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Anna-Kaisa Tupala

The Role of Citizens in Biodiversity Offsetting



UNIVERSITY OF JYVÄSKYLÄ
FACULTY OF MATHEMATICS
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Yhteenveto: Tutkielma kansalaisten roolista ekologisessa kompensaatiossa

Eco-crises appear as low-hanging dark clouds just before the storm – the collapse of critical ecosystems on Earth. Several scientific reports show we are at an alarming stage of biodiversity and climate issues. If we wish to live on planet Earth, we need immediate action to mitigate the negative impacts our current lifestyle has on nature. Achieving the global targets of nature conservation and ecosystem restoration requires alternative methods of implementation. One attempt to secure Earth's ecological condition is a mitigation hierarchy. It is a decision-making framework supporting, among other things, conservation planning. The last step of the hierarchy, biodiversity offsetting, has played an important role in global nature conservation discussions for a couple of decades. While biodiversity offsetting and its methodological features are debated in academia, my dissertation focuses on a different aspect, individual people. Individual people, here called citizens, may have different roles, interests, and possibilities to conduct pro-biodiversity actions and participate in the sustainability transition. Procedurally, biodiversity offsetting offers very few options for citizen actors and simultaneously biodiversity offsetting poorly recognises social impacts caused by a development project or the setting of an offset area. Multidimensional nature relations in the current Finnish context provide insight into different actor roles of citizens regarding biodiversity questions and values represented in societies. The citizen potential for pro-biodiversity actions are framed through their attitudes and willingness for concrete actions, for example in private gardens. In this dissertation I clarify the gap between citizens' potential and the space of action reserved for them in enhancing biodiversity and in biodiversity offsetting especially.

Keywords: Biodiversity offsetting; biodiversity conservation; citizens; garden; mitigation hierarchy; nature relation; participation.

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Elämme ekokriisien aikaa, jonka vakavuutta useat kansainväliset tutkimusraportit korostavat. Tarvitsemme pikaisesti tekoja elämäntapamme aiheuttamien negatiivisten luontovaikutusten pienentämiseksi. Kansainvälisesti on asetettu kunnianhimoisia tavoitteita luontokadon pysäyttämiseksi mm. luonnonsuojelun ja ennallistamisen keinoin. Poliittisen tason rinnalle tarvitsemme muitakin vaihtoehtoja. Yksi vaihtoehto maapallon ekologisen tilan turvaamiseksi on lievennyshierarkia. Se on päätöksentekojärjestelmä, joka muiden ominaisuuksiensa ohella turvaa luonnonsuojelulle tuttuja päämääriä. Viimeinen askelma neliportaisessa hierarkiassa on ekologinen kompensatio, josta on keskusteltu luonnonsuojelu- ja yhteiskuntatieteissä vilkkaasti viimeisten parin vuosikymmenen ajan. Sillä välin, kun laajempi akateeminen tutkijajoukko keskittyy debatoimaan ekologisen kompensatian metodologisesta riittävydestä, otan väitöskirjassani toisenlaisen näkökulman ja tarkastelen ekologista kompensatiota ihmisistä käsin. Ihmisillä, kutsun heitä kansalaisiksi, voi olla erilaisia rooleja, kiinnostuksen kohteita ja haluja osallistua kestävyysmurrokseen sekä toteuttaa luonnon tilaa tukevia tekoja. Ekologinen kompensatio tarjoaa nykymuodossaan hyvin vähän osallistumisen mahdollisuuksia kansalaisille ja samaan aikaan se tunnistaa huonosti ihmisille aiheutuvia sosiaalisia vaikutuksia, joita aiheutuu sekä hankealueesta, jossa luonnon tilan heikennys tapahtuu, että sitä korvaamaan osoitetusta hyvitysalueesta. Ihmisten henkilökohtainen luontosuhde, suomalaisessa kontekstissa tutkittuna, antaa lisäymmärrystä eri rooleista ja toimijuuksista, joita kansalaisilla on suhteessa luonnon monimuotoisuuteen sekä yleisemmän tason yhteiskunnallisista arvoista. Kysyin kansalaisilta myös heidän omia näkemyksiään ekologisesta kompensatiosta ja valmiuksista konkreettisiin luontohyvityksiin esimerkiksi omassa puutarhassaan. Hahmottelen tässä kirjassa kansalaisten toimintapotentiaalia luontohyvityksiin eli pienen mittakaavan luontoposiitivisiin tekoihin niin luontosuhteen, kuin asenteiden ja toimintavalmiuden kautta.

Avainsanat: Biodiversiteetin suojelu; ekologinen kompensatio; kansalaiset; lievennyshierarkia; luontosuhde; osallistuminen; puutarha.

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CONTENTS

LIST OF ORIGINAL PUBLICATIONS

1	BIODIVERSITY NEEDS VOLUNTARY CITIZEN ACTION.....	9
1.1	Concepts and the development of the mitigation hierarchy.....	12
1.1.1	Mitigation hierarchy.....	12
1.1.2	Character of biodiversity offsetting and the perspective of the natural sciences.....	17
1.1.3	Game of terminologies.....	19
1.2	Citizens in biodiversity offsetting and challenges in participation.....	19
1.2.1	Citizens as environmental actors in society.....	20
1.2.2	Spaces for citizen action and engagement with nature.....	21
1.2.3	Biodiversity offsetting criticised for ignoring social impacts.....	23
1.3	Aims of this dissertation.....	24
2	METHODOLOGY IN THIS DISSERTATION	26
2.1	Approaches to understand societal biodiversity restoration and conservation questions.....	26
2.2	Data and data collection	26
2.3	Data analysis.....	28
2.3.1	Qualitative analyses	29
2.3.2	Quantitative analysis.....	29
3	MAIN FINDINGS OF THIS DISSERTATION	31
3.1	Social impacts of biodiversity offsetting: A review	31
3.2	The intricate diversity of human-nature relations: Evidence from Finland.....	36
3.3	What are citizen-level <i>nature amends</i> ? Rescaling biodiversity offsetting from a citizen perspective.....	44
3.4	Gardens' potential as a place for biodiversity: A case study among garden enthusiasts	48
4	CITIZENS AS ALLIES IN BIODIVERSITY CONSERVATION.....	53
4.1	Citizen participation in biodiversity offsetting	53
4.2	From identifying nature relations to exploiting them.....	54
4.3	Voluntary citizen, voluntary actions.....	55
4.4	Looking for common ground and recommendations for further research	58
5	CONCLUSIONS.....	59
	<i>Acknowledgements</i>	61
	YHTEENVETO (SUMMARY IN FINNISH)	64
	REFERENCES.....	68

LIST OF ORIGINAL PUBLICATIONS

The dissertation is based on the following original articles, which will be referred to in the text by their Roman numerals I-IV.

