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Building a Better Society: Net environmental gain from housing and infrastructure developments as a driver for improved social wellbeing.

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Alongside experiencing economic inequality, the poorest in society also have to live in some of the most degraded outdoor environments in the country. Poor environments compound the misery of poverty and directly contribute to low levels of health and wellbeing. The paper outlines a funded approach to address this problem.

Summary

The poorest in UK society almost invariably suffer the most degraded environments. Yet environmental enhancement both directly improves wellbeing and regenerates local economies. However, plans for enhancing social wellbeing via environmental improvement suffer from a chronic lack of funding. Recent proposals to require the delivery of net environmental gain by housing and infrastructure developments clearly offer the potential for restoring the UK's degraded natural assets. However, current policies often focus only on net biodiversity gains and seek to locate compensation schemes as close as possible to the development areas. In this paper, we show how such approaches are likely to lead to net wellbeing losses to the poorest in society. By applying a number of straightforward principles we suggest ways in which such policy could be reshaped to deliver both improvements in wider ecosystems and to the wellbeing of those who currently suffer the poorest environments in the country.

Introduction

Human wellbeing is, to a considerable extent, a product of its environment. High quality environments can significantly enhance the health and lives of those that experience them. Conversely those who have to endure low quality environments often suffer poor wellbeing, degraded health and lower life expectancy (Health Council of the Netherlands, 2004; Corvalán et al., 2005; Maller et al., 2005; Guite et al., 2006; Pretty et al., 2007; Boyce and Patel, 2009; Power et al., 2009; Marmot, 2010; Geddes et al., 2012; Larson et al., 2016; Coldwell and Evans, 2018). Yet in real terms (adjusting for inflation), spending to enhance environmental quality, especially in terms of urban or peri-urban green infrastructure, is at a historic low (CLGC, 2017; HLF, 2016). Therefore, any proposal to improve wellbeing through enhancement of people's living environments also needs to find a funding source for such enhancements. A potential funding source arises from proposals within the Government's 25 Year Environment Plan (HM Government, 2018) and subsequent consultation (Defra, 2018) for the introduction of a Net Environmental Gain requirement upon building new housing and potentially infrastructure. The 25 Year Environment Plan is expected to be placed on a statutory footing by the proposed Environment Bill, which includes the establishment of an independent, statutory

environmental body, the Office of Environmental Protection (OEP). The OEP will hold the government to account with regards to the implementation of environmental law. It will be able to scrutinise environmental policy and law, investigate complaints, and take enforcement action (Defra, 2018b).

This note presents options for using the Net Environmental Gain proposals to not only deliver on the 25 Year Environment Plan ambitions for improving the environment, but to also enhance social wellbeing through improved decision-making regarding the siting of environmental improvements.

UK House Building: Policies, practice and poverty

UK Government house building targets, announced by the Chancellor of the Exchequer in the Autumn Budget 2017 (HM Treasury, 2017) and recently reaffirmed (House of Commons, 2019a), are to increase housing supply to approximately 300,000 new houses per year by the mid-2020s. This represents a huge increase over present levels of house building which stood at 162,270 in the year to March 2019, an increase of only 1 per cent over the previous year (MHCLG, 2019a). Findings from planning research suggest a shortfall of housing supply in England of up to 4 million homes (Holmans, 2013) implying a need to build 340,000 homes per year over the next decade to meet demand (Bulman, 2018), a figure significantly higher even than the government's optimistic aspirations. Furthermore, despite recent announcements from the Chancellor regarding funding to increase the proportion of affordable homes to 10% of the government's housebuilding targets (Collinson, 2019), figures from the Ministry of Housing, Communities & Local Government (2019b) suggest that attempts to address housing poverty are failing with just 1-2% of new housing built for social rent and that even this number is falling (Partington, 2018).

Housebuilding in the UK therefore occurs in a market of excess demand for homes, as reflected in long term price rises. As of May 2019 the average house price in the UK was £229,431 and rising by 1.2% per annum (Land Registry, 2019). Combined with the very low rates of social housing construction, this means that those benefiting from new house building are almost exclusively the relatively affluent, certainly when compared to the poorest sections of UK society who, as the above trends show, are increasingly ignored by the house building sector.

This is important because the knee-jerk thinking with respect to net environmental gain compensation is to locate this as close as possible to the area where building has taken place. The simple logic runs that as this is the area where loss has occurred then this should be the location for any net gain project seeking to compensate for that loss. As we discuss in further detail below, this thinking is flawed and appears prompted by a desire to make it easier for new developments to go ahead, and an undercurrent of political expediency which argues that in the world of local planning and politics such a 'local compensation rule' might ease fears over net environmental gain deterring building. Somewhat perversely this may result in an increase in land take for building which, if compensation is poorly designed, may increase environmental impact (de Zylva, 2018). Even more perversely, it may result in a decline in social wellbeing if the net environmental gain principle is not implemented with an awareness of its implications for those facing the poorest natural environments.

Yet the potential for improvement is enormous. Taking the current average house price and the Government's house building target, even a compensation charge of just 1% of sales price would raise nearly £700 million per annum (the issue of who should pay this charge and who should undertake compensation schemes is briefly discussed in Annex A). Such a sum is equal to roughly one third of the entire operating budget of the Department for Environment, Food & Rural Affairs, Defra (House of Commons, 2019b). If targeted carefully this is sufficient not only to generate enormous environmental gains but also to facilitate lasting improvements in the wellbeing of those facing the

worst living conditions in the UK. However, this will only be delivered if net gain policies are implemented in ways which avoid simplistic rules and instead follow principles which deliver to both the environment and wellbeing agendas.

House building, impacts and net gain compensation: Location, location, location

The principles underpinning the concept of net gain appear straightforward: for a net gain to arise the benefits to society have to outweigh the costs. The concept of a net environmental gain confines those benefits and costs to the environmental realm but the principle is the same; for a net environmental gain to arise the environmental benefits to society have to outweigh the environmental costs. This has to hold true irrespective of wider costs and benefits (including housing, impacts on incomes and the economy, etc.), the sum of which one would also expect to be positive.

