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Net Gain: Seeking better outcomes for local people when mitigating biodiversity loss from development

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Abstract

Economic development projects are increasingly applying the mitigation hierarchy to achieve No Net Loss, or even a Net Gain, of biodiversity. Because people value biodiversity and ecosystem services, this can affect the wellbeing of local people, however these types of social impacts from development receive limited consideration. We present ethical, practical and regulatory reasons why development projects applying the mitigation hierarchy should consider related social impacts. We highlight risks to local wellbeing where projects restrict access to biodiversity and ecosystem services in biodiversity offsets. We then present a framework laying out challenges and associated opportunities for delivering better biodiversity and local wellbeing outcomes. Greater coordination between social and biodiversity experts, and early and effective integration of local people in the process, will ensure that efforts to reduce the negative impacts of development on biodiversity can contribute to, rather than detract from, local people's wellbeing.

Introduction

New and upgraded roads, railways or ports, energy generation and transmission, extractive industries; all bring economic benefits but are also major drivers of global biodiversity loss >. In response, countries, companies and financial institutions are increasingly requiring that such development projects achieve 'No Net Loss', or even 'Net Gain', in biodiversity throughout their operations [2]. Ultimately much of the justification for mitigation of biodiversity impacts comes from the recognition that nature provides ecosystem services to society (from globally valued services such as carbon sequestration, to services with local value including provisioning of wild-sourced foods or recreational opportunities [3]). It is therefore perhaps ironic that the impacts on people from such efforts have, until recently, received relatively little attention [4]. The mitigation of biodiversity loss can and does affect people [5–9].

No Net Loss or Net Gain policies (hereafter Net Gain) require that, following the mitigation hierarchy [1]> (Figure 1), biodiversity losses are avoided and minimised as far as possible during the project design. Residual impacts are then remediated (e.g., by restoring habitat temporarily cleared), and any remaining biodiversity losses are 'offset' by equivalent and measurable biodiversity gains elsewhere. There are ongoing debates about the extent to which the mitigation hierarchy can indeed deliver Net Gain [11,12], and the ethical implications of the underlying commodification of nature [13,14]. However the approach is spreading rapidly. A 2018 survey identified approximately 13,000 biodiversity offset projects in operation worldwide [2], the UK government has recently announced legislation requiring a Net Gain in biodiversity from future developments [15], and a Net Gain is required in Critical Habitats for major development projects with International Finance Corporation funding [16].

It is good practice for economic development projects to account for both their environmental and social impacts, and to do so early in the planning process [17–1]>. However, there has been a strong tendency for these two categories of impacts to be dealt with separately [4,20]. Furthermore, the impacts are dealt with only in the context of the impact of the development project, not of its knock-on effects. This means that where biodiversity loss, or associated mitigation efforts, results in negative social impacts, these can easily be overlooked as they are considered by neither the environmental nor social impact assessment teams [9]. Failing to consider local people's values for nature might also result in missed opportunities to benefit

people while achieving a Net Gain in biodiversity, or for local people to play a role in delivering effective conservation [21].

The idea that application of the mitigation hierarchy should consider both biodiversity and associated ecosystem services (the benefits society gets from natural ecosystems) is increasingly recognised [4,2]>. In this paper we focus on local people (those living close to the development or its associated biodiversity offsets) and highlight how their wellbeing can be affected by loss and gain in biodiversity and ecosystem services caused by a development project and associated mitigation activities. We present ethical, practical and regulatory reasons why development projects should consider this issue when implementing the mitigation hierarchy. We highlight the particular risks to local wellbeing associated with the most controversial part of the mitigation hierarchy (biodiversity offsetting). Finally, we present a framework which identifies challenges and possible opportunities for delivering better biodiversity and local wellbeing outcomes from application of the mitigation hierarchy.

Local wellbeing and the mitigation hierarchy

The biodiversity of, and ecosystem services provided by, an area can impact the constituents of human wellbeing [2]> in a variety of ways (Figure 2). For example biodiversity underpins provisioning of basic necessities such as food, fuel and shelter for millions of people, especially in lower income countries [24], while functioning ecosystems can offer natural pest control [25] or flood protection [26] benefits. In these ways both provisioning and regulating ecosystem services contribute to material wellbeing. Spending time in nature can positively impact both physical and mental health [27] and social cohesion [28], and for some indigenous communities is inextricable from cultural identity [21,29]. Cultural ecosystem services can therefore contribute to material, subjective and relational wellbeing. Both a development project, and the activities undertaken to avoid, minimise, remediate and offset the consequent loss of biodiversity, can affect all components of local people's wellbeing, by either changing the supply of ecosystem services or local people's access to them (Figure 2). Taking account of the values to people deriving from the biodiversity and ecosystem services in their local area, through participatory processes, could therefore result in better outcomes for people when applying the mitigation hierarchy.