- I Tupala Anna-Kaisa, Huttunen Suvi, Halme Panu 2022. Social impacts of biodiversity offsetting: A review. *Biological Conservation* 267: 109431.
- II Raatikainen Kaisa J., Tupala Anna-Kaisa, Niemelä Riikka, Laulumaa Anna-Mari 2023. The Intricate Diversity of the Human-Nature Relations: Evidence from Finland. Submitted manuscript to *Ambio*.
- III Tupala Anna-Kaisa, Huttunen Suvi, Aro Riikka, Lizarazo Clara, Tuittila Satu 2023. What are Citizen-Level *Nature Amends*? Rescaling Biodiversity Offsetting from a Citizen Perspective. Submitted manuscript to *Conservation Science and Practice*.
- IV Tupala Anna-Kaisa, Laine Ilona, Raatikainen Kaisa J, Oldén Anna 2023. Gardens' Potential as a Place for Biodiversity: A Case Study among Garden enthusiasts. Manuscript.

The table below shows the contributions of the authors to the original papers. In papers II and IV planning was equally shared between each contributor.

	I	II	III	IV
Planning	AKT, PH, SH, RA	KJR, RN, AKT, AML	AKT, SH	IL, AKT, KJR, AO
Data	AKT, SH	RN, AKT, KJR, AML	ST, CL, AKT	IL
Analyses	AKT, SH, PH	KJR, AKT, RN, AML	AKT	AO, IL
Writing	AKT, SH, PH	KJR, AKT, RN, AML	AKT, SH, RA, CL, ST	AKT, AO, IL, KJR

AKT = Anna-Kaisa Tupala, SH = Suvi Huttunen, PH = Panu Halme, RA = Riikka Aro, KJR = Kaisa Raatikainen, RN = Riikka Niemelä, AML = Anna-Mari Laulumaa, ST = Satu Tuittila, CL = Clara Lizarazo, IL = Ilona Laine, AO = Anna Oldén

1 BIODIVERSITY NEEDS VOLUNTARY CITIZEN ACTION

As long as we have hope, we can act. If we lose hope, we are no longer motivated for important decisions or actions, such as saving biodiversity and ecosystems, the basis of our life. Humanity has proven able to make remedial changes: for example, the ozone layer has recovered because of persistent and long-lasting avoidance of ozone-depleting substances (WMO 2022), and millennium development goals for human well-being have been largely reached, such as reducing extreme poverty, hunger and child mortality by 50% (United Nations, 2015). Biodiversity targets aiming at conservation and sustainable use of biodiversity remain, however, unrealised (United Nations 2011, CBD 2023).

Eco-crises appear as low-hanging dark clouds just before the storm – the collapse of critical ecosystems on Earth. Several scientific reports produced by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), and the Intergovernmental Panel on Climate Change (IPCC) show we are at an alarming stage of biodiversity and climate issues (Montanarella *et al.* 2018, IPBES 2019, Pörtner *et al.* 2021). Land use for food production and housing causes environmental degradation (Montanarella *et al.* 2018), and major emissions to the air, water and terrestrial areas are results of, for example, our consumerist lifestyle and energy production (Akenji *et al.* 2016). Ecological crises frame our current life and require problem solving (Stockholm Resilience Centre 2022). If we wish to live on planet Earth, we need immediate action to mitigate the negative impacts our current lifestyle has on nature (Steffen *et al.* 2015).

Humankind seems to have a shared understanding of the seriousness of the ecological problems. Many political and international agreements have been made with targets to stop biodiversity loss and mitigate climate change (CBD 2023, UNFCCC 2023). One of the recent global agreement is to conserve 30% of terrestrial habitats and restore 30% of degraded ecosystems by 2030 (CBD 2022). The first *Convention on Biological Diversity* was signed at the 1992 Rio Earth summit to create a practical tool for translating the principles of Agenda 21 into reality. Convention was signed by 150 nations. After the first one there have been fifteen global meetings up to the year 2022 and every one of them has targeted to

reduce or stop biodiversity loss but without practical success. One reason for that might be the undervalued benefits of involving the local community, power of societal transformation and weak commitment of citizens (Armitage *et al.* 2020, Rice *et al.* 2020). Nations committed to the convention, such as Finland, have not been able to stop habitat destruction or the increase in the amount of endangered species (Hyvärinen *et al.* 2019). Insufficient voluntary targets have led to new mandatory requirements, for instance European Union restoration legislation (European Commission 2022).

One attempt to secure Earth's ecological condition is a mitigation hierarchy. It is a decision-making framework supporting among other things conservation planning. A mitigation hierarchy guides us to gradually consider the harm caused to nature from the avoidance of biodiversity loss to the compensation of it. The last step of the hierarchy, biodiversity offsetting, has played one role in global nature conservation discussions and target setting from the 1970s onward (Bonneuil 2015). Biodiversity offsetting is a procedure to relocate nature values to another location because of development projects, which destroy nature values in the first place. With a focus on the relocation of ecological values and their comprehensive compensation, halting biodiversity loss is theoretically possible.

There is a strongly arising interest toward biodiversity offsetting in land use planning and development projects as well as through biodiversity impact assessment via financial accounting. The Finnish Parliament enacted in December 2022 a new Nature Conservation Act defining conditions for biodiversity offsetting. Some voluntary biodiversity offsetting has been done in Finland already before and these were linked to certain species and their habitats (Pekkonen *et al.* 2020). New Nature Conservation Act tries to answer demands to clarify instructions for use of offsetting. Currently Finnish municipalities and private sector (e.g. retail trade, mining and energy companies) are looking for ways to incorporate biodiversity offsetting into use (Pekkonen *et al.* 2020, Hohti *et al.* 2022, Peura *et al.* 2023, S-ryhmä 2022). This curiosity may be driven by responsibility claims, public image, new business models in preparation, or a desire to be responsible.

While biodiversity offsetting and its methodological features are debated in academia (Walker *et al.* 2009, Bull *et al.* 2013, Gordon *et al.* 2015, Maron *et al.* 2015, 2016, Lindenmayer *et al.* 2017, Huff and Orengo 2020), my dissertation focuses on an aspect where nature conservation traditionally does not go: to individual people, because we need more scalable options for biodiversity enhancing.

People have organised their lives as societies. Individuals are the basic units of our society (Elias *et al.* 2010). As individuals, we carry different opinions and values, and we usually find other people who share our worldview. Some people like to do things alone, some of us are more productive as part of a group. I will call individuals in this thesis as citizens. Citizens can be motivated in various ways and, according to earlier studies, engagement in nature conservation actions varied between citizens but general similarities were found. Reasons for participating were personal beliefs regarding nature conservation, personal connection to nature, opportunity to be outdoors, physical well-being, social well-being and sense of belonging (O'Brien *et al.* 2010, Josefsson *et al.* 2017, Ganzevoort and van den Born 2020, Mac Donald and Staats 2022). In addition to

reasons for engagement, motivation can be strengthened by outer circumstances such as biodiversity crisis. The biodiversity crisis has increased people's awareness of the condition of nature and the desire to participate to biodiversity enhancing may rise as a result of this interest (Ministry of the Environment and Finnish Environment Institute 2022).

