoulou and Adams, 2017b; Duke et al., 2012 for the UK), as well as, particularly in the developing world, to the mining industry (Seagle, 2012). Moreover and relatedly, the policy spread in a political and socio-economic context characterised by the increasing entrepreneurialization and urbanisation of rural places (Apostolopoulou and Adams, 2017b; see also Brenner and Schmid, 2015 on the social-environmental transformation of rural places due to extended urbanization) and by a widespread implementation of austerity policies. Indeed, the increase in the adoption of offsetting policies after the 2008 financial crash coincided with major public disinvestments, initiatives to further commodify and privatize non-human nature and deregulate environmental and planning policies, leading to the loss of ecosystems and remaining green spaces (Apostolopoulou et al., 2014; Apostolopoulou and Adams, 2015).

Crucially, by framing the development and offset sites as 'equivalent' and 'interchangeable', biodiversity offsetting implies that a *particular* place can be destroyed *here* as long as *another* place is protected in return *there*. This presumption testifies the policy's reactionary character and its disinterest in local traditions and meanings, the uneven socio-economic consequences of land use change, the cultural importance of place, social ties between communities and particular habitats, access to green space and the diversity of both natural and social relations that social space contains (Lefebvre, 1991, 77). This interchangeability and homogenization of places is common under capitalism and reflects, as Lefebvre (1970, 1991) has classically emphasized, its attempt to achieve growth by occupying and producing space. The result is that places are deprived of their specificity since the need for comparability leads to the 'triumph of homogeneity', and to space being 'produced and reproduced *as* reproducible' (Lefebvre, 1991, 337). Castells (1977) also referred in *The Urban Question* to the creation of a 'placeless planet' in the sense that in an era of globalization, geographical sameness is replacing geographical difference (see also Herrera et al. 2007, 279 on capitalism's 'banal placelessness'). In biodiversity offsetting, spatial interchangeability is achieved not only through economic development, but also through the associated conservation of offset sites by framing the latter as places that can be exchanged on the basis of differences defined in monetary terms. Through this process biodiversity is deprived from its place specificity (Hillman and Instone, 2010). Thus, for example, in the offsetting logic the construction of 5,000 houses on land where nightingales breed at Lodge Hill (Kent, England) was considered as possible to be offset by purchasing 2821.2 credits and creating

658.28 ha of habitat somewhere else (Environment Bank, 2012). To paraphrase Lefebvre (1991), biodiversity offsetting ultimately *produces and reproduces non-human nature as reproducible*. Behind this appearance lies the hard materiality of the fact that the land on which biodiversity depends cannot be produced, nor reproduced – thus defining the material limit of any representation of reproducibility.

Lefebvre (1991) argues that the capitalist production of space is driven by the contradiction between the increased differentiation of space and the equalizing tendency of capital, leading toward the emancipation from space. Similarly, the tendency towards a loss of geographical differentiation is accompanied by the production of new forms of socio-economic difference (Herrera et al., 2007; Lefebvre, 1991[20]) bringing unevenness and injustices. Biodiversity offsetting is particularly exposed to these contradictions by enabling an uneven distribution of ecological losses and gains and establishing new mechanisms of rent extraction. In the developed world, this may involve the destruction of green spaces for executive housing leading to an inequitable quality of life for local residents (as in Tyneside, NE England, see Apostolopoulou and Adams, 2017b; Apostolopoulou, manuscript), proposing to create offset sites where public access is restricted (as in Lodge Hill in SE England, see Bormpoudakis et al., manuscript) or unevenly distributing ecosystem resources according to differences in median income and minority populations (as in Florida, Ruhl and Salzman, 2006). In the developing world, it may even include the loss of homes, farms, archaeological and cultural sites (as in Ghana, Newmont Golden Ridge Limited, 2009) and the heavy restriction of local communities from the development and offset sites (as in Rio Tinto operations in Magadascar, Seagle, 2012).

Conclusions

Harvey (2014, 247) characterizes capitalism as 'a working and evolving ecological system' within which not only capital but also nature is 'constantly being produced and reproduced'. The way the capitalist mode of production profoundly changes non-human nature has been emphasized by Marxists since the 19th century (Marx and Engels, 1970; Marx, 1964; Engels, 1940). Biodiversity offsetting constitutes one of the latest manifestations of the capitalist production of nature. By seeking to measure, recreate, and replace living nature across space and time, it adds new dimensions to nature-society relationship, revolutionizing it once again. The policy clearly shows capitalism's attempt to 'bypass the very externality of nature' (Smith, 2006, 30) by manifesting an increasing social reproduction of nature which aims to attenuate the need for continued plunder of 'external' nature. Although this partly responds to pragmatic capitalist concerns to ensure that a decline in natural capital does not threaten development (Bishop, 2012) by keeping

[20] As Smith (2010, 126) argues even though this is an original idea of Lefebvre, one can detect its embryos in the work of Marx, Luxembourg and Lenin.

the 'stock' of biodiversity constant, its success (even in those highly reductionist terms) is highly contestable (Curran et al., 2013). As we argue elsewhere (Apostolopoulou and Adams, 2015) capitalism's main environmental contradiction lies in the need to combine nature's preservation for future capital accumulation with the exploitation needed to support current accumulation. Biodiversity offsetting is particularly exposed not only to this contradiction but also to capitalism's dissonant geographical practices: it does not claim to halt biodiversity loss but to achieve an 'efficient' overall quantitative balance between preserved nature and permitted development by allocating and re-allocating land, invoking an image of the Earth 'as a virtual ledger' (Igoe et al., 2010). The net effect is at best zero: following Smith (2006, 23), in taking a wider geographical perspective on such policies, 'the bourgeoisie has no solution to the environmental problem, they simply move it around'.

