7 Creating conservation values under DEFRA's biodiversity offsetting pilot and the pragmatics of using a calculative device

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Introduction

In recent years, the mitigation practice of biodiversity offsetting (BDO) has proliferated globally as a means of securing biodiversity compensation from impacts associated with infrastructure development (for reviews see Quintero and Mathur 2011; Benabou 2014). BDO seeks to secure the 'no net loss' and preferably a 'net gain' of biodiversity through the application of valuation technologies. Such technologies (that here, after Callon and Muniesa 2005, are labelled 'calculative devices') measure biodiversity values at sites of *development impact*, to secure compensation through equivalent or additional biodiversity values at sites of conservation *investment*. BDO is distinguished from other types of ecological compensation in English planning by taking a position that gains are measurable via metrics and proxy scores sustained over specific time periods (DEFRA 2013). The UK pioneered this approach in England in 2011, and conducted a pilot study between 2012 and 2014 to test it out with six local planning authorities across the country (DEFRA 2011b).

Preceded by wetland mitigation banking and species banking in the United States from the 1970s and 1990s respectively (Fox and Nino-Murcia 2005; Carroll et al. 2008; Robertson and Hayden 2008; Pawliczek and Sullivan 2011), BDO in England is embedded in a wider discourse concerned with revealing and 'securing the value' of biodiversity and ecosystems (DEFRA 2011a; TEEB 2010; Helm 2014, 2015). Indeed, the UK government initiated its BDO pilot study as part of this broader effort and specifically in relation to rethinking conservation policy in terms of its contribution to growing the 'green economy' (DEFRA 2011a). In DEFRA's 2011 Natural Environment White Paper announcing the BDO pilot, the Secretary of State at the time captured this sentiment thus:

> government and society need to account better for the value of nature, particularly the services and resources it provides… Valuing nature properly holds the key to a green and growing economy, one which invests in nature – not just for us but for our children's children.
>
> (Rt. Hon. Caroline Spelman MP, DEFRA 2011a, 2)

This agenda and its call to 'account better for the value of nature' implies that the ('green') economic values of biodiversity have been present all along, waiting to be recognised, accounted for and captured so as to ensure green economic growth. The interpretive starting point for this chapter instead takes valuation to be a social practice through which economic values are fabricated via the consolidation of discursive, calculative and institutionalised practices (Helgesson and Muniesa 2013; Sullivan 2017, forthcoming). As such we are concerned with processes of economic performativity that contribute to and format the reality they describe, rather than simply discovering it (Callon 1998). Economic performativity occurs through active practices of economisation and marketisation, through which behaviours, institutions and devices actively work to qualify and constitute things as 'economic' that previously have been located beyond (or 'external to') economised and marketised values (Çalişkan and Callon 2009, 2010). In this chapter we are interested in the ways in which economic qualifications can transform entities (biodiversity habitats) into market goods through application of calculative devices that facilitate 'the delimitation of the boundary between goods included in the space of market calculation and those that [are] excluded, (Callon and Muniesa 2005, 14; also Muniesa et al. 2007).

Consequently, the focus of this chapter is the 'DEFRA biodiversity offsetting metric' as a calculative device (see especially DEFRA 2012a), which in application enacts biodiversity values as numerical surrogates that produce a new entity called a 'biodiversity unit'. The biodiversity unit forms the currency of BDO as an emerging market instrument in biodiversity conservation and thereby permits the potential trade of biodiversity 'value' between developers and offset providers. As well as producing these economic values, we argue that the calculative device exemplifies practices of commensuration defined as 'the transformation of different qualities into a common metric' (Espeland and Stevens 1998, 2), and in so doing is a marketisation process involving the creation of tradable entities.

BDO is a relatively new conservation technology whose recency in application means that detailed case histories of offset implementation and actual (as opposed to projected) conservation outcomes remain limited. To support debate regarding the conservation effectiveness of BDO more generally, case study detail is important in understanding particularly how the calculative devices designed for BDO are deployed in practice. In particular, our empirical engagements trace the processes of economic value-making in conservation policy and practice and illustrate how conflicts and tensions identified within environmental markets more generally (Salzman and Ruhl 2000) are resolved by actors *in situ*.

This chapter reviews existing studies of BDO, focusing on the development and application of metrics that create seemingly comparable measures of biodiversity to demonstrate measurable gains – or 'yields' in biodiversity unit value. The BDO pilot established by DEFRA between 2012 and 2014 is then introduced and one of its key elements – namely testing through application, the calculative device of BDO technical metric – is described in detail. Findings from a 24-month field research engagement in BDO in England are then presented, to document the unfolding of a specific BDO offsets contract (also see Carver and Sullivan 2017), set within a broader dataset focusing on six DEFRA BDO pilot sites in England (Carver 2017).

We close by assessing the proposal that application of the DEFRA technical metric is able to standardise assessments of biodiversity value so as to offer robust numerical foundations on which to base planning in calculating biodiversity value for development and offset sites in England. Given that economisation is a social process, it is also therefore a political one. We illustrate through our case study that, as predicted in theory (cf. Walker et al. 2009), conservation policy decisions based on valuation and calculative (market) devices conceal and obfuscate the political character of such valuations. We argue that the calculations within biodiversity offsetting in England thus tend to reflect prior configurations of power and existing political priorities for economic over ecological values. This chapter presents an example of how a conservation 'valuation' approach is mobilised in practice. Insights gained and implications highlighted bear relevance for how similar value-based approaches or economistic methodologies may play out in other public policy fields, such as those under consideration in this volume.