Here I refer to citizen-driven biodiversity enhancement as pro-biodiversity actions. Citizens may have different roles, interests, and possibilities to conduct pro-biodiversity actions and participate in the sustainability transition (see more about the term: EEA 2023, Finnish Environment Institute 2020). Here are some examples: citizens were encouraged to be partners in climate adaption (stormwater management) via the installation of green roofs in Amsterdam and Rotterdam by being educated about the risks of hard surfaces in gardens and motivated to change planted garden surfaces (Hegger *et al.* 2017). Household owners had multiple possibilities to take pro-biodiversity actions in their gardens in Dunedin, New Zealand, and promote native species or specific species groups such as freshwater macroinvertebrates, especially in urban areas in Leicestershire, UK (Hill and Wood 2014, van Heezik *et al.* 2020). Local people can, in addition, be part of area-based nature conservation, that is, the establishment of protected areas, as the community-based conservation concept suggests (Berkes 2021). Voluntary private property stewardship, so-called citizen actions, in cities can be supported by indirect incentives such as market-based certifications, or community-based initiatives – all of which can be used to combine individual actions in order to reach landscape-scale benefits (Cerra 2017). Regulatory models and voluntary strategies offer a diversified set of solutions and make it possible to encourage civic action. When climate or biodiversity actions are conducted on private property, they offer a new land area for use, especially in urban areas (Cerra 2017).

In a recent barometer about the *nature relations* of Finnish people, citizens were committed to securing biodiversity and over half of the respondents took actions for supporting biodiversity, such as eating and consuming in a more nature-friendly way (Ministry of the Environment and Finnish Environment Institute 2022). Thus citizens can be seen as change makers in sustainability transitions (see also Day *et al.* 2022). However, understanding citizen roles needs to be better addressed (Hegger *et al.* 2022), in particular in the context of biodiversity governance. Besides participation in pro-biodiversity actions, this means citizen participation in conservation planning processes.

Traditional nature conservation is usually optimised at regional scales, for example by using methods to spatially evaluate a network of sites which provide the best option for biodiversity (Ban *et al.* 2013). This kind of planning is, however, insufficient in considering social processes, namely dynamic interactions between individuals, institutions, social organisations and cultural norms (Ban *et al.* 2013). From a procedural point of view, citizen participation is often limited to tokenistic, only symbolic forms of attendance (Kiss *et al.* 2022). On the other hand, it is not self-evident that collaborative multi-stakeholder engagement automatically leads to an enhanced state of biodiversity (Kiss *et al.* 2022). Governmental actors are struggling with the problem of how to sufficiently engage citizens in the approaches reaching to climate or biodiversity

targets (Hegger *et al.* 2022). It is important to clarify what citizens expect of themselves in relation to biodiversity conservation and under which preconditions they can participate. Biodiversity offsetting as a new and attractive way of dealing with our unsustainable contemporary life is a potential venue for citizens to take action.

Here I study citizens, their participation in pro-biodiversity actions and their views on both biodiversity offsetting and their own nature relations. I focus on citizens as potential participants in official biodiversity offsetting procedures (I), as a public enjoying and reflecting on an outdoors art performance and their nature relationship (II), as consumers and inhabitants pondering about sustainable lifestyles and direct actions for biodiversity (III) and as gardeners deciding their own management practices (IV). I start with a deeper look into concepts important for this thesis: mitigation hierarchy and its development, and biodiversity offsetting. I continue with citizen participation possibilities in offsetting and their concrete chance to take pro-biodiversity actions. I illustrate a critique that has been presented of biodiversity offsetting and introduce why nature relations are important to acknowledge in this context. I end the introduction section with the aims of the thesis.

We need action. Ecological crises are happening right now and we need co-operation on multiple levels to work for a safer and sustainable future. This dissertation clarifies the gap between citizens' potential and the space of action reserved to them in pro-biodiversity actions and in biodiversity offsetting especially. Citizens have the potential to be more active participants in this work, but their role is mostly forgotten when international agreements and targets are set in negotiations.

We need both: national and international regulation but also voluntary, motivated, individual actions for our planet.

1.1 Concepts and the development of the mitigation hierarchy

1.1.1 Mitigation hierarchy

The mitigation hierarchy is a decision-making framework for studying and determining the harm caused to ecological systems (Phalan *et al.* 2018). The hierarchy is linked to biodiversity values and ecosystem services. Despite being one of the most adopted concepts to explain the interaction of social and natural systems, the ecosystems services concept simplifies human-nature relation into an economic point of view (Silvertown 2015, Ives *et al.* 2018). Thus I here concentrate only on the biodiversity values. The mitigation hierarchy has its roots in international discussions between nature conservation actors and economic actors (Damiens *et al.* 2021) but in this dissertation the framework is understood as a nature conservation tool.

The mitigation hierarchy has four steps: The first, *avoid* the impact, is important because it alone ensures the untouchability of natural areas, which is actual avoidance from the ecological perspective. This means that developers

have to predict and prevent negative impacts on biodiversity before development actions take place. For example, this means screening potential risks prior to project design and selecting an alternate development site (BBOP 2012, Arlidge *et al.* 2018, Phalan *et al.* 2018). Actions in this step include following environmental regulations designed to protect biodiversity, giving comprehensible guidelines on key biodiversity areas and political decisions of set-aside areas (Arlidge *et al.* 2018). The conservation benefits of avoiding impacts are usually greater than the effect of restoration activities on already damaged areas (Watson *et al.* 2016, Lindenmayer *et al.* 2017). Phalan *et al.* (2018) discuss different forms of avoidance and seek better outcomes for biodiversity through the development and detailed classification of the first step (table 1).

TABLE 1. Forms of avoidance in biodiversity offsetting. Rebuilt based on Phalan *et al.* (2018).

