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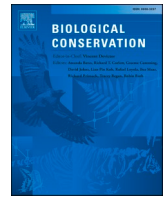
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Review

Social impacts of biodiversity offsetting: A review

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ABSTRACT

Biodiversity offsetting is the widely studied last step of the mitigation hierarchy. Despite numerous studies and the methodological development completed for biodiversity calculations, the human aspect remains unsolved. Biodiversity conservation is typically governed at national or state levels, but the harm caused to biodiversity as well as people occurs locally. In biodiversity offsetting, biodiversity values can be relocated far from the original area, but relocating the values people hold regarding their nearby nature may not be possible. Acknowledging the local people's hopes and values may further complicate biodiversity offsetting, therefore it emphasises even more the need to avoid and reduce the negative impacts, i.e. the earlier steps of mitigation hierarchy.

In this review we present the current understanding of the social impacts on biodiversity offsetting based on scientific literature. We identified a clear research gap in relation to the opportunities local people have to participate in decision-making processes related to biodiversity offsetting. Biodiversity offsetting can cause the displacement of local people and negatively affect their livelihood, but there is little literature on that aspect of the offsetting procedure. In addition, biodiversity offsetting can cause loss of livelihood or living area in the Global South while impacts in the Global North are often more indirect. Ways to compensate the losses to local people vary from land use rights in other areas to economic compensation. It is unclear if there are offsetting protocols which are acceptable both socially and in terms of biodiversity.

1. Introduction

Biodiversity offsetting (later **BO**) is the procedure of compensating for the residual loss or harm caused to nature by human activity by taking restoration or conservation actions in another location. BO represents the fourth and last step of the mitigation hierarchy (Griffiths et al., 2018, 2019) and it aims at contributing to nature conservation actions. Ideally, BO maintains and improves the state of biodiversity, and simultaneously enables important economic development projects (Bull et al., 2017). BO is mainly used in large-scale projects in industry, mining or road and railway building, but it is also considered in, for instance, land use planning (Persson et al., 2015). As a nature conservation tool, BO has been developed from the perspective of preserving and compensating ecological values. Meanwhile, BO's social impacts and the possibilities to strengthen the conservation of ecological values via better understanding of the social impacts remain less discussed (Ruoso and Plant, 2021).

Nature biodiversity has declined globally for decades (IPBES, 2018)

despite of good practices such as mitigation hierarchy. The mitigation hierarchy and compensation was originally introduced in the US in conservation-related legislation in the 1970s at the same time that the No Net Loss principle (NNL) was introduced (Damiens et al., 2021). The concept became more popular only later in the early 2000s as extractive industries did not agree with no-go zones proposed by IUCN and transnational NGOs (Damiens et al., 2021). As a result, voluntary guidelines, offsetting, planning and restoration were introduced into the discussion, and BO represents a compromise between heavy use of natural resources and the requirements of nature protection (Damiens et al., 2021).

Partially due to its history, BO is a contested concept in nature conservation. Apostolopoulou and Adams (2017), along with Ferreira and Ferreira (2018), emphasise that offsetting's narrowing and simplifying character is rooted in the concepts, models and language of economics (see also Lewontin and Levins, 1980). When attention is focused on credits and exchange, difficult-to-calculate immaterial values such as the intrinsic value of nature or the cultural values of local communities

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are easily excluded from the analysis. The discussion about BO has mainly been about an attempt to achieve nature conservation in way that enables economic growth, not about transformative change of the ways economies are organised to achieve strong sustainability (Damiens et al., 2021). To enable strong sustainability, BO needs to better allow for the acknowledgement of other social values than the economic value of the development project. Furthermore, excluding the perspectives of local stakeholders and inhabitants may reduce the potential to achieve successful restoration and conservation in the Global North (Apostolopoulou and Adams, 2019; Karlsson and Edvardsson Björnberg, 2021; Taherzadeh and Howley, 2018). Similar problems exist in the Global South: Heiner et al. (2019) stated there is a need to recognise indigenous people's traditional knowledge also because it can support nature conservation goals.

Traditionally, nature conservation has been separated from social aspects. This is especially due to the Western, enlightenment-based scientific perception, which tends to make a separation between humans and nature and views nature as wild and untouched (Cronon, 1996). In line with this, environmental policies are still widely made only to prevent or reduce harmful impacts caused by humans on nature instead of accounting for the multiple ways in which nature and humans have co-evolved and are inseparable (Biermann, 2020). This has led to the perception that the involvement of local inhabitants in nature conservation always implies a loss to nature (Cronon, 1996). In line with this, BO also often fails to acknowledge social acceptance and local community needs (Apostolopoulou and Adams, 2019; Bidaud et al., 2018; Bidaud et al., 2017).

Social impacts of nature conservation stem often from restricted access to land, which has implications on livelihoods and recreational opportunities and, especially in the context of indigenous people, also on sociocultural habits and customs and can even change the ways people relate to their surroundings (West et al., 2006). While the impacts may in some cases be positive, often the needs of society and biodiversity run contrary to each other in a dual sense. First, the development initiative threatens biodiversity and in some cases also the other ways of using the area by local inhabitants, and second, the attempt to compensate for the lost biodiversity can further threaten the needs of local inhabitants via land acquisition or restricted access to resources. In practice this can mean for example lost livelihood security (Bidaud et al., 2017; Huff and Orengo, 2020) or fewer green places around lower middle-class residential areas (Apostolopoulou and Adams, 2019). Conservation initiatives based on market and value calculation (of which some BO procedures represent examples) can even go deeper in influencing local inhabitants' livelihoods and their relationship to nature. This can increase pre-existing inequalities and social differentiation by, for example, changing the price and accessibility of the area earlier utilised by indigenous people or other traditional land users (Holmes and Cavanagh, 2016). Understanding the different meanings nature provides to humans helps to recognise values and beliefs which guide actions and can help successful nature conservation (Ives et al., 2017).