Shaping the calculation of 'biodiversity yield'

BDO policy and best practice guidelines (e.g. BBOP 2009, 2012; DEFRA 2012a, 2012b, 2012c, 2012d, 2013; Gardner et al. 2013) are intended to support biodiversity conservation outcomes by providing methodologies for the technical calculation (i.e. quantification) of biodiversity values. These methodologies aim for the determination of losses and gains at different physical sites and temporal moments in a manner that is commensurable, and that thereby creates the possibility of 'offset' compensation for ecological damage caused by site-specific economic development. BDOs inevitably fall across two separate geographic sites. They propose that quantitative biodiversity gains are reflected as units or credits from a baseline over time at a 'receptor' or offset site, in compensation for biodiversity unit losses at a development site. These are additional to a projected 'counterfactual' scenario in the absence of compensation (Bull et al. 2014). Replicating the wording of a respondent in our research (see below) we use the term 'biodiversity yield' to describe these projected gains in biodiversity values, calculated according to the balance of 'biodiversity units' attained through application of a calculative device.

A variety of metrological approaches exist for calculating and creating equivalence between biodiversity losses and gains at different sites and temporal moments. In application, these are normally linked with use of a standardised reference system for the classification of habitats and/or land cover (Quintero and Mathur 2011, 1122). In England, as further discussed below, the basis for such calculations is the BDO metric developed by DEFRA (2012a), referred to in practice as the Biodiversity Impact Assessment or BIA.

As Habib et al. (2013, 1313–1314) state, '[e]xchanging dissimilar biodiversity elements requires assessment via a generalised metric' and substitution of biodiversity elements through an appropriately fungible currency, or system of credits. A stated aim of BDO is thus the standardisation of state and private sector biodiversity auditing methodologies so as to improve and stabilise approaches considered ad hoc in practice (Gardner et al. 2013, 1254). At the same time, as detailed in this chapter, it is noticeable that the metric as a standardising assessment technique and calculative device in application is being adjusted in creative and diverse ways, such that direct comparisons of offset quality between contexts become difficult. This observation also holds for assessment devices in carbon accounting (see Lohmann 2009; and Lippert 2014, 39). Indicative tensions between ease of compliance for development interests and robustness of conservation gain in terms of measurable biodiversity yield (Maron et al. 2012) again make empirical studies of BDO in application relevant. In particular, such studies can enhance understanding of how these tensions are worked out in practice, given the metrological and policy tools at hand.

The DEFRA BDO metric is adapted from one developed in State of Victoria offsetting programmes in Australia. This quantifies biodiversity values for 'habitat hectares' (Parkes et al. 2003) and is used for calculating and making commensurable losses and gains of biodiversity in development and potential offset sites (DEFRA 2012a; see review in Sullivan 2013). In applying the metric, development sites are first 'mapped and divided into habitat parcels' (DEFRA 2012a, 7) and then classified according to the habitat designations of the Joint Nature Conservation Committee, a public body that advises the UK central and devolved governments on nature conservation.[1] The classification of habitats is made according to three attributes characterising the habitat hectare methodology. These attributes are *spatial area, habitat distinctiveness* and *condition* (DEFRA 2012a). DEFRA provides a gridded matrix for the last two attributes so as to allocate spatial units of mapped habitats to one of three banded scores (Table 7.1). The official BDO scoping report forming the basis of this technical guidance by Treweek et al. (2009, 118) recognised that 'a larger matrix might give a closer fit to reality but would be less straightforward to apply in practice'. Indeed, the BDO metric agreed by DEFRA was itself reduced in complexity from the four habitat condition bands originally proposed (in GHK and eftec 2011, 16) to three in the device proposed by DEFRA (Sullivan 2013, 85). By scoring habitats in this way, the metric quantitatively aligns a score for the qualities of a habitat's ecological distinctiveness with a score for its condition. Through this mechanism, a value for a hectare of biodiversity habitat is generated as a numerical surrogate with a score of between 2 and 18.

Table 7.1 Habitat scoring system for biodiversity offsetting in England

		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

Source: DEFRA (2012a, 7).

Biodiversity offsetting in England

Together with the United States, Australia, South Africa and Germany, England is considered to be at the forefront of developing BDO. BDO in England has been enthusiastically endorsed at ministerial level (DEFRA 2013), as well as in a number of recent environmental policy documents and reports (Lawton et al. 2010; DEFRA 2011a, 2013; DCLG 2012). DEFRA set up a BDO pilot that ran for two years from April 2012 to April 2014 and involved six local planning authorities (Devon; Doncaster; Essex; Greater Norwich; Nottinghamshire; and Coventry, Warwickshire and Solihull), as well as various private sector organisations (DEFRA 2011b; for discussion see Hannis and Sullivan 2012; Sullivan 2013; Carver 2015; Apostolopoulou and Adams 2015; Sullivan and Hannis 2015; Ferreira 2017).