The final stage of the mitigation hierarchy (biodiversity offsetting) compensates for unavoidable residual biodiversity losses. This happens either through ecological restoration ('restoration offsets') or by making a contribution to preventing biodiversity losses ('avoided loss offsets'). For both these types of offset, the offset may be some distance away from the development (potentially meaning different components of biodiversity are restored/conserved compared to those that were lost). This has implications for wellbeing, as those who benefit from biodiversity and ecosystem services in the proposed offset area may be different from those who lose out in the proposed development site >. Such changes in distributional equity are particularly concerning where pre-existing inequalities are exacerbated [30]. For example wetland mitigation banks in the US have tended to result in relocation of wetlands away from urban areas, resulting in the loss of ecosystem services previously used by poor and marginalized communities [31].

Particularly significant wellbeing impacts are likely to arise from offsets that require local people to lose, or have restricted access to, biodiversity and ecosystem services on which they

depend for their livelihoods (Figure 3, quadrant a). Avoided loss offsets have prevented small scale farmers in Madagascar [3>], and Sami reindeer herders in Sweden [33], from carrying out their traditional agricultural practices. However, the risk that avoided loss offsets pose to wellbeing depends very much on local context (Figure 3). If local people do not depend on the biodiversity and associated ecosystem services at the offset site, or the creation of the offset does not restrict people's access to them, there is unlikely to be a strongly negative impact of offsetting on local wellbeing.

Reason to consider potential wellbeing impacts

Ethical reasons

Many businesses have made explicit commitments to act ethically [3>]. Policy makers also face a moral obligation to consider the indirect impacts of their environmental policies on people, and to consider justice or equity impacts of these policies [35]. The application of the mitigation hierarchy has implications for distributional equity (by affecting who gains and who looses access to biodiversity and ecosystem services) and procedural equity (those most affected by the changes may have least influence). As always, pre-existing inequalities among stakeholders in assets and power can exacerbate the impacts of changes while simultaneously preventing those most affected from having a real voice in the process [30]. For this reasons, the values for biodiversity and ecosystem services held by poor or marginalized local people deserve particular consideration in the design of efforts to mitigate the impact on biodiversity loss from development.

Practical reasons

Dealing transparently and effectively with issues of local concern contributes to building the trust essential for companies to obtain a social license to operate [3>]. This is well recognised with respect to many of the impacts from development which affect local people (such as traffic and noise), however lack of attention to local biodiversity and ecosystem services values may also pose a risk to business. For example, a planned housing development at Lodge Hill in Kent (UK) stalled for many years due to the likely impact on one of Britain's most significant populations of nightingales (*Luscinia megarhynchos*). A plan to offset these impacts by creating new nightingale habitat patches up to 50 km away was criticized on grounds of feasibility [37], but local people also argued that they would not be able to hear the nightingales calling from the new sites, representing a significant and real loss. The amenity value of the nightingales to local communities was not adequately considered in the initial offset plan and their objections have been important in preventing the development going ahead so far.

Secondly, where offsets involve slowing biodiversity loss caused by local people's livelihood activities, biodiversity outcomes simply cannot be achieved without involving local people. A major mine in Madagascar's eastern rainforests aimed to offset their forest loss through a project that tried to slow the deforestation that was being driven by small-scale farming outside the mine's footprint. The mine provided agricultural support to local farmers to facilitate a move away from shifting agriculture towards more settled and lower-impact forms of agriculture. However research shows that the people most involved in clearing forest were those that were least likely to benefit from agricultural support activities [3>]; potentially undermining the effectiveness of the offset.