Because environmental problems and conservation questions are also political issues, discussion of values, preferences and opinions is needed. This can be achieved by engaging citizens in participatory planning (Sterling et al., 2017) to improve, for example, informed decisions in trade-off situations between conservation and development (Maestre-Andrés et al., 2020). In conservation projects, stakeholder engagement is generally considered useful for proper consideration of the social dimensions (Sterling et al., 2017). The inclusion of local people in any development projects can also ease the implementation of the project and decrease resistance (Sterling et al., 2017). A more collaborative and participatory process thus can lead to better conservation results (Scholte et al., 2016; Sterling et al., 2017).

In particular, trust building via transparency, early communication, attention to local stakeholders' perceptions and attitudes as well as joint knowledge production and shared responsibilities have been identified as important for successful conservation (Sterling et al., 2017).

Sustained long-term relationships and social capital building over decades with strong two-way commitments to maintain relationships can improve conservation considerably (Sterling et al., 2017). Furthermore, in some cases local farmers, forest users and fishers can even be "the best natural allies for conservation" (Berkes, 2004, p. 628), even though they are not the first ones usually involved in conservation practices (see also Alcorn, 1993; Redford and Stearman, 1993). Local farmers, forest users and fishers possess core knowledge about the areas and their utilisation. Adapting conservation to their knowledge and practices can reduce conflicts and generate effective conservation (Berkes, 2004).

In this paper, we review the scientific literature focusing on the social dimensions of biodiversity offsetting. We looked for evidence on how local people are engaged when planning or conducting offsetting and what are the identified social and cultural impacts of BO implementation. We present examples of solutions that have been presented to meet the needs of social acceptance and participation and conclude how the BO procedure, as we see it, with the most potential to secure both biodiversity and human aspects, could be developed further. Regarding to terminology, we use BO when we refer to biodiversity offsetting in general, and BO procedure when refer to the process of planning and implementing BO in a particular setting. We emphasise that we do not promote a biodiversity offsetting protocol where social values could replace biodiversity. Instead, we should be looking for a system where these are evaluated in parallel on every step of the mitigation hierarchy. This means that no such development projects should be allowed, which cannot be realized without the no net loss of biodiversity and only acceptable changes in social values at the local level.

2. Materials and methods

We conducted a literature review with the Scopus and Web of Science databases. We used an opportunistic search of relevant literature, the so-called snowball method, to find essential keywords for the actual search algorithm (Perez-Bret et al., 2016). Snowballing means that we started with a set of keywords and added new ones after identifying new relevant papers via the reference lists of the papers we had already read. The aim was that in the end the selected keywords described the situation we were interested in.

Finally, we used all the most common term variations of biodiversity offsetting, plus "social", "cultur*", "socio*", "people" and "stakeholder*" as keywords (Table 1). We searched for hits in title, abstract or keywords. In Web of Science, these three are called "topic". Our algorithms are shown in Table 1 and the summary of results frequency in Table 2. Our final search was made on 26 May 2021 and it includes the timespan 1960 to 2021.

Table 1
Search algorithms of biodiversity offsetting and involvement of people.

Database	Algorithm
Scopus	TITLE-ABS-KEY (("Biodiversity offset*") OR ("Conservation offset*") OR ("Ecological compensation") OR ("Ecological offset*")) AND ((social) OR (cultur*) OR (people) OR (socio*) OR (stakeholder*)) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "re") OR LIMIT-TO (DOCTYPE, "ch"))
Scopus additional information	Timespan: 1960–2021. Indexes: SCI-EXPANDED, SSCI, A&HCI, ESCL.Document type (article, review, book chapter), Publication stage (final)
Web of Science	You searched for: TS = (("Biodiversity offset*") OR ("Conservation offset*") OR ("Ecological compensation") OR ("Ecological offset*")) AND ((social) OR (cultur*) OR (people) OR (socio*) OR (stakeholder*))
Web of Science additional information	Refined by: DOCUMENT TYPES: (ARTICLE OR REVIEW OR EARLY ACCESS) Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, ESCL.

Table 2
Result frequency. Final search made 26.5.2021.a

Database	Amount of hits	Total amount of hits ^a	Included to the analysis
Scopus	511	741	45
Web of Science	230		

^a Doubles removed.

Our search resulted in 741 scientific articles. However, not all of them actually dealt with biodiversity offsetting and considered the social aspects of the method. To identify the relevant articles, we carefully read through all the abstracts. We made the final selection based on three criteria. First, we included only those papers in which the social aspects of BO were actually considered. This meant excluding papers which only briefly mentioned the search words in their abstracts. Second, we included only papers focusing on biodiversity offsetting and excluded environmental compensation studies, because the environmental or eco-compensation studies in our search did not really deal with biodiversity offsetting. Third, we concentrated on terrestrial BO cases and excluded studies from the marine environment. In most cases of marine biodiversity offsetting, compensations were only made for livelihood (to local fishermen) and clear evidence of actual biodiversity offsetting could not be verified.

In the scientific literature, *ecological compensation* and biodiversity offsetting are not synonyms. According to our qualitative content analysis ecological compensation concentrates often on securing livelihoods and ecosystem services (see e.g. Zhang et al., 2012): at the same time, it has weaker linkage to securing biodiversity.

We noticed that for example in China, ecological compensation has been developed further as “eco-compensation” where main weight is in “taking into account the costs and benefits of environmental goods and services in economic activities” (Development Asia, 2017). Terminology differences emphasises terminology overlaps in scientific literature, which challenges further research. Terminological variation exists also between continents, and there is no single procedure which is already involving biodiversity values and social values. In this study we wanted to ensure that we focus on paper where biodiversity values are secured.

. After reading all the abstracts and, in promising cases, the entire articles, we identified 45 articles relevant for our analysis. We accepted articles written in English only. Books or conference papers were not included. The relatively small amount of the relevant articles (6%) compared to initial search results shows how the social aspects are not often considered. The rather general search words invited a considerable number of irrelevant articles only using such words as social or people without really paying attention to social impacts of BO.