While these principles are straightforward, the devil is in the detail. One issue is to clearly define terms such as "environmental"; "society"; "benefit" and "cost". Annex B discusses these terms in greater detail. A further, often overlooked yet vital issue is that the location of any compensation scheme will fundamentally influence the benefits and costs it delivers and the distribution of those values across society (Perino et al., 2014; ONS, 2018). As a simple example consider the issue of recreational open space delivered through the establishment of an open-access woodland. Locating this near to the urban fringe is likely to generate much greater benefit values than the establishment of an objectively identical woodland in a remote rural location accessible to only a small population (Bateman, 2009). This value also varies according to the availability of alternative, substitute resources (*ibid.*). Location decisions can therefore have major effects upon the redistributional impacts of compensation schemes.

We are not starting from a level playing field; poorer communities live in lower quality, more polluted environments (Fecht et al., 2015). This inequality is exacerbated by poorer populations having relatively lower ability to travel and access higher quality resources. Given the very strong evidence (cited earlier) that poor quality environments also lead to lower levels of wellbeing and health this means that locating compensation sites near to disadvantaged groups can bring major benefits to those populations.

Three approaches to locating net gain compensation sites

We can identify three mutually exclusive approaches to the siting of net gain compensation schemes: (i) pure net biodiversity gain, (ii) local gains and (iii) net environmental and social wellbeing gains (which we refer to as net natural capital gains for reasons explained subsequently). We discuss the pros and cons of each of these approaches as follows:

(i) Maximising net biodiversity gain

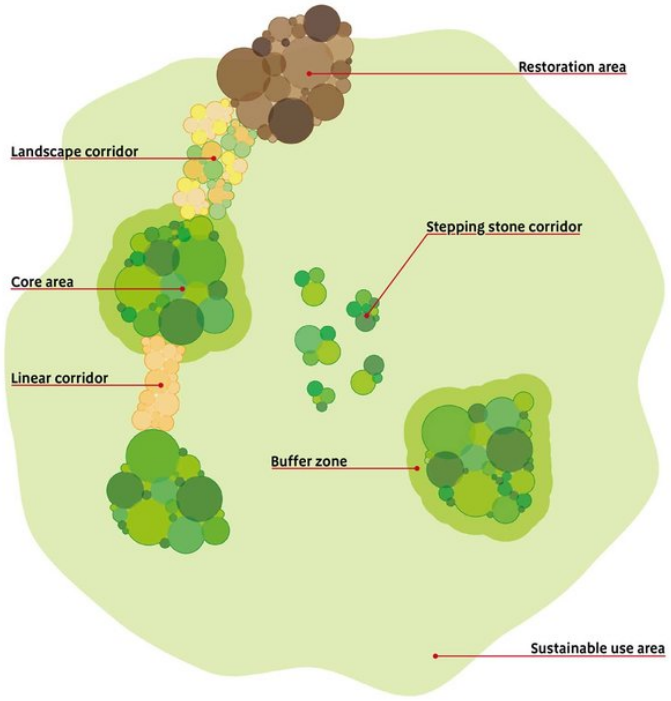
Perhaps in a step towards implementing the 25 Year Environment Plan (H.M. Government, 2018) objective of requiring net environmental gain, the UK Chancellor of the Exchequer recently announced that the forthcoming Environment Bill will mandate net biodiversity gain for UK infrastructure and housing development (HM Treasury, 2019).

The definition of biodiversity is contentious (see Annex B). A first issue is that wild species cannot thrive separately from the ecosystems upon which they depend and so species and habitats need to be considered as the system they are. Indeed, improvements to the water environment, enhancing

recreational access, reductions in greenhouses gases, etc. can all lead to better levels of biodiversity while biodiversity improvements generate a similar array of ecosystem co-benefits (Phelps et al., 2012; Bateman et al., 2013; Onaindia et al., 2013). A second issue is that people are typically not interested in biodiversity as scientifically defined; literally the diversity of species in an area. So, in any given area, eradicating one species and introducing two others increases biodiversity. However, if the lost species is the skylark and the new ones are pigeons and rats then it is unlikely that this net biodiversity gain would be seen as beneficial. In other words, "net biodiversity gain" would be better termed as "net gain in wild species which people value". A third issues is that, even if we redefine in this way, there is evidence to indicate that people care not just about which species are under consideration, but also where any gain might occur, with people having a clear preference for improvements near to where they live (Badura et al., 2019). This is problematic because this latter result implies that there is a trade-off between gains to species diversity and gains to people, with lower gains occurring near to someone's home being preferred to greater gains in remote locations.

Despite this preference for gains occurring nearer to whoever is expressing a preference, locating 'net biodiversity compensation' next to sites which have recently been developed is extremely unlikely to optimally improve the diversity and/or population status of species of conservation interest. Areas within or near development sites will be highly disturbed, artificial environments. Such compensation sites may not provide suitable habitat for displaced species, and may also not be optimally sized and sited for essential ecological processes such as foraging and dispersal., Many species of conservation interest might therefore be unlikely to take advantage of such sites, while the resources available for compensation might deliver much greater conservation gains if targeted to places that really need them (CIEEM, 2016). This prioritisation of locations on purely conservation grounds was highlighted by the acclaimed Making Space for Nature report (Lawton et al., 2011). This exposed the fragmented nature of wildlife sites across the UK and argued persuasively for investments in the creation of an ecological network, linking sites through a variety of corridors (see Figure 1).

Figure 1: Optimal location of compensation sites for net biodiversity gain - Types of corridor site.



Source: Lawton et al., (2011).

The use of net environmental gain funds to create Lawton-style biodiversity corridors offers the best use of net gain compensation in terms of improvements to the viability of species of conservation interest. Given the severe population declines in the UK's wildlife over the last half century (Scholes and Biggs, 2005; Hayhow et al., 2016), this approach should be considered as an important element of a compensation programme. However, such an approach on its own will do very little to enhance social wellbeing as it results in compensation projects which are located in areas which are optimal for wildlife, without considering potential benefits for people.

In summary, the maximisation of net biodiversity gains as defined above provides the best outcome for nature conservation but very little in the way of social wellbeing improvements. To deliver both requires net biodiversity gain compensation to be complemented by other strategies.