Type of impact avoidance	Where appropriate	Example	Reference
Project cancellation	Irreplaceable features with no viable alternatives, & where offsets unlikely to succeed	Development permit refused for São Luiz do Tapajós dam in Brazil.	(Vidal 2016)
		Titanium mine in Cardamom Mountains of Cambodia cancelled.	(Hance 2011)
Spatial avoidance	Lower-impact alternative locations can be identified	Site for desalination plant in Namibia selected to avoid tern colony.	(Aurecon & SLR 2015)
		Via Baltica road re-routed to avoid Rospuda Valley & other protected sites in Poland	(Niedziałkowski <i>et al.</i> 2013)
Temporal avoidance	Time periods when activities will not affect vulnerable features can be identified	Construction & seismic surveys suspended during breeding season of Steller's Sea eagles and seasonal presence of grey whales in Okhotsk Sea, Russia.	(Sakhalin Energy 2009)
		Logging activities in USA scheduled during dry periods to avoid erosion & sediment runoff.	(Bilby <i>et al.</i> 1989)
Design-based avoidance	Technology & planning can be used to modify project components to avoid specific impacts	Tunnelling equipment used to install pipeline underground below estuary in Ireland.	(Shell 2014)
		Logging operations to reuse old access roads instead of creating new ones in Central Africa.	(Kleinschroth <i>et al.</i> 2016)

The second step of the mitigation hierarchy, *minimise the impact*, refers to various ways of reducing the harm caused to the natural areas. Minimisation means, for example, saving valuable natural areas through project placement (Arlidge *et al.* 2018), wider buffer strips, and project planning that takes local ecological conditions into account. With minimisation, the aim is the smallest environmental damage caused, while still executing the project at the planned site.

The third step of the hierarchy, *restore* (also remediate or rehabilitate), is used when the minimising principle is insufficient and additional action for securing biodiversity is needed to assure no net loss, that is, no residual loss is left unfulfilled. Restoring is here produced at the same place where harm occurs. Restoration is a widely used method for degraded habitats, and it has been in use since the 1970s (Bonneuil 2015). The connection between restoration and the mitigation hierarchy evolved in the United States in wetland restoration (Gardner 2009). In Europe, restoration is used as standardised tool for habitat improvement as part of the conservation toolbox (see e.g. Flávio *et al.* 2017).

The fourth step, *offsetting the residual loss* (biodiversity offsetting), has been preferred by industry and land-use development projects. The use of the last step should indicate that all earlier steps are carefully considered and applied when possible, but ecological harm is considered unavoidable. Biodiversity offsetting is used, for example, in mining where natural habitats are lost permanently (open-cast mine) and earlier steps of the hierarchy, minimisation and restoration, are not manageable in practice. When a project is applied for in strictly protected areas such as Natura 2000, the fourth step is automatically used (Moilanen and Kotiaho 2020, Pekkonen *et al.* 2020), but the permit process stands for the first and second step.

The boundary between step 2 *minimise* and step 3 *restore* is sliding as well as sometimes between steps 1 *avoid* and 2 *minimise* (e.g. in cases where development area is only partly built and the rest of it is left in natural condition). The mitigation hierarchy has been described more as a web than a linear hierarchy: in contrast to visual illustrations, the steps are strongly linked and available choices depend on what kind of damage is caused to what ecological features (Moilanen and Kotiaho 2021). Discussions of correlation between spatial avoidance and design-based avoidance described by Phalan *et al.* (2018) versus *minimisation* remains open and needs to be addressed in future research.

The mitigation hierarchy has been tested in practice for five decades (Bonneuil 2015). Reviewing the achieved outcomes, there are many unsuccessful attempts with hierarchy implementation and especially with follow up of wanted outcomes (Phalan *et al.* 2018, Barbé *et al.* 2021, Evans *et al.* 2021, Gelot and Bigard 2021). This means that biodiversity has declined despite the use of the mitigation hierarchy. The problem is rather in implementation than in the hierarchy itself. For example, offsetting should be the last option used. When all alternatives have been considered and the process conducted right, use of offsetting should be highly expensive and thus mostly avoided. Depending on the development site and its location, landowners may be willing to pay a very high price to make profit on the land they own (Hytönen and Tupala 2022).

Partly due to the noticed problems, the mitigation hierarchy has been developed further. A few suggestions have been made on how the hierarchy could better meet the challenges of securing biodiversity (Fig. 1). The use of the entire hierarchy, not only the offsetting option, is highly important since earlier steps will reduce the time-lag between biodiversity losses and gains. Hierarchy works also as a preventative consideration framework for all planning and development projects (Fernandes *et al.* 2022). Phalan *et al.* (2018) made a great work by developing the avoidance step into a clearer and more coherent description of requirements for the use of that step (Table 1). They detailed key roles of conservation organisations in acquiring political will, improving impact assessment processes, building capacity and technical knowledge (Phalan *et al.* 2018).

Moilanen and Kotiaho (2021) suggest a twist between two last steps of the original mitigation hierarchy. They focus on methodological exploration in relation to net positive impact (NPI), which is an additional securing route for biodiversity offsetting to be a positive outcome for nature. The net positive impact complements the no net loss objective, the minimum target of which is to compensate for negative impacts on nature. Researchers approached NPI via a variation where changing the gains made by restoration in the third and fourth step are now quantified as positive add-on instead of reducing the caused impact, as in the traditional mitigation hierarchy (Moilanen and Kotiaho 2021).

Milner-Gulland *et al.* (2021) compiled a new formula of the mitigation hierarchy for a variety of situations and actors. They created a parallel four-step hierarchy, *refrain-reduce-restore-renew*, for conservation called the mitigation and conservation hierarchy (MCH) (Milner-Gulland *et al.* 2021). The MCH expands the old version in two ways. First, it is useable for sectors and impacts which have not applied the traditional hierarchy such as city councils, community groups, individuals, and sectors where “the impacts are sometimes geographically dispersed through long, complex value chains, and where environmental licensing does not require Environmental Impact Assessment” (Milner-Gulland *et al.* 2021). Second, the new mitigation and conservation hierarchy gives an opportunity to encompass any activities affecting nature – positive, negative, past, or current. Thus, by using the MCH, different actors can compensate historical, systemic and non-attributable biodiversity loss. The fourth step of their hierarchy, *renew*, covers proactive biodiversity actions beyond direct and visible impacts, such as cascading the impacts of supply change in the finance, media or tourism sectors (Milner-Gulland *et al.* 2021). Milner-Gulland *et al.* give examples of applications by national governments and companies, at sub-national levels (e.g. cities, NGO’s) and by the general public.