We analysed the articles quantitatively regarding the years of publication and countries of the first author. Our main analysis, however, was qualitative content analysis. We carefully read the articles and identified the type of the article and the subject related to the social aspects of BO. We ended up with three categories of article types: empirical case studies of BO, analyses of BO-related policies and review articles, including conceptual papers. Related to the social aspects we classified the articles into four themes: social impacts, societal impacts, procedural development and social acceptability. This qualitative classification is built on a multidisciplinary understanding of the topic and it includes biological and social scientific scholarship. The subject-based classification was made based on the way social aspects were approached in the articles. In some cases, the social aspects were not the main topic of an article, but they included important information related to them. In the following section we start with basic qualitative information about the articles. We then present our analysis via four main categories, Social impacts (Section 3.1), Societal implications (Section 3.2), General preferences, acceptability and motivation to participate (Section 3.3) and Procedural challenges and limitations (Section 3.4).

3. Results

The 45 studies relevant for this analysis represent a varying set of empirical and conceptual studies published between 2008 and 2021, a timespan which indicates that social considerations have appeared only relatively recently in the scientific literature on BO (Fig. 1). Most of the articles are written by researchers working in universities at the UK, Australia and Canada (Fig. 2). When compared to the review on general BO studies conducted by Gonçalves et al. (2015), we can note that also the amount of BO studies in general has been increasing considerably between 1999 and 2015. Lead authors from the USA dominated the general BO studies (Gonçalves et al., 2015), while in our review the UK was considerably more emphasised (Gonçalves et al., 2015). One reason for this could be wetland restoration tradition in USA; wetlands are rarely inhabited by people, whereas studies in UK in our scope dealt with biodiversity conservation in or near urban areas. The strong presence of Australian studies is similar in both studies. The rise in UK-based studies can also be partially explained by the time-lapse between the two studies, in 2015 BO was only under testing in the UK (Gonçalves et al., 2015).

The majority of the studies (20) were empirical case studies with at least one element related to studying the perspectives of local people on BO (Fig. 3), 13 articles were classified as policy analyses and 12 articles represented wider reviews of conceptual development of BO. The most common theme related to the social aspects of BO was procedural development of offsetting (16 articles). These were often reviews and conceptual discussions about the needs to develop offsetting procedures to better include social aspects. The identification of social impacts was almost as common, with 13 articles. Social acceptability and the wider societal impacts of BO were less common with 9 and 7 articles respectively. Social acceptability was only dealt in empirical case studies. In some cases, the article included more than one theme. In these cases, we have categorised the article here based on the main theme. The basic information and classification of 45 journal articles, also including multiple themes, is presented in the attachment as Table 3. In the following section, we introduce the themes in detail.

3.1. Social impacts

In the papers in our data, “social” often meant mainly economic or livelihood security (Calvet et al., 2019; Griffiths et al., 2018, 2019; Yu et al., 2016). Several papers suggested different natural scientific frameworks for approaching these issues (Bull et al., 2015; Tallis et al., 2015). The rare participatory elements were mostly about asking about local people's perspectives on, for example, impairment of the nearest natural/green area and how it will affect their way of living (Taherzadeh and Howley, 2018). Social involvement was usually passed off as making an interview afterwards, not actively searching for ways to do things

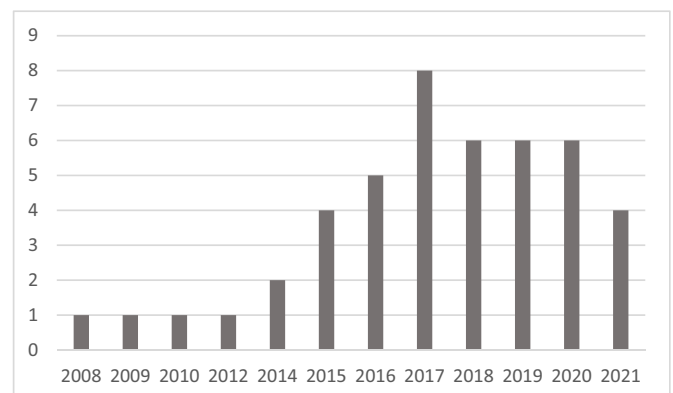


Fig. 1. Publication year and the yearly number of the papers ($n = 45$).

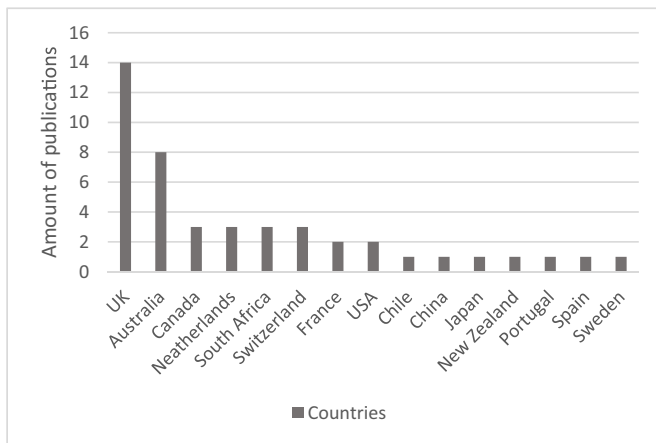


Fig. 2. Publication location by the first author country ($n = 45$).

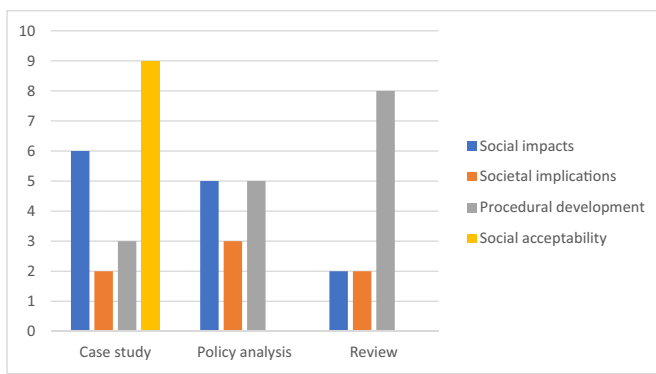


Fig. 3. Articles classified based on the type of the article and subject of the research. More detailed classification in Supplement, Table 3.

better. Furthermore, we found no papers describing the whole BO procedure from the inclusion of local people in the planning together with biodiversity values to the participatory phase and ending up with the actual establishment of a BO area and follow-up with local people about how the process affected their lives and how they felt they influenced the process. Despite this, the inclusion of people into the BO procedure was continually called for BO as well as NNL research papers (Griffiths et al., 2020; Ruoso and Plant, 2021; Scholte et al., 2016).