As we have tried to show in this paper the production of 'equivalent' natures lies at the core of biodiversity offsetting and has profound implications for the involved socionatures. Representing nature through interchangeable equivalences violates the diversity of unique, not producible and incommensurable use values offered by nature through the quantification exercise behind equivalence. At the end of this process we are left with a 'biodiversity unit' whose use value is not apparent – and perhaps will never be. This distinguishes biodiversity offsetting units from the commodity form, whose use value is usually immediately apparent. Because of this absence, the defence of biodiversity offsetting as a viable 'market tool' has been requiring extraordinary ideological efforts on the part of its proponents revealing that this quantification, contrarily to many others operated by capitalism, is not self-evident.

Furthermore, biodiversity offsetting has been largely introduced to facilitate economic development in a wider context of extended urbanization and to legitimize environmental destruction by portraying the whole process as capable to achieve a NNL of biodiversity (Apostolopoulou and Adams, 2017b). The policy frames the debate over the environmental impacts of development as a technical issue of allocating 'natural capital', or the 'stock' of biodiversity resources, across space and time which has no social implications (Apostolopoulou and Adams, 2017c). It thus parodies nature-society unity, at once trivializing the relationship and concealing its perversion by capitalism (see Katz and Kirby, 1991); it aims to define nature as separated from society only to impose a particular vision of what nature is, how ecosystems should be managed and who owes to have an opinion on those choices. Adopting a Marxist analysis can reveal biodiversity offsetting's role in the production of nature and place under capitalism and its class dimensions. Biodiversity offsetting re-inscripts everyday lives by redefining places as the arbitrary result of urbanization, economic development and financial speculation serving the interests of industries and landowners. The whole process carries within it the leveling of place and ignores the 'situated identity' of different people and social groups (Harvey, 2001). More importantly, under the surface of equivalence,

uneven outcomes are created socially, spatially and temporally. The land use implications of biodiversity offsetting programmes are often exclusionary; new enclosures and territorializations can occur to control land by ruling out alternative land uses. The role of the state here is central (Apostolopoulou and Adams, 2017b) because biodiversity offsetting programmes are usually controlled by state agencies and their implementation can lead to land dispossession (a so far under-researched aspect of offsetting that is fundamental to class analysis) even in the absence of private interests triggering waves of land speculation. Not surprisingly, social struggles over land rights and the use of and access to space and nature lie at the core of biodiversity offsetting. Individuals and social groups possess a distinctive 'geographical praxis' (Harvey, 2001, 296), whose social transmission is an object of political and social struggle and local places worldwide are already the locus of resistance against the destruction of their areas to favor the plans of big industries[21].

The specific role of the policy to capital accumulation is, however, far more complex than the existing critical literature has often implied. Analyzing the historical specific social and economic relations driving biodiversity offsetting is necessary for understanding that even though it may entrench a utilitarian and fetishistic disposition towards nature, it cannot be a priori considered as supporting capital accumulation (see also Heynen et al., 2007, 11-12). In particular, a nuanced understanding of biodiversity offsetting requires consideration of its breadth of implementation: offsetting can be delivered on an individual project basis, or in conjunction with banking, and may (or may not) require human labor. It may involve the destruction of either private or public land, and be carried out by the private sector, NGOs or municipalities. The owner of an offset may be different from the agent who actually supplies it. In the developing world, biodiversity offsetting can involve the forced resettlement of the rural working poor, often with the exploitation of their labor power, thus reproducing pre-existing patterns of uneven and combined development. Biodiversity offsetting can be interwoven with competition for land and space, and promote the privatization of nature in various ways (e.g. in habitat banking, credits owners may include NGOs buying land of conservation value).