Finally, by demonstrating alignment with best practice, developments may obtain permits or funding more efficiently. While local values for biodiversity and ecosystem services are currently often not fully considered, best practice guidelines do suggest they need to be addressed. For example, the prominent Business and Biodiversity Offset Programme (BBOP) Standard [1]> explicitly states that biodiversity offsets should achieve no net loss of biodiversity with respect to "*species composition, habitat structure, ecosystem function and people's use and cultural values associated with biodiversity"*

Regulatory reasons

Policies which make provisions for the use of variations on the mitigation hierarchy exist, or are being developed, in over 100 countries >. While these do not tend to explicitly require that biodiversity Net Gain initiatives incorporate social considerations, some mention ecosystem services in general terms [4,22]. One hundred and ninety six countries are signatories to the Convention of Biological Diversity which last year adopted guidelines for safeguards in biodiversity financing mechanisms (including biodiversity offsetting). These explicitly refer to fair and equitable participation of indigenous peoples and local communities [38]. In addition, most countries have related policies on sustainable and equitable development. For example, while not legally binding, 150 countries adopted the UN's Sustainable Development Goals in 2015. Many countries have principles of sustainable and equitable development enshrined in their development plans (e.g. Namibia's "2030 Vision"). More generally, most countries have ratified human rights legislation which protects individuals from dispossession or harm. Within human rights law, states should ensure that private parties, including businesses and NGOs, do not violate human rights and should provide an effective remedy if violations occur [39].

Where Net Gain initiatives are implemented at least partly in response to lender requirements, high standards concerning social outcomes are expected. For example, the International Finance Corporation (IFC) Performance Standard 6 mandates No Net Loss or Net Gain of biodiversity in certain situations (IFC Performance Standard 6) but compliance is expected with the full set of Performance Standards. This means that, despite confusion among some stakeholders, the stringent protections to local people who are involuntarily displaced - physically or economically - by a development project (Performance Standard 5), also apply to those displaced by its Net Gain activities, including any offset >. Similarly, disadvantaged or vulnerable groups and indigenous people are due special consideration under Performance Standards 1 and 7 respectively.

Addressing wellbeing in the mitigation hierarchy

Griffiths and colleagues suggest that the desired social outcome from Net Gain activities is that "*Project-affected people (appropriately aggregated) should perceive the component of their wellbeing associated with biodiversity losses and gains to be at least as good as a result of the development project and associated biodiversity offset, throughout the project life cycle, than if the development had not been implemented*" >. There are well-recognised challenges to achieving biodiversity Net Gain, and many have analogues in efforts to deliver positive social outcomes. Below we present a framework highlighting eight key challenges for efforts to deliver good outcomes for people as well as biodiversity from the mitigation hierarchy, and potential ways forward (Table 1). We hope that by laying out these issues side-by-side, we will help those tasked with designing and delivering Net Gain initiatives to address both together.

One well-recognised challenge in the biodiversity Net Gain approach is that there is no one metric which captures the richness and complexity of biodiversity and can be used to compare biodiversity losses and gains [40,4]>. Similarly, human wellbeing cannot be measured using narrow economic measures, such as GDP or personal income. To assess the impacts of an intervention on wellbeing, a combination of objective indicators (demonstrating tangible changes), and subjective indicators (which provide insight into how people are feeling about any changes), is required [23,42]. We therefore suggest that such multidimensional indicators of wellbeing [43] should be used when considering the impacts of the application of the mitigation hierarchy on wellbeing.

Another important critique of biodiversity offsetting has been the concern that irreplaceable elements of biodiversity will be destroyed [4]> which, by definition, cannot truly be compensated for by investment in conservation elsewhere. There are likely to be elements of biodiversity and ecosystem services which local people consider irreplaceable, even if they are not of particular conservation concern to a wider set of stakeholders. For example, this would apply to aspects of the natural environment which underpin identity and sense of place for indigenous communities [21], but may equally apply to areas of particular recreation importance. Such components of biodiversity and ecosystem services therefore cannot be offset without negative impact on local wellbeing. These impacts should be avoided at the first stage of the mitigation hierarchy wherever possible. If this is not possible, the trade-offs need to be acknowledged (that if the project goes ahead there will be an inevitable loss of local wellbeing). A requirement for transparency on such points should generate pressure to avoid such situations; ideally pushing developers back up the mitigation hierarchy to focus more on avoidance and reduce reliance on offsetting.