Although it had been under discussion prior to 2010 (Treweek et al. 2009), BDO came to fruition under the new UK coalition government which formed in May that year. The Conservative-led coalition government came to power amid a spate of environmental commitments, declaring theirs would be the 'greenest government ever'.[2] The moment was animated by a convergence of factors that produced a wider 'green' political economy discourse shaping the context in which BDO was initially justified (see, for example, Wilshusen and MacDonald 2017). These conditions included the stabilising of a consensus over ecosystem service and biodiversity valuation as the basis for environmental markets to stimulate innovative sources of funding for conservation under a pronounced climate of economic austerity (Comerford et al. 2010; TEEB 2010). In addition to this alignment, a discursive turn towards marrying economic and ecological goals through the 'green economy' dovetailed with a powerful agenda for economic 'recovery' reflected through extensive business de-regulation. One of the hallmarks of this de-regulation was the introduction of a 'one-in two-out rule' which stated that '[w]hen policymakers do need to introduce a new regulation, and where there is a cost to complying with that regulation, they have to remove or modify an existing regulation with double the cost to business'.[3] Under this rule the UK government sought to reduce the cost of regulation to businesses. At the same time as the Department for Communities and Local Government (DCLG) was reforming planning policy through the publication of the National Planning Policy Framework (NPPF) (DCLG 2012), DEFRA announced its intention to trial

BDO with a pilot study in line with this agenda. Among various other modifications, the NPPF included an ideological commitment to a 'presumption in favour of sustainable development' and introduced the concept of a 'no net loss' of biodiversity to planning policy (DCLG 2012) to be managed through application of BDO. Overall then, BDO guidelines were intended to reduce regulatory cost to developers whilst simultaneously conserving biodiversity.

Calculating biodiversity value in practice

We present empirical observations of the actual conducting of biodiversity calculations and valuations for a case study of BDO, as this unfolded in the context of DEFRA's two-year (2012–2014) pilot study. Field research proceeded in three phases and was based on participant observations and semi-structured interviews with 30 key actors through repeat site visits to DEFRA pilot and voluntary offset sites (described in full in Carver and Sullivan 2017; Carver 2017). Textual analysis of 50 semi-structured interview transcripts, secondary public domain and unpublished documents, field-work journals and case study narratives, has been conducted using Dedoose, a cloud-based qualitative data analysis software program. Deductive and inductive coding of text excerpts enabled the emergence of overarching themes and concepts to form the basis of analysis (see, for example, Sullivan and Hannis 2015). Interviewees were grouped into stakeholder categories and subcategories (see Table 7.2). In referring to interview transcripts below, stakeholder categories for the DEFRA pilot sites (as a sample of the six local planning authorities [LPA] that took part in the pilot), are labelled 1–5. The complementary voluntary pilot offsetting site is denoted by a *comp* prefix. Respondent codes are denoted according to the following sequence: stakeholder category, followed by site number, the individual within that site, and date of interview (e.g. LPA2.3 130515 denotes the third individual interviewed within the LPA stakeholder category at pilot site 2, on 13 May 2015).

Below we detail the process of making biodiversity calculations to negotiate biodiversity values in terms of losses, gains (or 'yields'), and prices for

Table 7.2 Categories and subcategories (abbreviations in parentheses) of stakeholders interviewed relative to biodiversity offsetting in England

Category	*Subcategory*
Government:	1. local planning authority (LPA)
	2. Natural England (NE)
Private sector:	3. developer (DEV)
	4. consultant ecologist (CE)
	5. planning consultant (PC)
Civil society:	7. conservation and wildlife NGO (NGO)
	8. local resident (LR)
	9. landowning offset provider (OP)

different nodes of the offset agreement for a particular offset contract – as these were negotiated over 32 months between March 2013 and December 2015. We draw on multiple sources of data acquired through participant observations, semi-structured interviews and analysis of planning documents (described fully in Carver and Sullivan 2017) to document negotiated outcomes for the development site, and to present in detail the metric calculations in the BIA applied to the development and offset sites in this case. As discussed below, the different iterations of the BIA have implications for the scored values arising through its application, independently of the biophysical dimensions of the habitats being assessed.

The development site subject to biodiversity calculations

The case study followed a planning application in England for the delivery of 200 residential properties along with a new sports stadium, and a range of playing fields across 13 ha of mostly agricultural fields (for maps see Figure 1 in Carver and Sullivan 2017). Under the guidance of the DEFRA BDO pilot, and with the assistance of a private offsetting brokerage firm, the development became subject to BDO compensation payments in line with the calculated value of affected biodiversity at the development site. The baseline habitats of the development site consist largely of amenity and improved grasslands, hedgerows, scattered tall ruderal vegetation and four ponds, one with great crested newts (*Triturus cristatus)* which are protected under the UK's Conservation of Habitats and Species Regulations 2010. The site forms the south-western fringe of a small medieval market town. It is bordered to the north by an industrial and residential development, and to the west and east by roads with open countryside beyond. The planning application was submitted in March 2013 by the existing owners, the local football and bowls club, in conjunction with a large residential developer who would oversee the bulk of the planning process and through whom the residential properties would be built, marketed and sold. Under new requirements shaped by the DEFRA BDO pilot study, the local planning authority asked the developer to apply the DEFRA metric, in the form of a BIA, to guide the biodiversity mitigation and compensation measures required to offset the development.