The crucial aspect here is that further research is needed to differentiate between these cases and analyse the specific interests that benefit and the way value creation and rent extraction works in each case. The latter is necessary for understanding how productive, financial and rentier capital combine (Castree and Henderson, 2014) and it demands an explicit engagement with the Marxian theory of value and rent. Leaving unaddressed or bypassing key questions – such as what is value, what is its origin and how is it distributed in society? – results in an implicit (and most likely unwitting) compliance with the superimposition of what

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[21] See e.g. https://ecologicalequity.wordpress.com/themes/stories-of-right-stories-of-might/akyim-community-in-ghana-protests-against-newmont/; http://old.fern.org/naturenot4sale

capital sees as value. As Harvey (2006, 15) explains, the Marxian theory of value extends beyond addressing the problem of defining a standard of value for determining commodities relative prices; it approaches value 'as a social relation and not as simply created by capitalism'. This has important implications. In particular, if we accept –as a significant part of the critical literature on biodiversity offsetting does- that value is produced simply through the act of measuring nature then we accept that capitalism can create value from nothing. This not only ignores the pivotal role of human labor (and consequently of workers) in the creation of value but also severely underestimates capitalism's accumulation crisis tendencies. Moreover and relatedly, ignoring the fact that in most cases biodiversity offsets are an instance of rent prevents understanding new forms of socio-ecological struggles and their varied relations to the state. Indeed, reinserting the theory of rent in political ecology can provide a sharp conceptual tool for understanding intra- and inter-class struggles and for situating various socio-ecological conflicts and movements as class struggles over value appropriation and distribution (see Andreucci et al, 2017).

Importantly, beyond the discussion on value and rent, it is crucial to emphasize that, against the hegemonic policy discourse on nature valuation, price can never be an adequate measure of nature's wealth. Whether offset sites are commodities or commodity forms they nonetheless manifest a treatment of nature as a sum of alienable objects (Harvey, 2006). As Marx, following Aristotle, argued, money is a radical lever, the great leveler of all things. Representing biodiversity units as exchange values means representing them as merely different *quantities* and consequently as if they do not contain an atom of use value (Marx, 1887). To follow Burkett (2003, 160), there can be no reconciliation between use values found in nature -with their 'qualitative variegation, interconnection, locational uniqueness, and quantitative limits' and money - the symbol of universal equivalents established by value - which is, by contrast, 'homogeneous, divisible, mobile, and quantitatively unlimited'. The contradiction between use-value and exchange-value holds a central position in Marx's (1887) value analysis (Harvey, 2014) and is a key component of a critical stance against environmental economics approaches arguing that putting a price on nature will capture its 'economic value' (e.g. Costanza et al., 2014). It has to be noted that the latter is deeply problematic also because it implies that correcting exchange values (which according to mainstream economics do not currently take nature into account) will end nature's exploitation. This roots value in consumption/exchange and shifts the discussion on issues like subjective consumers preferences. Following Huber (2017) we argue that rooting value in production (and not in exchange) yields far more radical political questions allowing us to imagine alternative forms of production, oriented toward social and ecological needs.

The above observation brings us to the last crucial point about the ideological role of biodiversity offsets as valuation tools. Critical analysis so far has tried to underline the 'overflows' of (capitalist) metrics, strong of the

disagreements among natural scientists on the scientific aspects of the quantification of biodiversity and the forms of resistance (of 'use values' against value) in the form of 'value struggles' (e.g. Sullivan and Hannis, 2015). By doing so, the ideological role of this valuation tool is discounted. As we showed in this paper, biodiversity offsetting aims at changing the common sense (in Gramscian terms) of what biophysical interactions are and how they work historically. Its underlying ideology is neoliberalism – a particular variant of economic thinking which extends the econometric principles of measurability and efficiency-maximising behaviors to previously untouched domains, as reflected by the colonization of social (Fine and Milonakis, 2009) and increasingly natural sciences (in our case ecology and conservation science) by economics. Though largely the preserve of specialists and confined to experts' meetings, the debate on the valuation of nature has nonetheless deeper implications for society's shared sense of what biophysical reality is, how it changes, and what the alternative options for change could potentially be.

Overall, biodiversity offsetting constitutes a deeply contradictory and reactionary public policy which tries to respond to the increasing environmental contradictions of capitalism by effectively creating separate areas for development and conservation, deepening uneven development and the conceptual and material alienation[22] between society and nature. Offsetting renders the discussion on the environmental impacts of development a narrow, technical discussion focused on the calculation of nature lost in terms of biodiversity 'units' and 'credits' ignoring dimensions of place and space eventually separating the practice of conservation from struggles by environmental and social movements (Apostolopoulou and Adams, 2017a, b, c). Its dystopian vision for the future makes it an important focus for all critical scholars whose research is positioned within the broadly defined interdisciplinary research field of nature-society relationship. To combat its logic,

[22] The concept of alienation (Entfremdung) is dominant in the classic German philosophy (e.g. in Hegel). For Marx human alienation from nature is intrinsic to value's formal abstraction from use value (Burkett, 1999) and is related to alienation of labor while both concepts are grounded in Marx's understanding of the capitalist mode of production (Foster, 2000; Marx, 1964).

however, it is necessary to actively 'engage in the political battle over the re-enchantment of nature' (Smith, 1998, 279) along with activists and social movements that try to articulate alternative futures to neoliberalism. The debate on the valuation of nature is often dismissed by radical movements and typically embraced by large transnational environmental NGOs, who often provide consultancies and technical expertise to implement offsetting programmes, alongside conservative academics. This battle has thus a double front as it entails a systematic demystification of biodiversity offsetting as orthodox 'science' within neoliberal academia; and a wider political commitment towards a radically different production of nature based on societal needs.

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