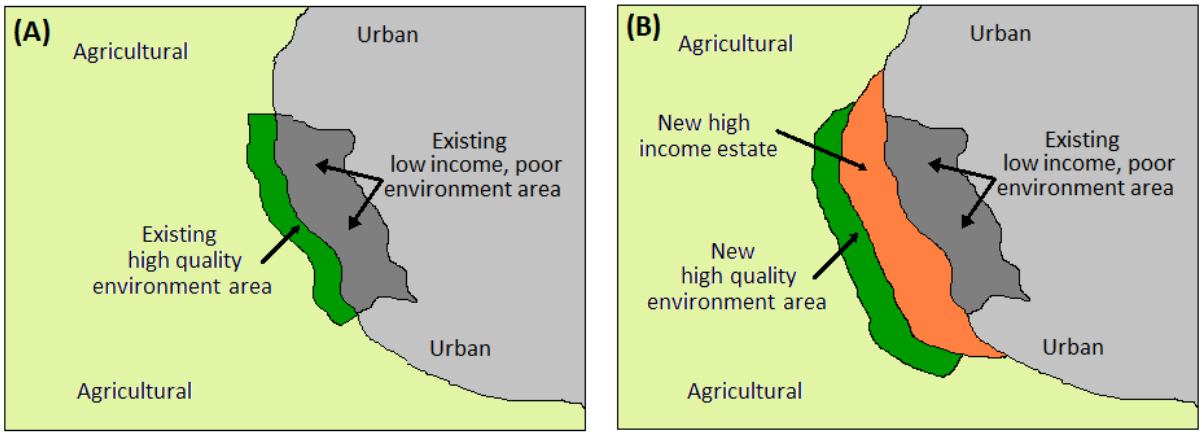
(ii) Local gains for local people

Both planners and politicians favour the locating of net gain compensation near to development sites (RTPI, 2019; Suff, 2013). Such an approach avoids the need for a national strategy and eases the administration of a compensation scheme. However, as we note above, the tying of compensation to the locality of developments can result in poor value for money in terms of the conservation gains it can provide and might even further degrade biodiversity unless species are adequately protected (CIEEM, 2016).

Procedures for locating compensation schemes have to reflect the impacts of alternative siting if they are to be effective. Alongside biodiversity concerns, it is easy to demonstrate that constraining compensation to areas close to development sites can make social wellbeing gains trivial or even turn them into losses, worsening the environmental inequality which characterises many countries (Baek and Gweisah, 2013; Grunewald et al., 2017; Kasuga and Takaya, 2017) and is particularly prevalent in the UK (Fecht et al., 2015).

To demonstrate this, consider Figure 2. Here Panel (A) shows a pre-development situation where a relatively economically poor neighbourhood which internally suffers from low environmental quality can benefit from an adjacent high-quality environment area. Panel (B) of Figure 2 shows a new situation for the area considered where a new estate of executive homes has been built on the land which previously provided access to a high-quality environment for the disadvantaged community. This is hardly an unusual or highly hypothetical scenario. There is a high demand for property on the edge of urban areas as these combine ease of access to central business districts with high quality environments. Consequently, builders are keen to supply such homes as they command high prices and deliver excellent profits. Demanding that such schemes provide net environmental gains yet constraining these compensation schemes to the local area is highly likely to result in outcomes such as that shown in Panel (B). Here the local compensation requirement results in an 'executive garden' positioned to favour the new estate. This is a likely outcome because it allows the developer to market their new executive homes as having excellent access to such high-quality environments. However, comparison of Panels (A) and (B) shows that it is the low income/poor environment area's residents that are the losers, yet it is the high-income executive home owners who have captured the compensation.

Figure 2: Environmental capture by developers and high-income new home owners: How local net gain compensation can reward the rich and penalise the poor



Comparison of Panels (A) and (B) shows that while the higher income population who occupy the new development area have easy access to the high-quality environment created under the net gain requirement, the distance to such areas has actually increased for the low-income community. The fact that both the benefits of and visits to parks and other recreational sites declines with increasing distance is well established (Bateman et al., 2006; Mowen et al., 2007). However, there is also ample evidence that this distance decay effect is significantly stronger for those with lower as opposed to higher incomes due to the relatively higher real cost of travel faced by the poor (Doucouliagos and Hall, 2010; Stevens et al., 2014). Therefore, the decline in expected visitation rates to nature by the poorer community in Figure 2 is even greater than might be expected from simply looking at the increased distance to high quality environments.

The reliance of poor communities upon informal non-developed areas for access to richer quality environments is commonplace. One example of this is my own home area of Handsworth in inner city Birmingham, one of the most deprived neighbourhoods in one of the most deprived cities in the UK (Cangiano, 2007; Fenton et al., 2010; Bradnam, 2015). While being highly disadvantaged in economic terms, nevertheless Handsworth benefits from the undeveloped land locally known as Hilltop Farm, a small collection of fields surrounding an abandoned WWII gun emplacement, informal access to which provides some relief to the wellbeing of the local community.

The impacts of losing such vital areas are demonstrated through the experience of multiple communities across the country. For example, the Victorian terraces of St James in Exeter originally faced onto open fields which, in the post WWII era, were developed into the desirable detached housing of Pennsylvania (RGS, 2019). While the former population were clearly the losers, the residents of Pennsylvania could now enjoy views over the fields of Duryard and ready access to nearby Stoke Woods and Mincinglake Valley Park. An ongoing case concerns the area of North Walbottle, Newcastle upon Tyne, a relatively deprived city in north eastern England (Public Health England, 2013). Panel (A) of Figure 3 shows the current situation with the residents on North Walbottle looking out over large areas of countryside to which they have ready access for recreational purposes (Journal, 2013). Panel (B) shows recent proposals for the major Callerton Park development to this area including the building of between 900 and 3,000 new homes (Pod Newcastle, 2018; Lynch, 2018). The new development includes a number of high quality environment areas, dedicated access to the countryside through the north east corner of the development and a long term plan for landscaping that area as shown in Figure 4. These high quality environments 'compensate the winners', by benefitting those who move into the new development, people who, unless they were compelled to make this move against their will (clearly not the case given the price they freely pay for houses in this desirable development) have already had their welfare enhanced by that move. In contrast 'penalise the losers' is the clear consequence for the present residents of North Walbottle, who have lost access

to the open land now under Callerton Park and now have to walk more than a kilometre through that new estate to just reach the access point to the countryside.