The BIA in practice

In the case explored here, the developers' consultant ecologists completed primary habitat surveys in addition to using existing records derived from earlier surveys of the site as the basis for an Ecological Impact Assessment (EIA) report for the planning application. Subsequently, as a desk-based exercise and to establish the site's biodiversity unit baseline and mitigation values in a format required for BDO under the DEFRA pilot, the contents of the EIA were translated into the BIA by a LPA ecologist and the offset broker assisting the LPA with the contract. As the calculative device, the

BIA computed the ecological condition and proposed mitigation works at the development site. This process entailed re-codifying the existing habitats into an Excel spreadsheet supplied by the County Council planning authority ecologist acting as the DEFRA pilot site lead. The BIA spreadsheet operationalises the DEFRA BDO metric to arrive at biodiversity unit scores for each bounded habitat type on the development site.

In order to arrive at these scores the development site was first categorised by the LPA ecologist into habitat types entered on separate rows of the BIA spreadsheet, each with a code, description, size in hectares, and numerical scores for habitat distinctiveness and condition (Table 7.3 shows the first BIA draft on 27 June 2013, prior to re-negotiation). The spreadsheet enables three sets of calculation. The first (Table 7.3, rows 15–28) generates a 'Habitat Impact Score' (HIS) for the total scored habitat on site prior to the development, in this case 46.68 biodiversity units (cell O53).

The second step shown in Table 7.3 (rows 56–89) calculated the 'Habitat Mitigation Score' (HMS) as the total number of biodiversity units that will be restored or created on-site so as to 'mitigate' or minimise projected biodiversity losses, in this case 16.78 units (Cell O89). In this case, a notable feature of the HMS is that almost 40 per cent of the on-site mitigation work was to be delivered through creation of a number of football pitches of varying sizes. The presence of these football pitches was calculated as contributing significant amounts of on-site biodiversity unit value and the largest habitat spatial value of all mitigation activities. This mitigation value was to be achieved by attributing biodiversity value to the amenity grassland of the pitches themselves (cell O63), through permitting the perimeter surface area of their proposed grassy margins to grow un-mowed and develop into semi-improved grassland (cell O70). Although receiving low habitat scores for both distinctiveness (2) and habitat condition (1), the size of the football pitches amenity grassland meant that in five years this aggregate *spatial* area was calculated to contribute 4.07 units. After 15 years the grassy margins would contribute a further 2.29 units. The football pitches therefore would make up 6.36 units of biodiversity value out of 16.78 units of total on-site mitigation and habitat creation (Figure 7.1).

In the third step, and through comparing the scores from steps 1 and 2 above, the residual biodiversity 'net loss' was calculated. This value indicates how many units would be required for mitigation purposes via an offset where additional biodiversity conservation value is purchased. This 'net' loss or gain value is the Habitat Biodiversity Impact Score (HBIS), and is generated through the equation:

$$\text{Habitat Mitigation Score (HMS)} - \text{Habitat Impact Score (HIS)}$$
$$= \text{Habitat Biodiversity Impact Score (HBIS)}$$

In this case the HBIS is calculated as an overall loss of 31.90 biodiversity units (Table 7.3 cell O91). It is this calculated biodiversity value that requires an off-site offset to satisfy planning requirements for mitigation of development impacts on biodiversity.

Table 7.3 Spreadsheet (version17.4, draft 1) used in biodiversity impact assessments to calculate the residual losses of biodiversity from development impacts[a]

A[a]	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*
11														
12		*Existing habitats on site*			*Habitat distinctiveness*		*Habitat condition*		*Habitats to be retained with no change within development*		*Habitats to be retained and restored within development*		*Habitats to be lost within development*	
13	*T.note*[b]	*habitat code*	*phase 1 habitat description*	*habitat area (ha)*	*Distinctiveness*	*score*	*condition*	*score*	*area (ha)*	*existing value*	*area (ha)*	*existing value*	*area (ha)*	*existing value*
14			direct impacts and retained habitats			A		B	C	A × B × C = D		A × B × E = F		A × B × G = H
15	F1	B4	grassland: improved grassland	1.78	low	2	moderate	2					1.78	7.12
16	P1	G1	wetland: standing water	0.01	high	6	good	3					0.01	0.14
17	P1	B4	grassland: improved grassland	3.10	low	2	moderate	2					3.10	12.40
18	F2	C31	grassland: amenity grassland	0.18	low	2	moderate	2					0.18	0.70
19	Bowling green	J12	grassland: amenity grassland	0.12	low	2	poor	1					0.12	0.24
20	F6	J12	grassland: amenity grassland	0.97	low	2	poor	1					0.97	1.94
21	West of football grid	B4	grassland: improved grassland	0.08	low	2	good	3					*0.08*	*0.48*