3.1.1. Threats to livelihoods

In general, it is well known that conservation initiatives can have multiple negative impacts, especially on the livelihoods of indigenous people (Vanclay, 2017). Problems occur when people who are deeply dependent on natural resources and the ecosystem services they provide are denied the use of those resources, such as the nearest forest, because an offset area is established (Bidaud et al., 2017) or because the area is destroyed by a development initiative (Seagle, 2012). In the latter case, the offsetting area may be placed hundreds of kilometres away (Hackett, 2015a). However, even if the offset area is placed close to the destroyed area, it may cause additional harm by preventing the use of the offset area as well (Bidaud et al., 2017).

Access to natural resources and the dependence on the surrounding resources vary highly among countries and areas. In the Global North, relatively few people are directly dependent on nearby nature for their livelihood, but in the Global South nearby nature is usually critical to an area's inhabitants (Bidaud et al., 2017; Seagle, 2012). For example, in Madagascar, Rio Tinto QIT-Madagascar Minerals affected land use possibilities and food security via a refusal to use a safe harbour bay (Huff and Orengo, 2020). Similarly, a study by Bidaud et al. (2017)

examined a threat to food security, while Yu and Xu (2016) looked at profound economic and cultural disruption caused to individuals and local communities in Indonesia. The most alarming cases threaten livelihoods through how the development causes degradation as well as through the offsetting protocols. Seagle (2012) looked at how a mining company downplayed the impacts of mining and made the sustainability problems appear to be caused by the local inhabitants, who had to cope with the rapid environmental change arising from the mine itself and to adjust to the more sustainable fishing practices introduced by the company (Seagle, 2012).

Offsets can displace people, especially in the Global South and among indigenous people in the Global North (Virah-Sawmy, 2015; Bidaud et al., 2017; Vanclay, 2017; Sonter et al., 2018). In Sonter et al.'s (2018) meta-analysis, 35% of offsets ($n = 70$) caused displacement (often reducing provisioning services), while there was no significant difference whether the reported offsets simultaneously negatively affected livelihoods. Sonter et al. (2018) view 35% as a conservative estimate, because the offsetting strategies and impact assessments can exclude displacement information (Sonter et al., 2018, p. 146). They also pointed out that "trade-offs between biodiversity and productive land uses may incur large costs to communities if not mitigated through additional means, such as financial compensation" (Sonter et al., 2018, p. 147, see also Franks et al., 2014; Mandle et al., 2015).

On the other hand, as a side effect, BO can secure untouchable habitats important for local livelihoods. In Alberta, Canada, Little Red River Cree Nation used BO as a tool to resist agricultural pressure from the surrounding areas (Hackett, 2015b). When the government or state lacks a formal instrument for BO, private operators can hijack markets and use conservation tools for reasons that run counter to their original purpose.

One form of securing livelihood is a payment to the landowner or farmer for producing ecological gains on their land. In France, farmers were concerned about farmland restrictions due to offsetting area needs, and an agri-environmental biodiversity offsets scheme that enabled the farmers to retain land ownership proved to be socially more acceptable than land acquisition for BO (Calvet et al., 2019). According to the study, this new form of land use must fit with old practices and a sufficient level of payment needs to be offered to achieve farmers' willingness to participate in offsetting procedures (Calvet et al., 2019).

Different ways to secure livelihoods were also used in large hydro-power projects in Indonesia, Thailand and Vietnam (Yu and Xu, 2016). In Indonesia, fish cage aquaculture was developed to mitigate local food and population crises. In Thailand, diverse mechanisms were used, such as direct financial compensation for resettlement, community development funds, and payment for ecosystem services schemes. In Vietnam, the compensation was made by benefit-sharing mechanisms such as electrification of affected communities and providing access to reservoir fisheries (Yu and Xu, 2016).

Governance of the use and protection of natural resources is typically separated from the livelihood impacts and different development actions. In extreme cases, this makes the implementation of social rights clearly lag behind the implementation of biodiversity aspects in pursuing offsetting schemes (Bidaud et al., 2018). This means benefits and costs are not equally shared in BO projects (Bidaud et al., 2017). One example of this was the time delay between the immediate restrictions and associated development activities in Madagascar (Bidaud et al., 2017).

3.1.2. Place-based cultural and recreational values

In relation to BO, many of the nature values that matter the most to people are place based, related to spiritual and cultural connections to a certain area. In Western countries, the place-based values are not commonly spiritual but rather described as a connection to nature, nearby nature or recreational values (Karlsson and Edvardsson Björnberg, 2021). Spiritual values are difficult to offset because they are inherently unique and connected to a certain place (Maron et al., 2016),

but other sociocultural values, such as recreational values, are more easily replaceable (Griffiths et al., 2020). However, the social and financial price can be high if, for example, the important areas for biodiversity and social sustainability do not fully overlap.

Griffiths et al. (2020) studied the impacts of the Bujagali Hydro-power Dam project on six villages in Uganda. The main concerns caused by the dam and BO related to (a) spiritual beliefs, rituals and ceremonies, (b) nature and (c) changes in cultural heritage. They noticed special difficulties in addressing proper compensation to affected people when they had lost spiritual and sacred places. The difficulties related to assessing the lost values due to, for example, the reluctance of people to talk about them and to the uniqueness of the places (Griffiths et al., 2020). The researchers recommend the use of a practical decision framework that could be incorporated in the Environmental and Social Impact Assessment (ESIA) process to evaluate environmental, social and cultural values proactively (Griffiths et al., 2020).

In addition to the location of the harm, it is important to pay attention to the location of the offset. Burton et al. (2017) studied the social acceptability of placing offset areas in a different country than where the harm was caused and found that people favoured domestic biodiversity offsetting. This can also be seen as an attachment to a place: local biodiversity values were regarded as important to be secured locally. Green areas and forests are important to citizens as places for recreation and relaxing and the risk of being destroyed or settled as a compensation area worries people. In cities this aspect is even more concrete than in the countryside. People value surrounding nature whether they lived in Australia or United Kingdom and any impairment of it was not well-liked (Apostolopoulou and Adams, 2019; Burton et al., 2017).