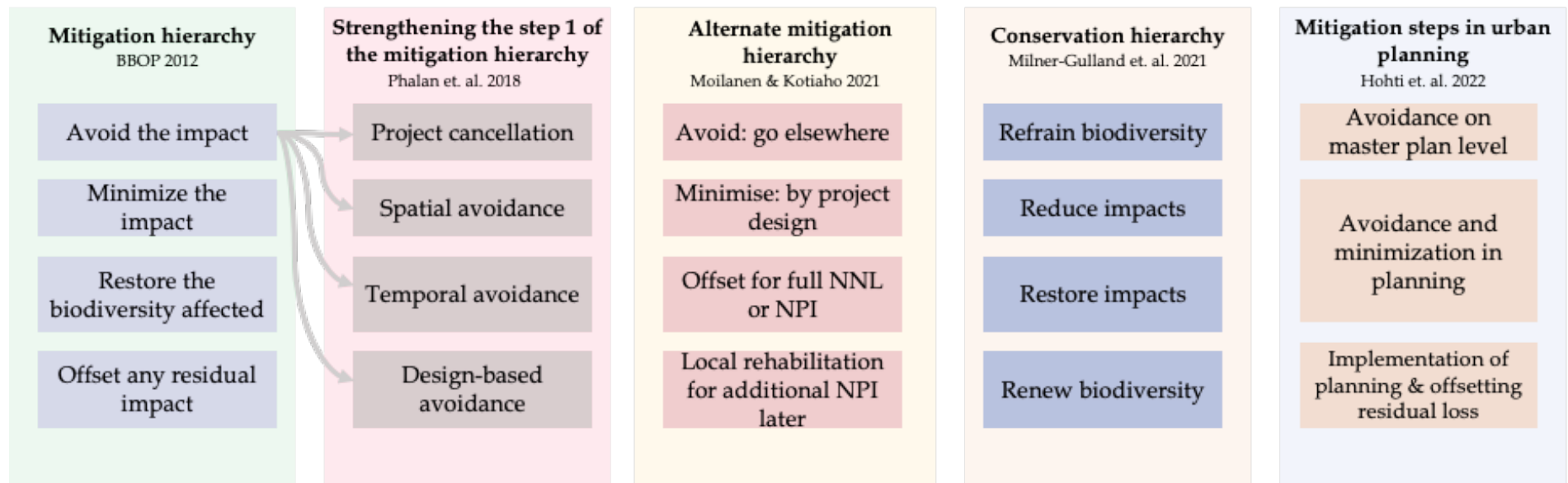


FIGURE 1 Mitigation hierarchy development starting from BBOP (2012) to variations by (Phalan *et al.* 2018, Milner-Gulland *et al.* 2021, Moilanen and Kotiaho 2021, Hohti *et al.* 2022).

A fourth development of the mitigation hierarchy has been conducted in relation to urban planning, where the starting point of consideration is unavoidable loss of natural areas because of human impact. In many cases, the possibilities to minimise or restore losses due to, for example, housing is impossible, as effects such as clear cut forests cannot be saved with minimising impacts. The applied version of the hierarchy in this case contains a reduced three-step hierarchy: *avoid–minimise–compensate* (Hohti *et al.* 2022). Here the minimisation includes the idea of restoration activities done in a development site but due to typical project characteristic restoration cannot be fully performed and it can lead to non-remedial actions for local biodiversity and more general ‘addition of green’ instead. Adding of general green does not help address the loss of biodiversity, what helps instead is to secure locally corresponding habitats and also to consider the habitats of more demanding species.

The mitigation hierarchy is not a stable procedure, and it has been scaled for different purposes. Use of hierarchy’s earlier steps is often challenging to verify afterwards since planning documents rarely include left-out options – those options which are dismissed because of other legislation, remarkable ecological or recreational values or other reasons why a development project is located elsewhere. The spirit of the hierarchy is included in environmental consideration of planning processes as well as environmental legislation (Nature Conservation Act 2023, Water Act 2011, Waste Act 2011), but the hierarchy as a procedure as science knows it has not been in use in the context of biodiversity in Finland.

1.1.2 Character of biodiversity offsetting and the perspective of the natural sciences

Biodiversity offsetting has its roots in habitat and species banking instruments. Habitat and species banking were established as part of the 1972 Clean Water Act in USA where the Reagan administration encouraged the launch of a pilot program in 1982 (Bonneuil 2015). Habitat banking evolved into biodiversity offsetting over time as ensuring available habitats for offsetting (Damiens *et al.* 2021). Biodiversity offsetting is used in large-scale industrial and development projects such as infrastructure construction, mines, and municipality guided projects such as housing. In some countries there is legislation for biodiversity offsetting (e.g. USA, Australia, France, South Africa) and somewhere it is voluntarily in use without binding legislation (Canada, Spain) (Hackett 2015, zu Ermgassen *et al.* 2019, Maestre-Andrés *et al.* 2020, Souza *et al.* 2021). In Finland the first legislative guidance and written requirements for biodiversity offsetting were set in the renewal of the Nature Conservation Act in 2022.

The great interest in biodiversity offsetting starts from the urgent need to secure biodiversity values in a world where development projects and human needs are considered unquestionable (Stork 2010). Offsetting supports the idea that ecological values are moveable – something lost in one place can be replaced in another place. This is not completely true. Locally, nature is unique and precisely the same combination of biotic and abiotic elements cannot be moved

to another location. In biodiversity offsetting, adequate correspondence is accepted (Moilanen and Kotiaho 2018).

To be used accurately, biodiversity offsetting should be adopted only when avoiding, minimising, and restoring have been considered but residual loss for nature is still caused. In biodiversity offsetting procedure, the damage caused to biodiversity in a certain area is defined and described. To achieve understanding of the needed compensation, decisions need to be made firstly about the objectives (Moilanen and Kotiaho 2018): are the mitigation hierarchy degrees adhered to? What is the definition of no net loss in this case? What is the size of compensation in relation to no net loss? These are followed by four groups of factors important to consider: *space* (How far the implementation of offset is in relation to impact the area?), *biodiversity* (needed measurements, available data from the impact area, possibilities of trading up), *time* (Is the offset permanent? What is the time frame for biodiversity gains? Time discounting.), and *actions* (effectiveness of types of different offsets, leakage of human pressure to new areas, verified additionality) (Moilanen and Kotiaho 2018). Offset types can vary depending on an impacted area's biotic and abiotic structure and the needed compensation for it. In general, there are three types of offsets: (1) protect a virgin natural area (*conservation offset*), (2) restore degraded habitats (*restoration offset*) or (3) trade up the lost area into a habitat that is thought to be more valuable from a biodiversity perspective (*trading up*) (Moilanen and Kotiaho 2018). After verifying impacts and the consideration of minimisation actions, residual losses are compensated as protecting a new offset area via habitat banking delivery or the straight purchase of land (Bidaud *et al.* 2017). In order to understand and make decisions about the different forms of biodiversity offsetting, a lot of expertise in the field is required.