25		*n/a*	*built environment: buildings/ hardstanding*	*0.32*	*none*	*0*	*poor*	*1*						0.32	0.00	
26	F3	B4	grassland: improved grassland	4.88	low	2	moderate	2						4.88	19.52	
27	Slurry pit	G1	wetland: standing water	0.01	high	6	poor	1						0.01	0.05	
28	Part of F4 and F5	B4	grassland: improved grassland	1.52	low	2	moderate	2						1.52	6.08	
45	Total			12.96					Total	0.00	0.00	0.00	0.00	12.96	48.68	
46															ΣD+ΣF+ΣH	
47													site habitat biodiversity value		46.68	J
48	Indirect impacts, including offsite habitats			K					value of loss from indirect impacts[c]							
49	Before or after impact								K × A × B = Li, Lii	Li- Lii						
50	Before															
51	After															
52	Total			0.00					M		0.00					
53															HIS = J + M	
54													habitat impact score (HIS)		46.68	

54 Caution: Destruction of habitats of high distinctiveness, e.g. lowland meadow or ancient woodland, may be against local policy. Has the mitigation hierarchy been followed, can impact to these habitats be avoided? Any unavoidable loss of habitats of high distinctiveness must be replaced like for like.

55

(*Continued*)

A[a]	B	C	D	E	F	G	H	I	J	K	L	M	N	O
56			*Proposed habitats on site (onsite mitigation)*		*Target habitat distinctiveness*		*Target habitat condition*			*Time till target condition*		*Difficulty of creation or restoration*		*Habitat biodiversity value*
57			*phase 1 habitat description*	*Habitat area (ha)*	*distinctiveness*	*score*	*condition*	*score*		*time*	*score*	*difficulty*	*score*	
58			habitat creation	N	O		P				Q		R	(N × O × P)/Q/R
59	F1 & F6	n/a	Built environment: buildings orhardstanding	2.27	none	0	poor	1		5 years	1.2	low	1	0.00
60	F1 & F6	n/a	built environment garden (lawn and planting)	0.76	low	2	poor	1		5 years	1.2	low	1	1.27
60	F1 & F6	n/a	built environment garden (lawn and planting)	0.76	low	2	poor	1		5 years	1.2	low	1	1.27
61	F2, F3, F4	n/a	built environment: buildings or hardstanding	4.02	none	0	poor	1		5 years	1.2	low	1	0.00
62	F2, F3, F4	n/a	built environment: gardens (lawn and planting)	1.34	low	2	poor	1		5 years	1.2	low	1	2.23
63		J12	grassland: amenity grassland	2.44	low	2	poor	1		5 years	1.2	low	1	4.07
64	Area 4	B22	grassland: semi-improved neutral grassland	0.76	medium	4	good	3		15 years	1.7	medium	1.5	3.58
65	Area 3	G1	wetland: standing water	0.13	high	6	good	3		15 years	1.7	medium	1.5	0.92

66	*Area 1*	*B22*	*grassland: semi-improved neutral grassland*	*0.16*	*medium*	*4*	*good*	*3*		*15 years*	*1.7*	*medium*	*1.5*	*0.75*
67		G1	wetland: standing water	0.05	high	6	good	3		15 years	1.7	medium	1.5	0.35
68	Landscape	A112	woodland: broadleaved plantation	0.16	medium	4	good	3		32+ years	3	medium	1.5	0.43
69	Area 2	B22	grassland: semi-improved neutral grassland	0.19	medium	4	good	3		15 years	1.7	medium	1.5	0.89
70		B22	grassland: semi-improved neutral grassland	0.73	medium	4	moderate	2		15 years	1.7	medium	1.5	2.29
71	Total			13.01	ERROR: total area of habitats created must equal total area of habitats lost									
72	Habitat restoration								existing value S (=F)					((N × O × P) – S)/Q/R
88			Total							trading down correction value				0.00
89										habitat mitigation score (HMS)				16.78
90														HBIS–HMS = HIS
91										habitat biodiversity impact score				–31.90
92										percentage of biodiversity impact loss				65.53

Notes

[a] Numbers across rows 15–28 are multiplied to produce the habitat biodiversity value for each coded area subject to development. Numbers are rounded to 2 decimal places and, as such, if calculated manually here may produce different results. The sum of the values in column O for rows 15–28 (shown in cell O53) is the biodiversity baseline of the habitat impact score (HIS). In rows 59–70 numbers across rows are multiplied to produce the habitat-mitigation score (HMS) (cell O89), which is the value of habitats that will be restored or created onsite so as to mitigate or minimise projected biodiversity losses.

[b] T note refers to the 'target' area as habitat parcels subject to impacts coded on the development maps.

[c] Left empty on original BIA.

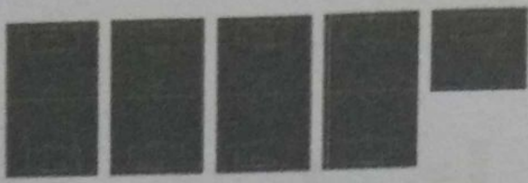
	Development Site	Offset Site
Full size football pitches (number)		 (Area of land equivalent in size)
Size (ha)	2.97	0.66
Habitat type (qualitative category)	Amenity grassland	Species-rich semi-improved grassland developed into a lowland meadow
Biodiversity units	4.07	5.6