Similarly, Scholte et al. (2016) recognised that people who have lived since their childhood in East Lothian in the UK resisted additional housing the most. The reason for this could be that additional housing is seen as a threat to their cultural identity, which cannot be compensated by the suggested woodland restoration (Scholte et al., 2016). Indeed, rural development may have social impacts in addition to environmental impacts and the increase of urbanities in the area changes not only the landscape but also the lifestyle of those living there before the development (Scholte et al., 2016, see also Antrop, 2004; Primdahl et al., 2013).

Yu and Xu (2016) reflected on the social impacts of large hydro-power projects, which often cause involuntary resettlements. They highlight that planning the resettlements together with the settlers may help to achieve the ecological targets because the resettlement causes additional biodiversity loss that should be minimised (Yu and Xu, 2016).

3.2. Societal implications

In addition to direct social impacts, BO can shape also societal practices, language used and the ways nature conservation is understood. A recurrent argument for opposing BO in the articles focused on the economic valuation of nature values and market-based logic of the method (see e.g. Wilshusen, 2019; Apostolopoulou, 2020). This raised concerns regarding the kind of societal development BO represents. It is seen as continuing neo-liberalisation as well as being a part of a new public management type of governance, where measurable economic efficiency is emphasised and can override other, less easily measurable values (Hackett, 2015b; Apostolopoulou et al., 2018). This relates to what is actually accounted for and compensated in BO, but also to the impacts the existence of a BO procedure has for the society.

The expert-led process of determining the natural value at the development and offset sites is often inaccessible to local residents, which makes it difficult for them to challenge the calculations or try to get social values included. The BO procedure can increase the technical and scientific character of planning and restrict the abilities of the public to participate and influence decision-making regarding their living environment (Apostolopoulou, 2020). Wilshusen (2019) calls this the

techno-managerialisation of nature conservation, which can make nature conservation apolitical and just a part of calculation methods performed by private companies. The lack of transparency and participatory procedures creates distrust of BO (Lukey et al., 2017).

Ives and Bekessy (2015) have criticised the BO procedure because it aligns with a utilitarian ethic and rejects ethical barriers, leading to the destruction of biodiversity. Hackett (2015b) has also expressed concern about the shift in the nature conservation discussion, where "nature conservation projects are being twinned with economic development" (Hackett, 2015b, p. 65). The economic value and market-oriented nature conservation techniques do not mainly protect nature but instead benefit local communities economically, particularly in the Global South (Hackett, 2015b). While the ability to combine economic benefits and nature conservation may seem like a beneficial path, it risks the selection of those natural values that are most suitable for the economic development activities, the reduction of public funding for conservation, and the privatisation of green areas (Apostolopoulou, 2016). Stronger societal actors can use nature values as a justification to push their own values over weaker societal actors, which leads to the suffering of those less well off (Apostolopoulou et al., 2018). For example, in the UK, concerns over social unfairness have been raised. Offsetting policy is not class neutral if green areas are built over with block houses or executive houses or villas with large private gardens instead of securing access for the lower class (who live without their own yard) to nearby green areas (Apostolopoulou and Adams, 2019). This criticism questions the benefits of BO altogether and is inclined to dismiss it as a useful method for biodiversity conservation, which paradoxically may hamper the interest to improve the method and make it more socially and culturally compatible.

3.3. General preferences, acceptability and motivation to participate

An important part of the studies analysed the acceptability, preferences and motivations to participate in BO by local inhabitants and different stakeholders. In general, the acceptability and preferences are highly dependent on context as the scope and impacts of the BO and the development projects vary considerably.

Our search found a few agriculture-related offsetting studies where either farmers or people living in rural areas were interviewed regarding their BO attitudes (Calvet et al., 2019; Junge et al., 2009; Lindemann-Matthies et al., 2010; Lindemann-Matthies and Bose, 2007; Sigwalt et al., 2012). Calvet et al. (2019) studied French farmers' willingness to adopt an NNL kind framework known as an agri-environmental biodiversity offset schemes, where farmland was used as an offset area. Factors increasing farmers' motivation to participate involved a suitable socioeconomic situation including higher education, the fit of the BO requirements with the current farming system, the farm development project or the low profitability of the current farming system, retirement or activity reduction (Calvet et al., 2019). Motivation was also affected by social norms: farmers who think that agricultural institutions have a positive opinion on the needed changes are more likely to participate.

Similarly Ruoso and Plant (2021) noticed the need for farmers' encouragement to participate in biodiversity offsetting schemes. Their case study in Australia described challenges to encourage all local farmers to provide areas for offsetting (Ruoso and Plant, 2021). The willingness to participate in BO procedure is affected by experience about the methods, available resources and access to information and support, especially social bonding with farmers already participating to the scheme.

In Switzerland three studies concentrated on the willingness to increase biodiversity on field margins or in meadows (Junge et al., 2009; Lindemann-Matthies et al., 2010; Lindemann-Matthies and Bose, 2007). The main results were similar in each study: people were willing to increase plant biodiversity and especially flowering species in the landscape (Junge et al., 2009; Lindemann-Matthies and Bose, 2007) or they appreciated most species-rich field margins (Lindemann-Matthies et al.,

2010). The typical Swiss Alpine landscape with arable land was not the greatest preference of respondents (Lindemann-Matthies et al., 2010), which indicates that lay people may not be aware of typical species richness or native species appearance in the area.

In Uganda preferences and acceptability of BO were bound to economic compensation for impacts on livelihood. Tourism is an important source of livelihood in Uganda and equally shared economic development was a desired outcome from biodiversity offsetting projects: “people affected by the dam’s impact on biodiversity prefer compensation that benefits their whole village, rather than compensation that only benefits targeted individuals. Overall, tourism revenue-sharing was most preferred, with revenues invested in community development” (Griffiths et al., 2019, p. 167). Moreover, the more educated people suspected that revenue-sharing might not be equal and therefore resisted tourism and revenue sharing more than the poorest people did (Griffiths et al., 2019).