Figure 3: Gains and losses in countryside access: Aerial map of North Walbottle region before (A) and after (B) development of Callerton Park, Newcastle upon Tyne

Sources: Imagery and map data ©2019 Google, Bluesky plc, Infoterra Ltd. & Bluesky, Maxar Technologies. Callerton Park map © Pod Newcastle (2018)

Figure 4: Gains and losses in countryside access: View of Callerton Park from North Walbottle, Newcastle upon Tyne

Source: © Pod Newcastle (2018)

There are numerous further examples of this capture of high quality environments by affluent groups and 'poor door' (Carter, 2014) redirection or exclusion of disadvantaged groups. A recent, particularly outrageous, example is that of the Henley Housing development of Baylis Old School in south London (BBC, 2019; Grant, 2019). Original plans for the development included communal greenspace and play areas for the use of all residents. However, planning permission was subsequently granted to block the social housing tenants from accessing these communal greenspace areas (Grant, 2019) including the building of a wall to physically prevent access (BBC, 2019).

The incentives for such moves are obvious. Social housing provides relatively poor returns for developers, whereas executive homes yield much higher profits. If developers are forced to provide environmental net gain but allowed (or even forced) to tie this to the local area then designing greenspace areas to serve those executive homes will allow developers to further increase the price of such homes, at very least offsetting the cost of net gain requirements and at best adding further margins to those profits.

Tying net environmental gain compensation to local areas is therefore likely to 'compensate' winners, rewarding them for their economic power and elevating the welfare gain they have already achieved through purchasing a new home, which will almost certainly provide a higher level of wellbeing than their previous residence. In contrast those who lose out from development may also be ignored in the siting of net gain compensation. In effect local compensation requirements can deliver "environmental capture" to winners while penalising losers, inadvertently exacerbating the welfare loss experienced from nearby developments.

The mantra that compensation should be kept local is deceptively simple and attractive, yet likely to be deceiving. At very least we should insist that it is the true losers that should be compensated otherwise 'local gains for local people' can actually lead to losses of social wellbeing.

(iii) Net environmental and social wellbeing gains (net natural capital gains)

Natural capital refers to "those elements of the natural environment which provide valuable goods and services to people, such as the stock of forests, water, land, minerals and oceans" (Natural Capital Committee, 2017). The natural capital approach to decision making, which is now central to UK official guidelines for public spending (H.M. Treasury, 2018) and the Government's 25 Year Environment Plan (H.M. Government, 2018), emphasises the need to consider the multiple costs and benefits arising from any change in the environmental system and also requires that multiple alternatives be assessed when a decision is made (Pearce et al., 1989; Costanza and Daly, 1992; Turner and Daily, 2008; Bateman and Wheeler, 2018). Because the natural environment is an interconnected system, changing one element (such as developing an area of land) will generate multiple effects (e.g. building houses and delivering accommodation will often lead to changes in food and timber production, wild species habitat and biodiversity, water use and quality, greenhouse gas emissions, recreational access and associated physical and mental health, etc.). All of these impacts and trade-offs need to be considered when setting compensation levels and comparing alternative sites for net gain.

In order for compensation to provide net environmental gain it needs to be delivered in terms of the physical environment rather than just in monetary terms, for example as a payment to the coffers of local authorities which might be spent on a multitude of ends and risks the possibility of the environment being effectively sold off to bolster local government budgets (echoing the concerns of de Zylva, 2018). This does not however mean that the nature of any physical compensation has to be like-for-like with that which was lost. Indeed like-for-like compensation can often be poor value for money (if better alternatives are available), impractical and in technical terms physically impossible in

terms of exact replication (CIEEM, 2016). However, for compensation to also deliver social wellbeing gains then the value of benefits must exceed the value of the loss. If we want those social wellbeing net gains to help the disadvantaged rather than those who have already benefited from the new house building, we have to reject the "local gains for local people" approach resulting from simplistic rules such as those requiring that compensation should be as close as possible to the building area.

Two alternative net natural capital gain approaches can be identified, each delivering net gains in terms of both the natural environment and social wellbeing. The first is applicable where policy makers demand that compensation remains local. This approach is to identify those local areas which, if their environmental quality was enhanced, would deliver net gains to the population suffering the loss from new developments (as opposed to the winners from that development as shown in (ii) above). For example, considering Panel (B) of Figure 2, it might be that brownfield environments within the low income / poor environment area could be enhanced using compensation funds.

The second approach arises where the constraint for local compensation can be relaxed or removed entirely. Any increase in the area under consideration for compensation can only produce a non-negative change in the resulting social wellbeing generated. The larger the area considered the greater the potential gain that can be realised as schemes can focus in on those communities which endure the most adverse conditions nationally. By definition potential improvements in social wellbeing are maximised when assessments consider possible compensation schemes across the nation. Such an approach can provide funds for restoring areas that are so degraded they deter development even in nearby locations. Such areas are never likely to benefit from net gain rules if local or even regional compensation rules are applied, yet these are precisely the areas which could benefit most from such gains. For these reasons we strongly advocate net natural capital gain approaches to implementing the net gain proposals in the 25 Year Environment Plan.

Conclusions

The introduction of a net environmental gain requirement for new building and infrastructure has the potential to generate substantial funding for compensation schemes. With careful design these schemes can deliver net improvements in both environmental and social wellbeing, contributing to reducing the environmental inequity which characterises much of the UK. However, a key determinant of the success of such schemes will be whether or not they are located in the right places.

Simple rules such as requiring that compensation has to be as close as possible to the location of development are likely to reduce the environmental and social wellbeing gains that could be delivered by such funding. Indeed, there is the potential that knee jerk heuristics, such as constraining compensation to be as close as possible to developments, will reward the winners and penalise losers from house building. We recognise that local politics and planning will want to capture net gain funds and there will be pressure to oil local wheels. Ideally such pressures should be resisted, but even if compensation is geographically constrained than a movement away from local towards regional assessment will improve the social wellbeing generated.