Figure 7.1 One football field with many 'fields' of value

The offset site

Established conservation NGOs and Wildlife Trusts are often preferred partners in delivering compensatory conservation to mitigate the development impacts. These organisations are typically perceived to possess the right 'experience and expertise to ensure delivery' (LPA2.1 020714), as well as being familiar and experienced with this type of contracted management for habitat creation. In this case, the offset site identified by the council for the supply of scored offset units comparable to the HBIS score above was a 5 ha grassland meadow 5 km north-east of the development acquired by a local wildlife and conservation NGO in 2013. The site consists of a meadow of species-rich, semi-improved grassland in close proximity to a local Site of Special Scientific Interest (SSSI). The site currently supports five species of orchid including the largest population of greater butterfly orchid (*Plantanthera chlorantha*) in the county. It also contains four of the county's six rare farmland butterflies, three of which (the grizzled skipper [*Pyrgus malvae*], the dingy skipper [*Erynnis tages*] and the white-letter hairstreak [*Satyrium w-album*]) are nationally designated as biodiversity priority species under the UK Biodiversity Action Plan 2007.

Despite demonstrating excellent ecological enhancement potential, limited funding meant that little management input was envisaged by the NGO at the time of acquisition of the site (NGO5.1 241114). A BIA was applied for the offset site to calculate its baseline and projected biodiversity values in a parallel way to the development site above. This BIA is not reproduced here but indicates that the NGO had intended to bring the grassland into a moderate condition and 'return' the site to a fully favourable species-rich lowland meadow condition of national importance with the offset payments from the developer. These improvements would thereby demonstrate conservation additionality against a projected counterfactual scenario (NGO5.1 Offset Site Draft Management Plan November 2013). In this case it was hoped that, with appropriate interventions, two other rare farmland butterflies, also designated nationally as biodiversity priority species, would establish colonies on the site (NGO 5.1 Offset Site Draft Management Plan November 2013).

In order to achieve this conservation additionality, the predicted biodiversity gain or 'yield' was quantified and costed according to a management plan for the works to be supplied by the offset provider. The BDO Draft Management Plan, written by the NGO conservation officer, estimates costs based on the combined workforce of NGO volunteers, conservation staff and external contractors, materials and capital or lease payments for the land itself (NGO5.2 280115). In this case, the predicted budget for 30 years' management at the offset site put the total figure of habitat work costs at £204,076, of which £98,030 was planned to come from the conservation NGO budget, and £106,046 from the biodiversity offset payment made by the developers (NGO5.1 Offset Site Draft Management Plan November 2013). The developer would pay a further 20 per cent in broker fees (OB5.1 241114), plus legal fees for arranging the contracts between parties (NGO5.2 280115).

Negotiating biodiversity calculations into 'something we can live with'

Successive calculations traced over time for scored HMS, HIS and HBIS values show that the stakeholders negotiated so as to arrive at the costs of compensation. These negotiations frequently involved changing the numerical scores entered into the first BIA for the development site. Over the course of the planning process in this case, the calculated baseline value of the development site was reduced by almost 48 per cent from 48.68 units in BIA draft 1 (Table 7.3) to 25.52 units in draft 2. This downward recalculation occurred through making category changes to the condition of existing habitats, thereby adjusting the numerical unit outcomes of assigned habitat values.

Table 7.4 shows the changes made to the condition values of the baseline habitats on-site and the dramatic effects on financial compensation requirements, identified through comparisons made from different drafts of the BIA Excel sheets. These changes included lowering the perceived condition of 4.88 ha of improved grassland on the development site from a 'moderate' to 'poor' condition, such that the BIA F3 baseline value of 19.52 on Table 7.3

Table 7.4 Changes in calculated biodiversity baselines between Biodiversity Impact Assessments drafts 1 and 2

BIA Habitat Area Code	*Habitat description*	*Area (ha)*	*Distinctiveness*		*Condition*		*Original unit value*	*New unit value*	*Percentage reduction in unit value*
			Category change	*Score change*	*Category change*	*Score change*			
F1	Improved grassland	1.78	None	None	Moderate to poor	2 to 1	7.12	3.56	50%
P1	Wetland-standing water	0.01	None	None	Good to moderate	3 to 2	0.14	0.01	93%
F2	Improved grassland	3.10	None	None	Moderate to poor	2 to 1	12.40	6.20	50%
F2	Tall Ruderal	0.18	None	None	Moderate to poor	2 to 1	0.70	0.35	50%
The Bowling green	Amenity grassland	0.12	None	None	None	None	0.24	0.24	0%
F6	Amenity grassland	0.97	None	None	None	None	1.94	1.94	0%
West of football grid	Improved grassland	0.08	None	None	Good to moderate	3 to 2	0.48	0.32	33%
F3	Improved grassland	4.88	None	None	Moderate to poor	2 to 1	19.52	9.76	50%
Slurry pit	Standing water	0.01	High to low	6 to 2	None	None	0.05	0.02	60%
Part of F4 and F5	Improved grassland	1.52	None	None	Moderate to poor	2 to 1	6.08	3.04	50%
Total							48.68	25.52	48%

(cell O26) became 9.76 units. Due to its size, this constituted a 50 per cent reduction of baseline biodiversity value for this habitat area. The same process was applied to improved grasslands in different compartments in habitat area codes F1 and F2. Modifications regarding anomalous local level category values (e.g. concerning what value scattered trees should have) were also made in anticipation of the numerical and financial outcomes that would arise through the multiplication or division effects of these modifications on biodiversity loss (HIS) or on-site mitigation (HMS). In other words, the ability of these modifications to either enlarge or shrink the final compensation costs of development planning applications was built into the numerical adjustments that followed. Other iterations to the BIA over the course of the pilot study included adding category values to the BDO metric (Table 7.1) with the odd numbers 1, 3 and 5 for local habitat types that have greater regional than national distinctiveness and rarity (NGO5.1 241114), as well as extensive formatting changes and editions to make the calculator more 'user-friendly' and manageable (OB5.2 050114).