In calculating biodiversity outcomes, a dynamic reference scenario is often used [1]>. This can mean that if biodiversity is declining anyway, the losses and gains due to development and its mitigation efforts are calculated relative to that declining baseline [44]. Under this sort of reference scenario, 'Net Gain' can be achieved even if biodiversity in the landscape continues to decline against some historical baseline as long as it is declining more slowly than would otherwise have been the case (an understandably controversial result). In contrast, a 'static' baseline, requires that biodiversity is kept at (or improved on) the level measured at the start of the development regardless of ongoing decline expected in the absence of development. In the case of wellbeing impacts, we suggest that the use of a dynamic baseline may not be appropriate if human wellbeing in the area would have been expected to decline in the absence of the project. It is not sufficient for the project to simply achieve a slowing of that decline – it should demonstrate an improvement compared to the pre-project situation. This places an additional burden on developers, but we feel that it is appropriate because local people are unlikely to be convinced by counterfactual arguments; if they see their local wellbeing declining in the context of investments for national economic development and biodiversity conservation, this will be perceived as a real-terms loss (even if in counterfactual terms it is a gain). In areas where wellbeing is declining, therefore, an aspiration of static or improving *absolute* wellbeing should be adhered to. However, if wellbeing is expected to be static or improving without the project, then it is necessary to demonstrate a Net Gain *relative* to the increasing trend. This asymmetry of baselines means that the presumption concerning which baseline to use is tipped in favour of maximising the benefit to local people.

In the biodiversity Net Gain literature there is extensive discussion about the extent to which 'out-of-kind' offsets should be allowed (when losses in one species or habitat type are

compensated with gains in another [1]>). Many argue that out-of-kind offsets are acceptable as long as they result in 'trading up' (where gains are made for species or habitats that are more threatened than those lost due to development [41]). For wellbeing impacts, out-of-kind compensation could relate to different and more highly-valued biodiversity and ecosystem services than those which are lost. Or it could relate to different components of wellbeing [22]; for example the affected groups could prefer investment in their local school or even cash transfers rather than replacement of biodiversity elements. The critical element in deciding what can be considered equivalent is effective participation of stakeholders in decision-making. This does not mean that biodiversity loss can trade off against gains in wellbeing; biodiversity Net Gain still needs to happen regardless of how local wellbeing losses due to loss of access to biodiversity and ecosystem services are compensated.

We suggest that wellbeing should be maintained (or improved) for at least as long as the negative impacts that are being mitigated are likely to persist. In practice, one-off compensation is likely to be used-which may not compensate for the time horizons over which losses of access to natural resources maybe felt [4]>. A mining company operating in Sami reindeer herder territory, signed a legally binding document committing to continued dialog to ensure interference from the mine on local livelihoods was minimized [33].

The uncertainty in delivering biodiversity gains from restoration or avoided loss offsets is often accounted for by requiring a larger area of offset than the area lost by development [4]>. Similarly, uncertainties in measuring impacts on wellbeing could be accounted for by taking a precautionary approach and aiming above the target.

Another critique of biodiversity Net Gain has been the issue of time lags; biodiversity losses due to development may occur immediately, but gains generated through biodiversity offsets may take time to materialise [4]>. From the perspective of human wellbeing, similar time lags may occur with people's access to biodiversity and ecosystem services being prevented immediately, but livelihood compensation activities taking time to implement [32]. This needs to be considered, and interim compensation may be required to ensure no one is left worse off at any stage in the project implementation process.

Finally, another important critique of biodiversity offsetting has been the risk that the conservation investments may not be additional. This is a particular risk where biodiversity losses due to development are offset by investment in strengthening protected areas which would likely have been conserved anyway [4]>. Similarly, when considering the local wellbeing outcomes from biodiversity Net Gain, any measures to improve wellbeing to counteract losses in wellbeing (due to loss of biodiversity or restricted access to ecosystem services) should be over and above existing commitments.

Although many of these points are very familiar to anyone involved in implementing social safeguards around development projects, the social issues are often not well considered by those designing and implementing strategies to mitigate biodiversity loss >. Given that conservation is essentially a social process, failure to fully involve local people means the conservation is unlikely to be a success [21], as well as bringing risks that the conservation directly harms local people. This framework cannot be applied without close involvement of local people themselves; which is why early and effective stakeholder engagement is so vital.

Conclusions

Global investment in infrastructure has increased substantially over the last decade, and is predicted to continue to rise; probably reaching US$3.8 trillion a year by 2040 [4>]. A range of policy drivers are increasingly pushing economic development projects to aim for a No Net Loss and ideally a Net Gain in biodiversity. The impetus for strong biodiversity policies tends to originate in the understanding that biodiversity ultimately underpins human wellbeing through ecosystem services [3]. However, the common separation of environmental and social expertise (among policy makers, regulatory bodies, or in companies implementing development projects), means that the social impacts of biodiversity losses, and efforts to mitigate these losses, are often overlooked. Given the significance of biodiversity and ecosystem services to the wellbeing of local communities, local values therefore need to be better incorporated into the design and implementation of any efforts to mitigate biodiversity losses. This will require effective participatory processes which fully engage local stakeholders early in the project planning process. There will inevitably be situations where there are challenging trade-offs, and the best mitigation measures for global biodiversity values may conflict with ensuring local ecosystem services are retained. However, application of our framework to the mitigation hierarchy will help ensure that efforts to reduce the negative impacts of development on biodiversity contribute to, rather than potentially harm, local people's wellbeing.