We have the data in order to target compensation to both benefit the environment and raise social wellbeing amongst the most disadvantaged groups in the country. By seizing this opportunity, net gain initiatives can contribute to reshaping and improving the UK's natural environment whilst at the same time actively addressing social disadvantage by providing a clear approach and funding route towards delivering social wellbeing enhancements through environmental improvements.

Annex A: Who pays? Who delivers?

Recent policy announcements have confirmed that developers will have to fund net biodiversity gain schemes (Defra, 2019) and it can be assumed that this principle would be extended to net environmental gain (H.M. Government, 2018). But a further issue concerns whether those that pay for compensation schemes (e.g. developers) are also the best placed to undertake such schemes. Bringing in 'mitigation agencies' (groups of compensation scheme specialists including natural scientists such as ecologists, hydrologists, soil scientists, as well as social scientists such as recreational planners, may well lead to higher value for money outcomes, particularly where competition between such agencies is permitted thought mitigation markets (Wende et al., 2005; Froger et al., 2015; Levrel et al., 2017)

Annex B: Net environmental gain - Principles and practical challenges

The principles underpinning the concept of net gain are straightforward; for a net gain to arise then the benefits to society have to outweigh the costs. The concept of a net environmental gain confines those benefits and costs to the environmental realm, but the principle is the same; for a net environmental gain to arise then the environmental benefits to society have to outweigh the environmental costs. This has to hold irrespective of wider costs and benefits (including housing, impacts on incomes and the economy, etc., the sum of which one would also expect to be positive, but that is beyond the present remit).

While the principles are straightforward, the practice is more complex and requires clear definitions such as differences between biodiversity, conservation and environmental compensation; wider social values; and comparison of benefits and costs.

Compensation has frequently been confined to impacts upon wild species or biodiversity (although these two terms are definitely not interchangeable and the subject of rigorous debate and definition elsewhere, see for example Maron et al., 2018). Biodiversity, strictly speaking, simply refers to the variety of plant and animal life in a defined location. Under such a non-anthropocentric and objective definition, the replacement of a single rare species by two previously absent yet globally common species would represent an increase in biodiversity. However, from a conservation management perspective, simply increasing biodiversity is not necessarily a positive conservation outcome, hence the switch to a focus on protecting and increasing numbers of species of conservation interest, rather than simply increasing overall species richness., This highlights the human aspect to environmental preservation, and the fact that gains and losses are defined in the context of the effects upon people. It shows that concepts such as "a good quality natural environment" are not solely environmentally determined or intrinsic in some non-human sense, but rather, that they are appreciated by society. Given that, as outlined above, a simple net gain in diversity is not necessarily a desirable conservation outcome.

Conservation targeted compensation should focus not only on biodiversity gains per se, but on enhancing populations of species of conservation concern. Ecological principles such as habitat connectivity and species territory size should be considered when targeting particular sites, species and/or habitats. While it might seem most appropriate to compensate in the immediate vicinity of losses, it is very unlikely that the funds made available for compensation will be best spent in that location. By definition this will be an area subject to recent, often severe, environmental disturbance. Setting aside other environmental benefits, compensation here is less likely to be effective in terms of wild species conservation. It is likely that there are other locations where compensation funds could

be far more effective in terms of the environmental net gains delivered in terms of both biodiversity in general, and species of conservation concern in particular.

Certainly 'species of conservation interest' (a much clearer and preferable concept than biodiversity) are an essential element of environmental gains or losses. However, they are not the totality of environmental impact and a policy which restricts itself solely to considering effects on species conservation is unlikely to be maximising net gains to society. Other valuable environmental benefits include: outdoor, open access recreation (which in turn can generate substantial mental and physical health benefits); clean drinking water; flood risk reduction; soil health, stability and resilience; climate regulation and air quality improvements (including for example carbon capture and the absorption of particulate matter)) visual amenity to both local residents and those passing through the area; etc.

So, in addition to conservation gains, the societal benefits of compensation schemes should be considered. Rather than targeting compensating compensation funding to the areas in the vicinity of environmental loss, thereby often benefiting mostly residents of the new development, we argue that (part of) compensation funding should be targeted to areas where societal gains are greatest, for example by looking to implement environmental enhancements in areas where wellbeing improvements for lower socio-economic groups would be greatest.

We recognise that local political pressures will mitigate in favour of local action. However, solely implementing compensation schemes near the area of environmental loss is highly likely to lead to sub-optimal outcomes in terms of both conservation and societal benefits, and we therefore argue that at most there should be a division of compensation between local and (more effective) nationally targeted schemes

A final but crucial question concerns the adequacy of any net environmental gain compensation scheme. Basic economic theory provides straightforward guidance here (Johansson, 1991). Compensation for any loss is only adequate when it makes those concerned just indifferent between the loss going ahead with the compensation being paid, or the loss not occurring (and of course compensation not being paid). If those concerned are keen for the loss to go ahead then compensation is too high. If, on the other hand those concerned would prefer not to have the loss plus compensation then that compensation is inadequate. In respect of environmental benefits and costs it is clear that the latter case dominates the former in real world planning and development cases. A practical problem arises concerning the assessment of the adequacy of net gain compensation. A basic requirement is that the benefits and costs generated by development and compensation are assessed and quantified. However, even then assessment of the adequacy of compensation is not straightforward because the diversity of environmental impacts (discussed above) involves a similar diversity in measurement units. Trade-offs become difficult: How many tonnes of greenhouse gas removal balance a number of recreational visits? How much money should be spent on compensation? This problem of 'commensurability' has been the subject of very extensive research with methods being developed to directly equate the value of these benefits to the costs they incur all assessed within economic units (NCC, 2017). This acknowledges the reality that, every time a decision is made to say provide a certain environmental improvement at a specified cost, economic values are being implicitly placed upon those benefits. Such valuation is unavoidable and the essence of decision making; it is better to acknowledge this and make these values explicit than to hide them behind decisions made through implicit, unchallenged values. Compensation schemes should seek to maximise the net environmental gain provided by available funds and indeed the scale of those funds should be determined through a combination of benefit-cost analysis and the adequate compensation principle.