Biodiversity offsetting has a strong connotation of being a market-based instrument (BBOP 2012, Damiens *et al.* 2021). The procedure and its implementation has gained critique over disciplines (Walker *et al.* 2009, Bull *et al.* 2013, Gordon *et al.* 2015, Maron *et al.* 2015, 2016, Lindenmayer *et al.* 2017, Huff and Orengo 2020). Critique includes an idea that offsetting enables every development project as long as the developer pays enough for compensation (Ferreira and Ferreira 2018). Offsetting has been claimed to be a narrowing concept and its content too close to economic terms and prerequisites (Apostolopoulou and Adams 2017, Ferreira and Ferreira 2018). In recent studies (Pekkonen *et al.* 2020), the conclusions underline that clear instructions for the use of biodiversity offsetting are crucial and special attention should be paid to flexibility (in-kind vs. out-of-kind offsetting) as well as principles of the impact evaluation with a focus on ecological and biodiversity conservation aspects. But when used accurately, offsetting pushes developers to avoid causing harm in habitats which are too expensive or rare to offset elsewhere. Biodiversity offsetting can be thus equally viewed as a nature conservation tool. When using this perspective, the focus is on the ecosystems, habitat types and species to be saved and restored.

Biodiversity offsetting has potential to safeguard places to be, places to live, places to eat and nest for those who do not speak any languages or use trousers, in other words, for non-human nature.

1.1.3 Game of terminologies

In the scientific literature there are two main terms used for to describe the fourth step of mitigation hierarchy: *biodiversity offsetting* or *ecological compensation*. The terms seem synonyms at first, but deeper examination reveals differences between them. The literature on biodiversity offsetting highlights the conservation of biodiversity. It describes ways to ensure habitat condition, for example with calculations, requirements for offset area and more recently in the 2020s with net positive impact and no net loss outcomes (Bull *et al.* 2017a, 2019). Ecological compensation studies concentrate more often on securing the livelihood of local people (Tan *et al.* 2014). Compensation as a word seems to direct interest towards monetary support. In China, ecological compensation has developed in a different direction called eco-compensation, where the loss of natural areas caused by development projects are calculated to be compensated by ecosystem services (useful for humans) or suitable areas for food production. Due to of the dense population of China, it has been a priority to feed people and this eco-compensation research responds to that target (Shang *et al.* 2018).

There are some exceptions in terminology use, such as when Swedish researchers talk about ecological compensation but the content of the study is purely about securing biodiversity values (Blicharska *et al.* 2022). Reasons for that might be language limitations in translations. In Swedish but also in Finnish we have no straight and simple correspondence to the English term *biodiversity offsetting* whereas *ecological compensation* is more easily adjustable to both languages. In Finland, we could have considered options such as *monimuotoisuuskorvaus*, but ecological compensation has already established itself as an official term in early 2000 (Suvantola 2006). Especially new terms that emerge quickly have no time to go through the national reflection about which equivalent best suits the recipient country's own language. This has also happened with biodiversity offsetting in Finland.

1.2 Citizens in biodiversity offsetting and challenges in participation

Biodiversity offsetting's primary purpose is to restore ecological losses. It does not consider the effects on local people (in the impacted area or offset area) and does not recognize citizens as potential actors in the implementation of the procedure (Scholte *et al.* 2016, Taherzadeh and Howley 2017). As the description of biodiversity offsetting implementation demonstrates, conducting offsets demands expertise in ecology, available data from the impacted area as well as the offset area, and guaranteed permanence of offsetting. These are skills and prerequisites few citizens have. The social impacts of offsetting and the potential of citizens to support biodiversity conservation through, for example, small-scale individual pro-biodiversity actions, remain less discussed (Ruoso and Plant 2021). Nevertheless, citizens' potential is underestimated and the private land

they own, for example gardens, provide opportunities for pro-biodiversity actions. The drivers behind citizen interest in nature and biodiversity-related actions depend on many things, the nature relation of individuals among them.

1.2.1 Citizens as environmental actors in society

The eco-crises at hand cause citizens to feel overwhelmed and they often lack opportunities to adequately engage with solutions (Hegger *et al.* 2022). At the same time, social processes influence conservation decisions and local people should be better involved in conservation and restoration planning (Ban *et al.* 2013). The inclusion of citizens into nature conservation has been studied through citizen science method and results show the importance of experienced connectedness to other people, and a sense of contribution as well as the inhibiting effect of economic valuation on citizens' motivation for nature conservation (Admiraal *et al.* 2017, Day *et al.* 2022). Research on conservation planning or biodiversity offsetting, with local people involved, has been conducted among certain professional groups, for example farmers, with a focus on their attitudes towards agri-environmental schemes (Calvet *et al.* 2019), actors in tourism (Griffiths *et al.* 2019) and by-passers on landscape values (Lindemann-Matthies and Bose 2007). Citizen participation in climate actions, such as residents' adaption to climate change, or to citizen-science projects in relation to nature conservation have been previously examined (Kiss *et al.* 2022, Day *et al.* 2022). What has been less studied are the perceptions and willingness of non-landowners to take pro-biodiversity actions.

Citizen participation in environmental action is explained through, for example, the concept of environmental citizenship, which includes diverse meanings under a sustainable way of living in modern market societies (Soopramanien *et al.* 2023). As people take pro-biodiversity action, they include themselves in the sustainable narrative: they do good for nature. If the number of actors is big enough and persistent enough, biodiversity actions by citizens can have a significant positive impact on the biodiversity of residential areas (Stephan and Chenoweth 2008, Kiss *et al.* 2022). Proactive social movements can arise from a concern for a social or environmental problem (Vaskelainen 2018).

Better inclusion of citizens into biodiversity offsetting is often called for in the literature but rarely studied. A few examples exist: Griffiths *et al.* (2018) introduced the *no-worse-off* principle which describes what needs to be considered when people are engaged in biodiversity offsetting and also how losses for local people can be avoided. Milner-Gulland *et al.* (2021) have made an effort to concretise the mitigation hierarchy, including the fourth step, *renew*, into decisions individuals make in everyday practices and consumption. Citizens are rarely considered as actors in biodiversity offsetting, but as environmental actors they are widely called on and have also shown potential for it. Since biodiversity offsetting is a top-down process I here focus on chances given to citizens on that perspective. There is research also on organic, bottom-up side of participation to land-use planning and in conservation and restoration (Horelli *et al.* 2015, Hardman *et al.* 2018, Mattijssen *et al.* 2018). In there the role of a citizen and the problems faced by decision-makers are different. Later in this dissertation I

present a conceptual innovation (Meadowcroft and Fiorino 2017) called ‘nature amends’ to answer challenges of citizen participation in biodiversity offsetting.

Societies are changing. Many roles and habits are changing. This can be seen in the social debate in general, the cracking of old institutions, the growth of the importance of cities, the ever-continuing migration towards urban centres, the future after the service society, the change in what information is used and for what purposes (Dufva and Rowley 2022, Dufva and Rekola 2023). These changes affect how debates in society are conducted. The increase of social media influencers, and waves either in political or other ways of acting as a team that fall as fast as they rise have changed the world we are used to (Dufva and Rowley 2022, Dufva and Rekola 2023). In this world, traditional regulatory instruments and nature conservation institutions seem to be slow actors. There has been space for new conservation methods such as NGO-based approaches and market-based instruments. Among these is biodiversity offsetting (Hackett 2015, Bonneuil 2015, Damiens *et al.* 2021).