In Australia, Rogers and Burton (2017) studied people’s preferences for biodiversity offsets for shorebirds. The protection of more endangered species was seen as more important than non-endangered species were. In contrast to a general BO procedure, people showed more trust in third-party or government-led offset implementation than in the company responsible for the actions. The respondents preferred direct activities (e.g. restoration projects) rather than indirect ones (e.g. research programme) and they were strongly against locating the offset elsewhere than where the harm occurred (Rogers and Burton, 2017).

The general acceptability of offsetting was also examined in Australia, this time without the lost species example. Burton et al. (2017) tested local opinions with the help of a choice experiment to understand what is acceptable BO, in the case of a new gas plant in the vicinity beach. While the majority of respondents accepted the BO in general and accepted a combination of direct and indirect actions, only a minority of respondents preferred offset actions to be direct. Respondents also showed strong support (42%) for an offsetting model which guaranteed the survival of more endangered species. This supports the thinking that people do not only favour their own personal benefit when talking about biodiversity offsetting.

Scholte et al. (2016) analysed the acceptability of BO and found that inhabitants in the countryside in East Lothian (UK) strongly opposed additional housing if they had lived in the area for a long time. Suggested woodland offsetting did not help as a compensation for these people, because of the loss of familiar landscape with a high emotional value and the threat to their own cultural identity. The willingness to accept BO was strongly related to their attitude towards additional housing.

3.4. Procedural challenges and limitations

Part of the articles emphasised the procedural challenges by which we mean the conducting of the BO procedure and limitations related to accounting the social and societal impacts and the involvement of local people. It is not straightforward who those local people and stakeholders are who should have the right to be involved in the BO procedure, regarding what questions, and at which stages of the procedure the involvement should take place. Brownlie et al. (2013) recommended that stakeholders are engaged to identify the social and cultural values linked to biodiversity (and ecological) services at different spatial scales, and always as a precautionary approach. However, as Takacs (2020) notes, in BO there are typically many conflicting interests presented by different stakeholders and finding equitable balance between these can be challenging. A potential answer lies in developing more equitable decision-making systems that also able to account for the non-human interests and better represent the vulnerable human groups. According to his study deeper level of equity would be required in democracy implementation (Takacs, 2020).

Procedural variety and expected success in BO procedures and its social impacts are partly connected to the strength of governance.

Bidaud et al. (2017) presented four main reasons why biodiversity offsetting processes and results vary in different countries: “1) different legal context, 2) different social context (different levels of poverty), 3) different environmental context and 4) dependence on natural resources and ecosystem services for subsistence” (Bidaud et al., 2017, p. 2). Legal context is an important factor which determines variation in the harm caused to local people: some countries have well-regulated biobanking protocols and in general strong environmental laws (e.g. USA, Australia) while voluntary initiatives dominate in Africa (Bidaud et al., 2017, see also Madsen et al., 2011). The strong legal context helps to protect the rights of local people and can also enable participatory opportunities (Gelcich et al., 2017). This also means that procedures designed in different legal context may not automatically be very useful in designing offsets in other settings (Gelcich et al., 2017). These weaknesses manifested in a tangible way in southern Madagascar, where the mining company used weak institutions and corruption to benefit their own aims and the local people suffered in many ways (Huff and Orengo, 2020).

On the other hand, these differences can be seen as a possibility on the corporation responsibility side: beyond the legal requirements by different states, companies responsible for the development action can also widen their social responsibility and include livelihood aspects proactively in their implementation of the BO projects (Virah-Sawmy, 2015). Nevertheless, in every BO case in the Global North or South, there is a risk that indigenous people or other vulnerable and less influential or visible groups of people are not heard as stakeholders.

We found several reasons why the involvement of local people is not achieved in BO projects. For one, there were no studies describing the entire process of participation from design to results and its influence on the results of the BO procedure, such as the location or area restrictions of a new BO area. We did identify few studies which described the BO procedure from the citizen point of view, but we found no follow-up cases studying how these citizens reorganised their lives after the process or area restrictions.

A habitat banking implementation case study describes the situation in Catalonia, where the regional government developed its own habitat banking guidelines (Maestre-Andrés et al., 2020). The policy planning process was led in a top-down manner and included only those stakeholders who were familiar from earlier projects and previous working relationships rather than expertise on biological conservation (Maestre-Andrés et al., 2020). The process was envisioned to be easy and fast, which resulted in limited stakeholder involvement that included only habitat banking supporters and excluded, for example, the five biggest Spanish environmental NGOs (Maestre-Andrés et al., 2020). In a similar manner in Quebec, wetland conservation is strongly influenced by local politics, agricultural sector lobbying, and a long history of promoting urban and economic development (Jacob and Dupras, 2021). However, the introduction of an NNL principle could gradually shift the balance and enable wider considerations to emerge with potential for a better balance between biodiversity and social needs.

The core problem in including social aspects in BO procedure is the baseline of BO itself. Apostolopoulou and Adams (2019) summarised the problem this way: “The local population should understand that we are not providing compensation for them, we are providing it for the birds” (p. 221). Biodiversity values are not a problem in themselves, but the limitations they place on the involvement of social aspects may cause difficulties (Hackett, 2015b). Practitioners on the biological side may not see any critical problems in the BO procedure regarding the local people – the needs for understanding also social and cultural values related to nature areas might not even come into their mind (Brown et al., 2014). The highly normative notion of loss is considered to regard only ecological criteria, not sociocultural criteria, as they are not regarded as being part of nature conservation (Tahezadeh and Howley, 2018). These aspects are significant barriers to participatory making BO more attuned to its potential social impacts. Furthermore, for a proper consideration of the social aspects, local people should be involved

already during the project planning phase. If the public gets to participate only in plans that have already been made, the possibilities to influence will be very limited (Apostolopoulou and Adams, 2019).

Despite the calls for more research to clarify how to implement social and ethical aspects through BO procedure (Bull et al., 2017; Taherzadeh and Howley, 2018), we found no strong evidence that those involved in developing BO have made an effort to develop the process so that citizens are better involved – in the BO procedure overall or parallel participatory process for local inhabitants. We identified conceptual development towards socially sustainable BO in two articles only. Griffiths et al. (2018, 2019) proposed a “no worse off” principle, suggesting that already existing frameworks to evaluate human well-being should be incorporated into BO procedures. They call for all three well-being dimensions (material, subjective, and relational) to be considered in the NNL strategy and proposed that the Happy Planet Index, Well-being in Developing Countries framework, and Voices of the Poor to be incorporated into NNL (Griffiths et al., 2018, 2019). Takeda et al. (2021) developed mixed method evaluation for the BO procedure, where biological and social information are combined to develop the most sustainable outcome for all parties.