References

Badura, T., Ferrini, S., Burton, M., Binner, A. and Bateman, I.J. (2019) A new approach to capturing the spatial dimensions of value within choice experiments, *Environment and Resource Economics*, available online at: https://doi.org/10.1007/s10640-019-00358-3

Baek, J. and Gweisah, G. (2013) Does income inequality harm the environment?: Empirical evidence from the United States, *Energy Policy*, 62: 1434-1437, https://doi.org/10.1016/j.enpol.2013.07.097.

Bateman, I.J. (2009) Bringing the real world into economic analyses of land use value: Incorporating spatial complexity, *Land Use Policy*, 26S: S30–S42, doi:10.1016/j.landusepol.2009.09.010

Bateman, I.J., Day, B.H., Georgiou, S. and Lake, I. (2006) The aggregation of environmental benefit values: Welfare measures, distance decay and total WTP, *Ecological Economics*, 60(2): 450-460. DOI: 10.1016/j.ecolecon.2006.04.003

Bateman, I.J., Harwood, A., Mace, G.M., Watson, R., Abson, D.J., Andrews, B., Binner, A., Crowe, A., Day, B.H., Dugdale, S., Fezzi, C., Foden, J., Haines-Young, R., Hulme, M., Kontoleon, A., Lovett, A.A., Munday, P., Pascual, U., Paterson, J., Perino, G., Sen, A., Siriwardena, G., van Soest D., and Termansen, M. (2013) Bringing ecosystem services into economic decision making: Land use in the UK, *Science*, 341(6141): 45-50, DOI: 10.1126/science.1234379

Bateman, I.J. and Wheeler, B. (2018) *Bringing health and the environment into decision making: The Natural Capital Approach*, Rockefeller Foundation Economic Council on Planetary Health, Oxford Martin School, University of Oxford, available at: https://www.planetaryhealth.ox.ac.uk/wp-content/uploads/sites/7/2018/06/Health-Env-in-Decision-Making.pdf

BBC (2019) Developers accused of 'segregating' children at London playground, *BBC News*, 26th March 2019, available at: https://www.bbc.co.uk/news/uk-england-london-47707838

Boyce T, Patel S, 2009. *The Health Impacts of Spatial Planning Decisions*. The Kings Fund.

Bradnam, L. (2015) Deprivation in Birmingham: Analysis of Index of Multiple Deprivation 2015, Economic Research & Policy Team, Birmingham City Council, Birmingham, available at: https://www.birmingham.gov.uk/download/downloads/id/2533/index_of_deprivation_2015.pdf

Bulman, M. (2018) UK facing its biggest housing shortfall on record with backlog of 4m homes, research shows, *The Independent*, 18th May 2018, available at

Cangiano, A. (2007) Mapping of Race and Poverty in Birmingham, Barrow Cadbury Trust, available at: http://www.bhamcommunity.nhs.uk/EasysiteWeb/getresource.axd?AssetID=13245&type=full&servicetype=Attachment

Carter, S. L. (2014) The 'Poor Door' to Outrage, *Bloomberg*, available at: https://www.bloomberg.com/opinion/articles/2014-07-24/the-poor-door-to-outrage

CIEEM (2016) Biodiversity Net Gain – Good practice principles for development, Chartered Institute of Ecology and Environmental Management, available at: https://cieem.net/resource/biodiversity-net-gain-good-practice-principles-for-development/

CLGC (2017) *Public Parks*, Communities and Local Government Committee, House of Commons, London, https://publications.parliament.uk/pa/cm201617/cmselect/cmcomloc/45/4502.htm

Coldwell, D.F. and Evans, K.L. (2018) Visits to urban green-space and the countryside associate with different components of mental well-being and are better predictors than perceived or actual local urbanisation intensity, *Landscape and Urban Planning*, 175: 114-122, https://doi.org/10.1016/j.landurbplan.2018.02.007

Collinson, P. (2019) Chancellor offers £3bn fix for Britain's 'broken housing market', *The Guardian*, 14th March 2019, available at: https://www.theguardian.com/uk-news/2019/mar/13/chancellor-philip-hammond-spring-statement-offers-fix-britain-broken-housing-market-build-30000-affordable-homes

Corvalán, C.F., Hales, S., McMichael, A.J., Butler, C.V., Campbell-Lendrum, D., Confalonieri, U., Leitner, K., Lewis, N., Patz, J., Polson, K., Scheraga, J., Woodward, A., Younes, M. (2005) *Ecosystems and human well-being: Health synthesis*, Millennium Ecosystem Assessment, World Health Organization, Geneva, Switzerland.

Costanza, R. and Daly, H. E. (1992), Natural Capital and Sustainable Development. *Conservation Biology*, 6: 37-46. doi:10.1046/j.1523-1739.1992.610037.x

Defra (2018) Net gain: Consultation proposals, Defra, London, available at: https://consult.defra.gov.uk/landuse/netgain/supporting_documents/netgainconsultationdocument.pdf

Defra (2018b) Draft Environment (Principles and Governance) Bill, Department for Environment, Food & Rural Affairs, available at: https://www.gov.uk/government/publications/draft-environment-principles-and-governance-bill-2018

Defra (2019) *Government to mandate 'biodiversity net gain'*, Department for Environment, Food & Rural Affairs, available at: https://deframedia.blog.gov.uk/2019/03/13/government-to-mandate-biodiversity-net-gain/

de Zylva, P. (2018) *Biodiversity offsetting and net gain: licence to trash nature*, Friends of the Earth, available at: https://friendsoftheearth.uk/nature/biodiversity-offsetting-and-net-gain-licence-trash-nature

Doucouliagos, H. and Hall, J. (2010) Park Visitation, Constraints, and Satisfaction: A Meta-Analysis, *Economics Series Working Paper 2010/18*, Faculty of Business and Law School of Accounting, Economics and Finance, Deakin University

Fecht, D., Fischer, P., Fortunato, L., Hoek, G., de Hoogh, K., Marra, M., Kruize, H., Vienneau, D., Beelen, R. and Hansell, A. (2015) Associations between air pollution and socioeconomic characteristics, ethnicity and age profile of neighbourhoods in England and the Netherlands, *Environmental Pollution*, 198: 201-210, https://doi.org/10.1016/j.envpol.2014.12.014.