The momentum is now also on the deeper environmental actions of individuals.

1.2.2 Spaces for citizen action and engagement with nature

Citizens have possibilities to conduct concrete pro-biodiversity actions on private gardens and yards. Those are under the control and decisions of their owners and biodiversity found in gardens is result of the owner’s gardening choices and local habitat types. For example, in the UK 84% of residents have access to a private or communal garden (OFS 2020), and gardens cover 3% to 4% of England’s land area (Loram *et al.* 2007, Gibbons *et al.* 2014).

Private gardens can provide a home for high levels of biodiversity, including for insects, native plants, birds, and mammals (Cameron *et al.* 2012). Activities in citizens’ own gardens help to understand the biological diversity and can thus motivate garden owners to become aware of the slowness of, for example, restoration success. Gardens allow managers to reduce their negative ecological impacts and increase their positive impacts on biodiversity (van Heezik *et al.* 2020).

Gardens provide ample opportunities to act on all the steps of the mitigation and conservation hierarchy (Milner-Gulland *et al.* 2021). For example, in a garden one can (1) *refrain* from changing the original habitat at least in some parts of the garden; (2) *reduce* alien species, the use of pesticides and chemical fertilizers; (3) *restore* the original habitat of the area by, for example, adding native trees, bushes and deadwood; and (4) *renew* biodiversity by creating species-rich habitats, or by adding structural complexity through offsetting elements. Pro-biodiversity actions carried out in private gardens do not fulfil requirements of biodiversity offsetting, but incomplete offsetting can be acceptable as offsetting when using it is transparently communicated (Hohti *et al.* 2022). In the bigger picture, instead of adding just ‘green’ in urban areas, there is a potential to add richer biodiversity. According to one barometer citizens responded positively to the claim that nature should be better taken into account in urban development (Ministry of the Environment and Finnish Environment Institute 2022).

In order to understand the different factors influencing the motivation for environmental action and biodiversity conservation, it is worth looking at people's nature relations. It has been shown that the level of human-nature connectedness is compatible with a sustainability-oriented mindset (Barragan-Jason *et al.* 2022). Being in nature can increase nature-connectedness, and especially if enriched with sensory and emotional activities (Lumber *et al.* 2017). Studies also demonstrate how art-based practices increase environmental responsiveness and engagement with nature through the incorporation of hands-on activities and emotional aspects (Raatikainen *et al.* 2020). In contrast, research shows that environmental education is not effective in increasing people's perceived connectedness to nature and pro-environmental behaviour (Lumber *et al.* 2017, Barragan-Jason *et al.* 2022). In Finland, because of the strong school system, people tend to rely on the power of education and suggest it as a solution to problems.

In the Nordic countries, citizens are highly educated, well informed about environmental problems and people have opportunities in general to contribute to sustainability actions due to their societies' high level of well-being and standards of living (Nordic Councils of Ministers 2022). Two barometers from Finland from 2021 (Sitra and Kantar) and 2022 (Ministry of the Environment and Finnish Environment Institute) described people's good understanding of eco-crises and their commitment to taking pro-environmental action. Respondents in barometers stressed the responsibility of every citizen and landowner to take care of nature in addition to public actors such as decision makers in politics and government authorities. It is important to identify how to better enable citizens to turn this feeling of responsibility into concrete pro-biodiversity actions and what role biodiversity offsetting could play in this.

Connectedness to and the appreciation of nature can be seen in the way people respond to changes in their local environment. In other words, people usually do care about the surrounding nature because they do have a nature relation. This can be observed, for example, in the form of environmental conflicts, which usually happen together with land use development plans (Taherzadeh and Howley 2017, Muradian and Pascual 2018, Apostolopoulou and Adams 2019). If citizens would not value the nearest green area, impairment of it could happen anywhere, anytime, without social impacts, resistance and compensation requirements of local nature (Tupala 2014). Simultaneously, our varying and diverse nature relations allow material use of natural resources (Ives *et al.* 2017). People can have various nature relations, and depending on the situation these relations permit our changing behaviour (Ives *et al.* 2017).

Two dimensions of nature relations, engagement and practice, are shown to be key factors contributing to behaviours making environmental change happen (Flint *et al.* 2013, Muradian and Pascual 2018). Engagement refers to the various ways people relate to nature that are embedded in their daily lives (Flint *et al.* 2013). Practices describe structured social conventions that set normative boundaries (Muradian and Pascual 2018). Since societies are formed by individuals (Elias *et al.* 2010), individual attitudes and values towards nature also form societies' overall perception of acceptable ways of treating nature. Understanding ways how people relate to nature and reinforcement of

individual nature relation strengthens our appreciation of nature. Through the individual's nature relation, societies can act more easily, more flexibly and with more nuance regarding the effort to stop biodiversity loss (Lumber *et al.* 2017, Muradian and Pascual 2018).

1.2.3 Biodiversity offsetting criticised for ignoring social impacts

Due to the lack of social consideration and a history of negotiations with private sector, biodiversity offsetting is a contested concept in nature conservation. From the procedural point of view, excluding local stakeholders may reduce new options for nature conservation and restoration in the Global North (Taherzadeh and Howley 2017, Karlsson and Edvardsson Björnberg 2021), but also in the Global South (Heiner *et al.* 2019).

Separating nature and people has a long tradition. Conceiving of nature as an object detached from ourselves, we in the Global North do not recognise our dependence on nature because of our long cultural history and exploitation of nature (Cronon 1996). When taking into account human needs, nature has usually come in second. By this I mean, for example, the dominant role of the economy in decision-making. For this reason the biodiversity aspect, by default, does not recognise humans as being included (Bidaud *et al.* 2017), since the human aspect is already recognised in every other discussion.

In practice, when biodiversity offsetting is implemented, it means area closures for local residents in the affected area plus protection and possibly restrictions on the use in the offset area. Impacts of these can affect livelihoods, recreational opportunities and ways people relate to their surroundings (West *et al.* 2006). The use of biodiversity offsetting can result in, for example, fewer green places for lower middle-class residents in urban areas (Apostolopoulou and Adams 2019).

Nature conservation issues are also very much political issues, and that is why interaction between the different actors is needed. Building long-term social capacity and engaging local people in interaction with governance can significantly improve conservation success (Sterling *et al.* 2017). With some occupations, the connection with nature questions may come naturally (such as with farmers) but with others it requires finding appropriate ways of working (e.g. for local residents or NGOs) (Berkes 2004, Calvet *et al.* 2019, Ruoso and Plant 2021). Local participation in any development project can also facilitate project implementation and reduce resistance (Sterling *et al.* 2017). Although engagement and involvement does not automatically lead to the desired outcome, deep engagement can produce other valuable results including a strengthened sense of belonging, environmental stewardship, inclusiveness and equity (Kiss *et al.* 2022).