Developmental suggestions were more common in our data (Scholte et al., 2016), such as BO learning platforms and pilot projects with a broader focus to support inclusion and include social and governance dynamics (Gelcich et al., 2017). Scholars propose a three-step process for improving BO procedure to ensure a higher probability of project success, which can be achieved via learning platforms. BO should be “1) based on an understanding of stakeholder's needs and interest, 2) iterative and adaptive in nature from ecological, social, and governance perspectives, and 3) place based—designed for specific local ecological and socio-economic conditions” (Gelcich et al., 2017).

4. Discussion

Most of the social aspects of BO are related to activities in the development area and offsetting area, and to the processes related to the location of both areas (Fig. 4). Involvement of local inhabitants is a crucial step, but it has rarely been part of the BO procedure. Even when it has, people still do not feel to be heard (Apostolopoulou, 2020; Taherzadeh and Howley, 2018). Lack of involvement causes experience of inequality and being a less-valued-stakeholder in the process. Compensation for lost nearby green area might not be considered at all from the developer's side. Furthermore, economic compensation is

sometimes used instead of direct accessibility to substitutive natural areas. This is suitable in cases, where the impacts are related to livelihoods, but the loss of cultural values is more difficult to compensate financially. At the moment, it is questionable if it is even possible to successfully compensate for both biodiversity and local people's values at the same time.

Our analysis demonstrates how spiritual values are inherent and unique and therefore extremely hard to compensate for (Griffiths et al., 2020). Attachment to a certain familiar landscape might be impossible to compensate in any alternative ways (Scholte et al., 2016). We need more research to understand the variation of spiritual values related to a certain location (Gelcich et al., 2017; Griffiths et al., 2020).

Many of the studies described hypotheses related to the social impacts of BO, and the potential willingness of the local inhabitants to act in a certain way, without providing concrete studies of real-life cases. The BO procedure has only rarely been developed in relation to the involvement of local inhabitants (Griffiths et al., 2018; Scholte et al., 2016), and we found no case examples which would have tested new procedural propositions. The obvious complexity of BO is caused already by the biodiversity perspective (Moilanen and Kotiaho, 2018a, 2018b) and may challenge the aim to complement it with social perspectives.

The critique of BO that it is just a helping hand of economic development questions the benefits of BO altogether and is inclined to dismiss BO as a useful method for biodiversity conservation. This may paradoxically hamper the interest to improve the method and make it more socially and culturally compatible. In addition to neoliberal criticism, it has been shown that offsetting has historically been promoted by reformist approaches, which supports economic growth without consideration of biocultural limits (Damiens et al., 2021). We agree with the conclusion by Damiens et al. that “without deep structural changes, NNL and offsetting are at high risk of being mobilised as ‘symbolic instruments’” from both biological and social perspectives.

Acceptable and biologically and socially successful use of BO is partly bound together with the strength of governance and the relevant level of administration. The lack of proper legislation in the Global South (Bidaud et al., 2017) leads to undesirable outcomes where the economic structure and livelihood of local people is tightly connected to local nature (Bidaud et al., 2017; Huff and Orengo, 2020). Traditionally, BO is used in a larger industrial scale and conservation policy and decisions are also mainly national or state level issues (Gibbons et al., 2018; Moilanen and Kotiaho, 2018a, 2018b). The scale for assessing both the loss and the offset is too large when harms occur locally both to

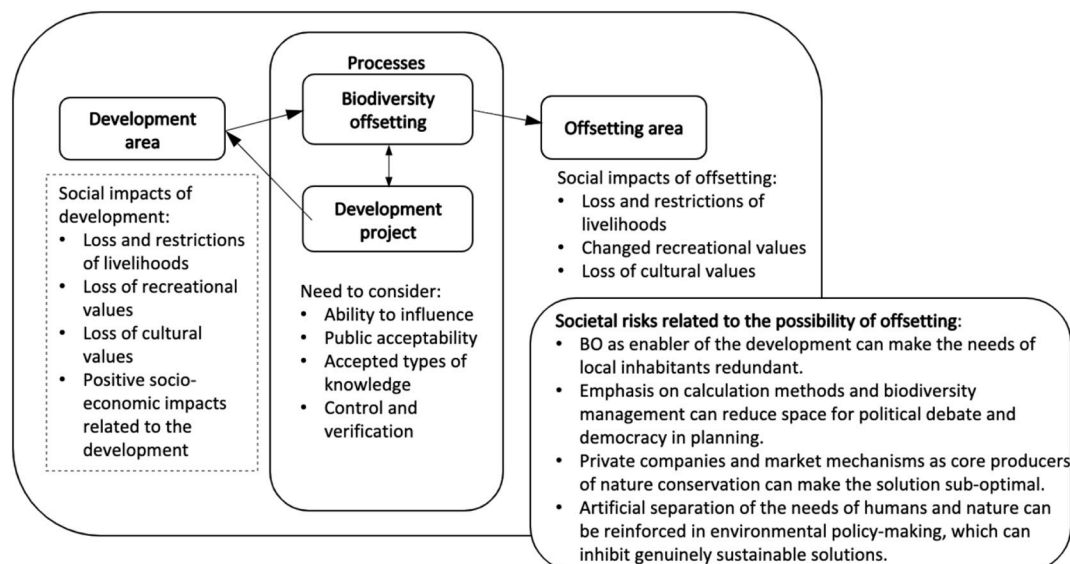


Fig. 4. The social implications of biodiversity offsetting.

biodiversity and people.