One explanation for these modifications is that local planning authorities have a relatively limited ability to determine the exact condition of the habitats under discussion. Only a handful of habitats will have been visited and verified by a county ecologist (LPA5.2 241114), due to the widespread shortage of ecological expertise within local governments more generally (NGO 270116, NGOCompl 2901016). Often the ecological data is assembled and cross-referenced remotely against a combination of records supplied in the Ecological Assessment Report in addition to biological and historical archives held on file at the council offices at the district council's Biological Records Centre. Indeed, in this instance the good quality and extensive scope of the ecological data held by the County Council for reference and the size of its own ecological team are considered to be anomalous within England (LPA5.2 241114).

At the same time, underlying the overall downwards recalculation of the development site's baseline value from 48.68 to 25.52 units was a view that the first BIA calculations would create too large a compensation package, thereby threatening the financial viability of the residential development (DEV5.1 060315). The initial calculation for the biodiversity offset compensation package was £300,000. During the course of an hour-and-a-half meeting between the developer and the local planning authority, and at the instigation of the development firm, the baseline habitat condition assessments for many areas on-site were adjusted downwards to produce the new figure of 25.52 biodiversity units in the second draft (Table 7.4). Described as 'something we could live with' (DEV5.1 060315), the ensuing revised cost for the final compensation package was £120,000.

Discussion: working towards the right balance of values

This chapter provides an in-depth case history of the assessments, calculations and negotiations of biodiversity and financial values for a BDO compensation contract *in situ*. Our case study illuminates several problems for biodiversity conservation predicted in the theoretical literature on BDO. In conclusion we highlight three points in particular, and focus on their broader implications for biodiversity conservation through the implementation of BDO.

First, evidence from repeat site visits to this and other pilot offsetting cases in England over 24 months shows that the business of making the DEFRA metric applicable to real-life planning cases has proven to be a process of constant iteration, trial and error. The BDO case history documented above illustrates in particular how metrics for determining biodiversity values at development and receptor sites are being redesigned in application and are generating numerical values that are then further negotiated and adjusted. The model of BDO and the devices in service to this are envisaged to produce a neutral calculative framework and a technical means for making impartial and objective decisions based around value. As our case study shows, however, the new metrics associated with BDO are being used in creative ways by different actors negotiating competing requirements. This creativity may be appropriate in response to real-world complexity. Nonetheless, it is also in tension with stated aims in BDO policy design for standardisation and comparability. In this case, the nexus of competing development, conservation and LPA interests meant that biodiversity values calculated through application of the metric were adjusted downwards so as to facilitate a compensation package that was cheaper for developers. The firm had been involved in another negotiation in connection with a different site, that also involved a reduction of biodiversity offset compensation value, from £300,000 to £90,000 in an even shorter 30-minute meeting (DEV5.1 06031; also see case documented in Sullivan 2013). Thus, as predicted in theory (Walker et al. 2009; Hannis and Sullivan 2012), these case observations seem consistent with concerns that an emphasis on market values for biodiversity conservation and compensation will encourage developers, as purchasers of impact compensation, to push prices downwards to lower their costs. In doing so, both the quality and quantity of conservation 'yield' through BDO may also be reduced. The downward adjustment to biodiversity impact values illustrates that valuation algorithms in service to decision-making are only as good as their numerical and category inputs, shown, by this case study, to be subject to economic and political factors.

Second, the case history provides empirical material illustrating the working in practice of commensuration processes making different habitats equivalent to each other through application of BDO metrics (Tables 7.1 and 7.3). Numerical signifiers form proxies for qualitatively different ecological assemblages, calculated with the aid of the DEFRA biodiversity metric as represented by the BIA Excel spreadsheet calculations presented above. Sometimes these commensuration processes generate counterintuitive outcomes. In this case it is unclear how exactly a sports pitch can really be said to be maintaining 6.36 units of biodiversity value at the development site that is equivalent to 6.36 units of high quality grassland habitat supporting a range of Biodiversity Action Plan species at the offset site. The proposed mitigation value provided through sports pitches, measured as habitats of low distinctiveness and poor condition and achieved through acting as the largest 'habitat type' within the development, illustrates the ability of numerical abstractions to commensurate distinct biota of very different qualities (Sullivan 2013; Carver 2015). The design principles of English BDO mean that large habitat areas of low biodiversity value can be treated as equivalent to small habitat areas of high biodiversity value (see Figure 7.1). In this case, the 'packaging' of football pitches as 'habitats' for on-site mitigation again reduced the financial compensation value in the final offset calculations, by decreasing offset unit requirements by an equivalent number of biodiversity units.