Fenton, A., Tyler, P., Markkanen, S., Clarke, S. and Whitehead, C. (2010) Why Do Neighbourhoods Stay Poor? Deprivation, Place and People in Birmingham, A report to the Barrow Cadbury Trust, Centre for Housing and Planning Research and Department of Land Economy, University of Cambridge, available at: https://www.barrowcadbury.org.uk/wp-content/uploads/2011/04/WDNSP_Final_report1.pdf

Froger, G., Ménard, S. and Méral, P. (2015) Towards a comparative and critical analysis of biodiversity banks, *Ecosystem Services*, 15: 152-161, https://doi.org/10.1016/j.ecoser.2014.11.018

Geddes, I., Allen, J., Allen, M., Morrisey, L. 2012. *The Marmot Review: implications for Spatial Planning*, Report 8/2012, Institute of Health Equity, University College London.

Grant, H. (2019) Too poor to play: children in social housing blocked from communal playground, *The Guardian*, 25th March 2019, available at: https://www.theguardian.com/cities/2019/mar/25/too-poor-to-play-children-in-social-housing-blocked-from-communal-playground

Grunewald, N., Klasen, S., Martínez-Zarzoso, I. and Muris, C. (2017) The Trade-off Between Income Inequality and Carbon Dioxide Emissions, *Ecological Economics*, 142: 249-256, https://doi.org/10.1016/j.ecolecon.2017.06.034.

Guite, H.F., Clark, C. and Ackrill, G. (2006) The impact of the physical and urban environment on mental well-being, *Public Health*, 120(12): 1117-1126, https://doi.org/10.1016/j.puhe.2006.10.005.

Hayhow DB, Burns F, Eaton MA, Al Fulaij N, August TA, Babey L, Bacon L, Bingham C, Boswell J, Boughey KL, Brereton T, Brookman E, Brooks DR, Bullock DJ, Burke O, Collis M, Corbet L, Cornish N, De Massimi S, Densham J, Dunn E, Elliott S, Gent T, Godber J, Hamilton S, Havery S, Hawkins S, Henney J, Holmes K, Hutchinson N, Isaac NJB, Johns D, Macadam CR, Mathews F, Nicolet P, Noble DG, Outhwaite CL, Powney GD, Richardson P, Roy DB, Sims D, Smart S, Stevenson K, Stroud RA, Walker KJ, Webb JR, Webb TJ, Wynde R and Gregory RD (2016) *State of Nature 2016*, The State of Nature partnership, Royal Society for the Protection of Birds, Sandy, available at: https://www.rspb.org.uk/globalassets/downloads/documents/conservation-projects/state-of-nature/state-of-nature-uk-report-2016.pdf

Health Council of the Netherlands and Dutch Advisory Council for Research on Spatial Planning, Nature and the Environment. 2004. *Nature and Health. The influence of nature on social, psychological and physical well-being*. Publication no. 2004/09E; RMNO publication nr A02ae, Health Council of the Netherlands and RMNO, The Hague.

HLF (2016) *State of UK Public Parks 2016*, Heritage Lottery Fund, available at: https://www.heritagefund.org.uk/publications/state-uk-public-parks-2016

H.M. Government (2018) *A Green Future: Our 25 Year Plan to Improve the Environmen*t, Department for Environment, Food & Rural Affairs, available at: https://www.gov.uk/government/publications/25-year-environment-plan

HM Treasury (2017) *Autumn Budget 2017: Building the homes the country needs*, HM Treasury, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/661430/Building_the_homes_the_country_needs.pdf

H.M. Treasury (2018) *The Green Book: Central Government Guidance on Appraisal and Evaluation*, H.M. Treasury, London, available at www.gov.uk/government/publications or directly at: https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-centralgovernent

HM Treasury (2019) *Spring Statement 2019*, Philip Hammond's speech of 13th March 2019, HM Treasury, available at https://www.gov.uk/government/speeches/spring-statement-2019-philip-hammonds-speech

Holmans, A. (2013) New estimates of housing demand and need in England, 2011 to 2031, *Town & Country Planning Tomorrow Series Paper 16*, TCPA, available at: https://www.architectsjournal.co.uk/Journals/2013/09/10/v/x/p/HousingDemandNeed_TCPA2013.pdf

House of Commons (2019a) House building targets, *HC Debates*, Westminster Hall, 11th June 2019, c308WH.

House of Commons (2019b) Department for Environment, Food and Rural Affairs: Annual Report and Accounts 2018–19, *HC 2389*, House of Commons, Crown copyright.

Johansson, P-O. (1991) The compensation principle and the social welfare function, *An Introduction to Modern Welfare Economics* (pp. 22-39). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511582417.004

Journal, The (2013) New homes plan for Callerton shock family who moved to 'countryside', The Journal, 25th June 2013, available at: http://www.thejournal.co.uk/news/north-east-news/new-homes-plan-callerton-shock-4419766

Kasuga, H. and Takaya, M. (2017) Does inequality affect environmental quality? Evidence from major Japanese cities, *Journal of Cleaner Production*, 142(4): 3689-3701, https://doi.org/10.1016/j.jclepro.2016.10.099.

Land Registry (2019) *UK House Price Index*, available at landregistry.data.gov.uk/app/ukhpi

Larson LR, Jennings V, Cloutier SA (2016) Public Parks and Wellbeing in Urban Areas of the United States. *PLOS ONE*, 11(4): e0153211. https://doi.org/10.1371/journal.pone.0153211

Lawton, J.H., Brotherton, P.N.M., Brown, V.K., Elphick, C., Fitter, A.H., Forshaw, J., Haddow, R.W., Hilborner, S., Leafe, R.N., Mace, G.M., Southgate, M.P., Sutherland, W.J., Tew, T.E., Varley, J. & Wynne, G.R. (2010) *Making Space for Nature: a review of England's wildlife sites and ecological networks*. Report to Defra, available at: https://webarchive.nationalarchives.gov.uk/20130402170324/http://archive.defra.gov.uk/environment/biodiversity/documents/201009space-for-nature.pdf

Levrel, H., Scemama, P. and Vaissière, A-C. (2017) Should We Be Wary of Mitigation Banking? Evidence Regarding the Risks Associated with this Wetland Offset Arrangement in Florida, *Ecological Economics*, 135: 136-149, available at: https://doi.org/10.1016/j.ecolecon.2016.12.025.