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Author contributions

Conceptualization, all authors; Writing-original draft J.P.G. J.; Writing-review and editing, all authors.

Declaration of Interests

The authors declare no competing interests.

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Figure 1:

The mitigation hierarchy. Avoiding, minimising and remediating impacts on biodiversity, and offsetting any residual impacts, can (at least in theory), result in No Net Loss or Net Gain in biodiversity overall. (NB versions of this figure are common in the literature; the earliest being from Rio Tinto[5]>).

Figure 2:

The impact of a development project and the mitigation hierarchy on local wellbeing. A development project and all stages of the mitigation hierarchy can change the availability of, or access to, ecosystem services and therefore can impact local people's wellbeing.

Figure 3:

The potential impacts on local wellbeing from an "avoided loss" offsets. These will vary with local dependence on biodiversity and ecosystem services, and the extent to which the offset restricts access.

Table 1. Framework highlighting the key challenges associated with the application of the mitigation hierarchy with suggested ways forward for ensuring biodiversity outcomes (adapted from Bull et al., 2013), and parallel approaches to promote positive wellbeing outcomes.

Challenge	**Ways to promote good outcomes for biodiversity**	**Ways to promote good outcomes for human wellbeing**
How to measure outcomes?	Biodiversity cannot be measured with a single, simple metric. Multiple indicators (ideally also incorporating ecological function), are therefore needed to generate proxies for biodiversity value.	The impacts of losses and gains in biodiversity (and associated measures to mitigate biodiversity loss) on people's wellbeing needs to be measured as a multidimensional concept using locally derived indicators. Simple indicators, such as household income, are not sufficient.
What impacts are unacceptable?	Where development impacts irreplaceable biodiversity, or where impacts would be irreversible, Net Gain cannot be achieved through offsetting. For example, loss of ancient woodland, or species extinction).	Certain wellbeing impacts cannot be compensated for to achieve sustainable and equitable social outcomes from biodiversity Net Gain (e.g. loss of irreplaceable cultural sites).
What reference scenario to use?	Biodiversity losses and gains need to be calculated relative to a defensible reference scenario. This may be a static scenario (the status of biodiversity when the policy was introduced) but dynamic reference scenarios (where losses and gains are measured relative to what would have occurred in the absence of the development) are often also used.	It will not be appropriate to measure losses in wellbeing due to a development project and its application of the mitigation hierarchy relative to pre-existing declines in wellbeing. Therefore use a static baseline unless local wellbeing is expected to increase, in which case the wellbeing of affected people should continue to improve at least as fast as if the development had not occurred.
What is considered equivalent?	In some cases, out-of-kind compensatory actions (i.e. offsetting losses in one habitat with gains in another) can be appropriate provided they 'trade up' (i.e. loss in less threatened	If local people are to be compensated for losses, the form of compensation may differ as long as affected groups consider that their wellbeing is at least as good as if the development project and biodiversity Net Gain

	habitat is replaced with gain in more threatened habitat)	activities had not occurred. This assessment should be based on a participatory process.
How long should the Net Gain activities last?	Biodiversity Net Gain should be achieved for at least as long as the negative impacts on biodiversity being mitigated.	Wellbeing should be maintained (or improved) for at least as long as the negative impacts that are being mitigated.
How should uncertainty be dealt with?	Uncertainties (e.g. due to measurement of biodiversity loss or gains, or the effectiveness of planned restoration) should be incorporated into the plan.	Uncertainties (e.g. in measuring impacts on subjective wellbeing and background trends in wellbeing) should be incorporated into the plan.
How should time lags be dealt with?	If mitigation activities run alongside a development project, there are likely to be time lags between losses of biodiversity due to developments and any compensation. Mitigation banks are often used to avoid such time lags.	Time lags in local wellbeing should be avoided. Transitional activities might be required to compensate for immediate costs if mitigation activities involve activities which will take some time to deliver gains.
How can 'additionality' be ensured?	Offsets must result in conservation that would not have occurred in the absence of the development project and its commitment to Net Gain.	Effort to compensate for losses to wellbeing should be over and above existing obligations so as to be genuinely additional.