One of our main interests in this study was to determine what kind of opportunities (and how) have been offered for local stakeholders in BO projects. After the analysis, we can conclude that currently there are almost none; in a few cases which covered stakeholder's opinions were not specific case studies during BO procedure but more post detecting or general instead (Apostolopoulou, 2020; Apostolopoulou and Adams, 2019; Taherzadeh and Howley, 2018). We detected a clear research gap in relation to participation in decision-making processes related to BO. If BO is solidifying its use as a workable procedure to secure biodiversity values, further research is needed to develop and test frameworks which are acceptable in terms of biodiversity as well as social values. Also needed the inclusion of participatory methods in the earlier steps of mitigation hierarchy. It should pay attention to the consolidation of biodiversity values and the success of social involvement.

4.1. Why is it so difficult to get local people successfully involved in BO?

Local inhabitants and other stakeholders are not consulted because the BO procedure does not originally include participatory aspects. When people are included, the evidence on how their perspectives affected the results have not been presented (see Apostolopoulou and Adams, 2019). Including extra people in the BO procedure requires time, money and education, because lay people need to orientate themselves to the difficult biological-technical language of the discussion. This can be seen as an equity shortage if people are excluded in the process or receive no help in understanding the technical language.

In the case of BO, the involvement of local people would also be important to increase their understanding of the methodology and the facts behind it. At the same time, we need to notice that not just any kind of involvement fulfils local people's needs for participation: proper and successful involvement needs careful pre-work from developers to explore an affected area, social groups and stakeholders existing there, general attitude towards development projects and historical episodes which can affect general opinions.

According to one critique, biodiversity offsetting markets are built on the language, concepts and models of economics (Ferreira and Ferreira, 2018). When the whole BO procedure is based on economic concepts, it may be difficult verbalise or describe, for example, cultural values within the scheme. Similarly, Fraser et al. (2016) criticised quantitative approaches for lacking sensitivity to cultural values, especially in societies in the Global South.

In the Global North, BO has supported the expansion of urbanisation, which is often led by private funding and "a developer organisation" – as is the main idea in BO. While acknowledging the critique of the economic aspects of BO, we need to notice that after a new method is presented, it can be tested and modified, so that lessons can be learned and the method developed further. At the same time, it is important to ensure that BO is not used in ways that decrease living comfort and reduce access to nearby green areas.

Moreover, no researcher can alone handle the interdisciplinary challenge. In restoration science, it has been observed that practitioners have failed to "signal links between ecological restoration, society and policy and are underselling the evidence of benefits of restoration as a worthwhile investment for society" (Aronson et al., 2010, p. 143). Multidisciplinary research groups including social scientists are heavily needed to improve the understanding of local people's perspectives on BO and to develop better practices.

4.2. Socially involving and community-based biodiversity offsets

Community-based conservation, where local inhabitants are involved in the conservation activities via capacity building, is an existing framework (see for example: Berkes, 2007) and we suggest a similar kind of method to be introduced for BO. As we are currently in the middle of rapid biodiversity loss, we propose the unification of BO

procedures with already existing criteria for social wellbeing in BO or combining biological and social science data (Griffiths et al., 2018; Takeda et al., 2021). Further research should be made in close connection to practical solutions and real life cases. The better inclusion of social aspects should never replace biodiversity values. It should not be a complementary layer while planning the offsets, but a parallel analysis affecting how the no net loss state of biodiversity is achieved.

In Western countries where legislation enables planning procedures to more broadly include, for example, broader, socially involving approaches, BO could become a more successful conservation tool (Persson et al., 2015). This would help to see BO as the political decision it actually is: "by presenting offsetting as a technical issue, the problem of biodiversity loss due to development is depoliticized" (Apostolopoulou and Adams, 2017, p. 23). If the political nature of BO is acknowledged, it may also become more open for public discussion. Dempsey and Collard (2017) call for a stronger environmental movement and wider infiltration: "Could conservation organizations...be a part of a growing movement of a transnationally organized union of conservation labourers who could collectively demand higher payments for ecological debt?" (Dempsey and Collard, 2017, p. 38).

Collaborative and participatory planning, or the acknowledgement of social impacts of the project is not common in the BO literature. However, these aspects are commonly studied in relation to nature conservation, which provides useful guidelines also for BO procedures. Stakeholder engagement in nature conservation in general has been studied longer than it has within BO. Most of the critical literature in our data was related to the "stakeholder" keyword, which is contested in much of the critical social science literature but is less likely to be used in studies published in conservation journals (Sterling et al., 2017; Friedman and Miles, 2006). The lack of monitoring in many engagement projects contributes to a limited understanding of how they contribute to biodiversity outcomes. The perspectives of self-organised engagement were difficult to capture, because these efforts are generally underrepresented in the literature (Sterling et al., 2017).

5. Conclusions

Procedural development is needed to reach equitable outcomes for biodiversity and humans. Based on our results, multidisciplinary capacity building is needed in both science and society as a whole. Instead of including only ecologists or biologists in research teams, there should be more research on BO conducted by interdisciplinary and transdisciplinary teams to achieve a more holistic approach (Grimm and Redman, 2004; Redman, 1999; Taherzadeh and Howley, 2018; Takacs, 2020).

There is also a clear need for case studies where, in addition to participatory methods, a follow-up phase is included to evaluate the success of the BO as well as of the experienced involvement and compensation of lost areas for local inhabitants. We agree with Sterling et al. (2017) that interaction between varied academic professionals and lay perspectives and seeking to learn from other types of knowledge will help us to better understand what could be improved when engaging local inhabitants in biodiversity conservation as well as biodiversity offsetting.

Based on the reviewed papers, it is unclear if there are BO procedures which are acceptable both socially and in terms of biodiversity. Moreover, it remains to be studied which participatory methods generally work best with local stakeholders and if there are cases where the needs for biodiversity and local people can be reconciled. For example, in cities securing local biodiversity and also near green areas for people should be studied more carefully. Moreover, research projects observing personal small-scale biodiversity offsetting, which is based on the willingness of people instead of legislative necessity, seems to be totally lacking.

As long as BO procedure with proper parallel participatory and evaluation approach for social perspectives is lacking, the truly socially

just solutions are more likely to be found in the earlier steps of the mitigation hierarchy. BO focusing on biodiversity located far from people's homes may not help if they lose access to the nearest green area due to the construction that caused the BO in the first place. The lack of detailed studies prevent further conclusions but this finding may be especially relevant for those people who lack direct access to privately owned green spaces such as private gardens.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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