Lynch, O. (2018) Huge Newcastle residential development set for go-ahead, Insider Media Limited, available at: https://www.insidermedia.com/insider/northeast/huge-newcastle-residential-development-set-for-go-ahead

Maller C, Townsend M, Ptyor A., Brown P, St. Leger L. 2005. *Healthy nature healthy people: 'contact with nature' as an upstream health promotion intervention for populations*. Oxford University Press, Oxford.

Marmot M. 2010 *Fair society, healthy lives: The Marmot review; strategic review of health inequalities in England post-2010*, Institute of Health Equity, University College London.

Maron, M., Brownlie, S., Bull, J.W., Evans, M.C., von Hase, A., Quétier, F., Watson, J.E.M. and Gordon, A. (2018) The many meanings of no net loss in environmental policy, *Nature Sustainability*, 1: 19–27, https://www.nature.com/articles/s41893-017-0007-7

MHCLG (2019a) *House building; new build dwellings, England: March Quarter 2019*, The Ministry of Housing, Communities and Local Government, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/814487/House_Building_Release_March_2019.pdf

MHCLG (2019b) *Live tables on affordable housing supply*, The Ministry of Housing, Communities and Local Government, available at: https://www.gov.uk/government/statistical-data-sets/live-tables-on-affordable-housing-supply

Mowen, A., Orsega-Smith, E., Payne, L., Ainsworth, B. and Godbey, G. (2007) The Role of Park Proximity and Social Support in Shaping Park Visitation, Physical Activity, and Perceived Health Among Older Adults, *Journal of Physical Activity and Health*, 4: 167-179, available at: https://pdfs.semanticscholar.org/3b0e/7387cda3a2d129b073ce75a3b8dea7582919.pdf

Natural Capital Committee (2017) *Economic valuation and its applications in natural capital management and the Government's 25 Year Environment Plan*, UK Government, London, available from the UK Government website: https://www.gov.uk/government/groups/natural-capital-committee or directly from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/608850/ncc-natural-capital-valuation.pdf

Onaindia, M., de Manuel, B.F., Madariaga, I. and Rodríguez-Loinaz, G. (2013) Co-benefits and trade-offs between biodiversity, carbon storage and water flow regulation, *Forest Ecology and Management*, 289: 1-9, https://doi.org/10.1016/j.foreco.2012.10.010.

ONS (2018) *Value of nature implicit in property prices – Hedonic Pricing Method (HPM) methodology note*, Office for National Statistics, London.

Partington, R. (2018) Construction of homes for social rent drops 80% in a decade, *The Guardian*, 22nd November 2018, available at: https://www.theguardian.com/society/2018/nov/22/construction-of-homes-for-social-rent-down-80-percent-on-a-decade-ago-england-families-waiting-lists

Pearce, D.W., Markandya, A. and Barbier, E.B. (1989) *Blueprint for a Green Economy*, Earthscan, London, DOI: 10.4324/9780203097298

Perino, G., Andrews, B., Kontoleon, A. and Bateman, I.J. (2014) The value of urban green space in Britain: a methodological framework for spatially referenced benefit transfer, *Environmental and Resource Economics*, 57(2): 251-272, DOI 10.1007/s10640-013-9665-8

Phelps, J., Webb, E.L. and Adams, W.M. (2012) Biodiversity co-benefits of policies to reduce forest-carbon emissions, Nature Climate Change, **2:** 497–503, DOI: 10.1038/NCLIMATE1462

Pod Newcastle (2018) Callerton Park, Newcastle, Pod Newcastle, available at: https://podnewcastle.co.uk/portfolio-item/callerton-park-newcastle/

Power A, Davis J, Plant P, Kjellstrom T. 2009. *The built environment and health inequalities. Task group submission to the Marmot Review*, Institute of Health Equity, University College London.

Pretty J, Peacock J, Hine R, Sellens M, South N, Griffin M. 2007 Green exercise in the UK countryside: Effects on health and psychological well-being, and implications for policy and planning. *Journal of Environmental Planning and Management*, 50(2):211-231.

Public Health England (2013) Health Profile 2013: Newcastle upon Tyne available at: http://www.newcastlegatesheadccg.nhs.uk/wp-content/uploads/2015/02/HealthProfile2013NewcastleuponTyne00CJ1.pdf

RGS (2019) *Life on the Edge: a suburban enquiry*, Royal Geographical Society, available at: https://www.rgs.org/CMSPages/GetFile.aspx?nodeguid=2866b0c3-6f28-483a-bdd3-0c610b21b643&lang=en-GB

RTPI (2019) *RTPI response to Defra consultation on Biodiversity Net Gain*, The Royal Town Planning Institute, London, available at https://www.rtpi.org.uk/knowledge/consultations/2019-responses/rtpi-response-to-defra-consultation-on-biodiversity-net-gain/

Scholes, R. J. and Biggs, R. (2005) A biodiversity intactness index, *Nature*, 434: 45–49, https://www.nature.com/articles/nature03289

Stevens, T.H., More, T.A. and Markowski-Lindsay, M. (2014) Declining National Park Visitation, *Journal of Leisure Research*, 46:2, 153-164, DOI: 10.1080/00222216.2014.11950317

Suff, P. (2013) Paterson favours biodiversity offsetting, *Transform*, IEMA, available at: https://transform.iema.net/article/paterson-favours-biodiversity-offsetting

Turner, R.K. & Daily, G.C. (2008) The Ecosystem Services Framework and Natural Capital Conservation, *Environmental and Resource Economics*, 39(1): 25-35. https://doi.org/10.1007/s10640-007-9176-6

Wende, W., Herberg, A. and Herzberg, A. (2005) Mitigation banking and compensation pools: improving the effectiveness of impact mitigation regulation in project planning procedures, *Impact Assessment and Project Appraisal*, 23:2, 101-111, DOI: 10.3152/147154605781765652