Finally, elements of both points above suggest that the pressure of creating value for money in compensation strategies for conservation may be pushing BDO in directions that favour the growth of market values and exchanges for offset units, but that may work against the robust generation of conservation value (Hannis and Sullivan 2012; Dauguet 2015). Additional observations in our case study confirm this tendency. For example, although conservation NGOs are considered to be convenient offset providers or 'low hanging fruit' by district councils (LPA5.1 010215), as in the case presented here, councils also recognise that in order to achieve market liquidity in offset units, private landowners will have to play a significant role. Indeed, a barrier to the development of BDO in England has been a shortage of 'supply side' offset sites from which to purchase biodiversity offset credits, as confirmed in DEFRA's pilot evaluation report (Baker et al. 2014). The local authority in the above case has thus engaged partnerships with organisations that can assist in stimulating and brokering a greater supply of offset credits and receptor sites through private landowners. High transaction costs from site identification, preparation and legal fees are fostering economies of scale by bringing offset provision together with the economically astute farm management strategies of large commercial landowners (OB5.2 020315; and predicted in Sullivan and Hannis 2015). This is expected to result in a better supply of offset credits from newly formed 'habitat banks'.

Emerging offset brokerage firms hope that a high supply of offset credits will improve market competition, resulting in cheaper prices for developers seeking compensation. This combination of commercial outlook, farming experience and land management makes the corporate broker now partnering with the county council confident that with this approach they can produce a 'good biodiversity yield per hectare' across multiple sites (OB5.2 020315). In doing so, BDO is becoming further aligned with commercial agricultural productivity agendas that emphasise efficiencies and scale of production through concepts of agricultural 'yield'.

The case presented here is of a BDO to be provided directly by a conservation NGO to a UK local planning authority. Despite months of preparation and considerable staff costs, the developer eventually rejected the proposed offset site in favour of developing an offset arrangement with the farmer issuing the land for development in the first place (OB5.1 140116). The calculations and negotiations presented here are nonetheless valuable as a detailed example of how the DEFRA metric is being applied in practice to commensurate biodiversity assessments between different sites. In tracking, documenting and analysing the calculations and negotiations in this and other cases, we observe that although BDO is constituted by technical and apolitical practices to calculate equivalence and commensurability between sites of biodiversity damage and conservation investment, the way these are enacted in practice is subject to a proliferation of methods, techniques and valuation criteria that are balanced to meet conflicting user requirements.

As such, instead of confining the decision-making process to a neutral calculative and technical framework, the technical process itself opens new possibilities through which stakeholders negotiate, and sometimes struggle over, specific outcomes (Coralie et al. 2015; Sullivan and Hannis 2015).

These spaces and the political conditions in which they are produced are obscured within the black boxes of idealised calculative models and final-draft 'valuations'. As Walker et al. (2009, 149) identify, the concern is that 'biodiversity protection interests will fail to counter motivations for officials to resist and relax safeguards to facilitate exchanges and resource development at cost to biodiversity'. Application of scoring practices that create numerical values may help stimulate greater compensation payments for biodiversity loss in the English planning system and elsewhere, thereby supporting greater biodiversity outcomes (however, see Carver 2015). Obscured within these technical practices in the application of a calculative device, however, and as predicted by Salzman and Ruhl (2000), are additional value judgments and struggles over arriving at the perceived 'right' numerical values. Our empirical observations show that these values must be able to straddle competing demands such that they are economically palatable, politically pragmatic as well as ecologically coherent. Whether or not biodiversity 'yields' are achieved through these negotiations will depend on the bargaining powers of those involved, beyond the application of standardised practices to calculate and commensurate biodiversity losses and gains.

There is a broader postscript to the case history shared here. At the close of the DEFRA pilot study in 2014 it was expected that DEFRA would release a policy statement following the publication of its evaluation report (Baker et al. 2014), and yet no such announcement materialised. Amongst other things, the evaluation of the pilot proposed that a system of BDO in England would likely increase the overall costs of compensation to developers in the short and long term (Baker et al. 2014). As such, BDO would neither align with the promises to the construction industry made in the Conservative manifesto, nor meet requirements from HM Treasury for de-regulation and the 'one-in two-out rule' (stepped up to one-in three-out the following year) as described above. Our case study illustrates the ways in which a 'value for money' requirement appears as an influence shaping the application of the calculative practices at the level of individual BDO contracts. In the end, however, it appears that BDO as a regulatory approach could not prove its own 'value for money' within a political climate of de-regulation and economic growth. From 2014 onwards, DEFRA quietly let the spotlight fade from the BDO approach as a legislated policy requirement for the management of development impacts in England. BDO in a voluntary capacity, however, continues to unfold within local government and corporate contexts. As a calculative approach with a focus on measurability BDO thus remains as the only mechanism now available to meet policy requirements in the NPPF for demonstrating measurable 'no net loss' of biodiversity 'value'.

Notes

1 See http://jncc.defra.gov.uk
2 See transcript of 2010 speech by then Prime Minister David Cameron at https://www.gov.uk/government/speeches/pms-speech-at-decc (Accessed 2 August 2017).
3 See https://www.gov.uk/government/publications/2010-to-2015-government-policy-business-regulation/2010-to-2015-government-policy-business-regulation#appendix-4-operating-a-one-in-two-out-rule-for-business-regulation (Accessed 2 August 2017).

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