1.3 Aims of this dissertation

In this thesis I seek understanding of biodiversity offsetting as a conservation and restoration tool used by small-scale actors and what kind of potential citizens provide as voluntary employees for biodiversity offsetting.

Citizens have the potential to be allies in nature conservation and restoration practices (Berkes 2021). In this thesis, I study the roles and possibilities both given and desired by citizens. I look into the attitudes people have on pro-biodiversity actions and what the requirements are for better inclusion of citizens in biodiversity enhancing.

We have a common responsibility on planet Earth, no matter do we represent nations, companies, communities, or ourselves as citizens. Some actors have more power and more possibilities to contribute to biodiversity conservation. In my study I concentrate on one wealthy Northern Europe country, Finland, where resources for acting are generally good.

Citizens in the Global North have been given power as consumers from the mid 1800s onwards (Stearns 2021). Other power relating to masses of people can be seen, shared or given. When citizens have power, they should not be forgotten in biodiversity questions. At the same time, citizens should not be expected to solve alone those problems which are not initially their fault; companies and nations have their own role to play.

My general research question for the whole thesis is how do citizens relate to biodiversity offsetting? As a sub-questions I have: (1) Are citizens engaged in biodiversity offsetting procedures? (2) How can citizens participate in biodiversity offsetting and what are their own preferences for ways to be involved? (3) What are the shared nature relations in Finnish context and how do they connect with citizen-level biodiversity offsetting? I am also looking for an understanding of the links between these (Fig. 2).

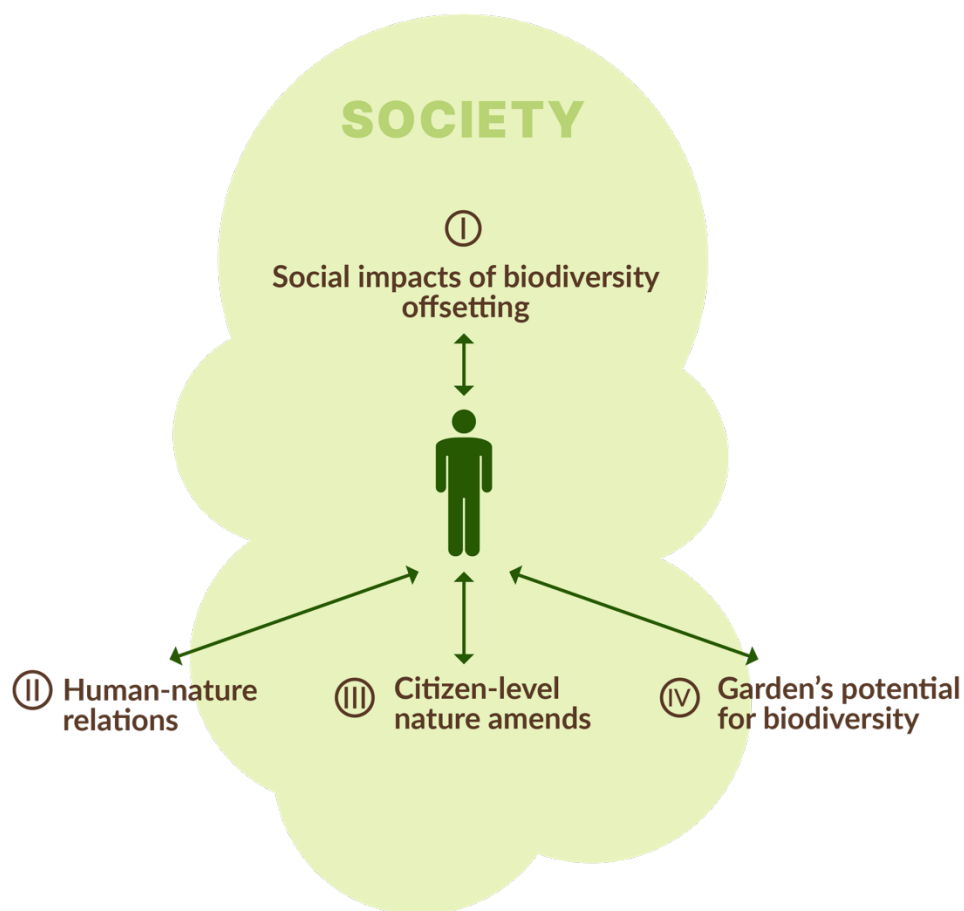


FIGURE 2 Themes of the articles.

In the next sections I first present the methods of this dissertation and then continue with results of the four articles included in it. I present the results in the following order: I start by presenting the challenges of biodiversity offsetting scalability to the citizen level (I). Then I continue with my study of human–nature relations, which clarifies the multi-dimensional nature of one’s own nature relations (II). In the third section I show citizens’ willingness and ideas to take pro-biodiversity actions (III) and I end by presenting the willingness of private garden enthusiast to conduct concrete biodiversity-enhancing actions in their own gardens (IV).

2 METHODOLOGY IN THIS DISSERTATION

2.1 Approaches to understand societal biodiversity restoration and conservation questions

I have focused on a qualitative approach in my research. In addition, papers II and IV include mixed method or quantitative settings. I focus on understanding peoples' perspectives, ideas, and willingness for concrete biodiversity enhancement as well as the procedural characteristics of biodiversity offsetting. Details of the studies' data sets, data collection and analysis methods are explained in more detail in the following sections.

2.2 Data and data collection

I used many different data sources to answer the multidimensional research questions. Each of the paper uses different data. Data collection started in autumn 2018 with citizen workshops (III) and continued through the years 2019 and 2020 ending with interviews regarding a site-specific walking performance (II) in August 2020.

In the article *Social impacts of Biodiversity Offsetting: A Review* (I), we were interested in the involvement of local people in the biodiversity offsetting procedure and identified social and cultural impacts of offsetting implementation. We conducted a literature review. We collected our data from the scientific databases Scopus and Web of Science. We used the most common search words for biodiversity offsetting plus relevant words for the societal point of view. Our search algorithm was: (("Biodiversity offset*") OR ("Conservation offset*") OR ("Ecological compensation") OR ("Ecological offset*")) AND ((social) OR (cultur*) OR (people) OR (socio*) OR (stakeholder*)). We selected papers for analysis using three criteria: (1) We included only those papers in which the social aspects of BO were actually considered. (2) We included only papers focusing on biodiversity offsetting and excluded environmental

compensation studies. (3) We concentrated on terrestrial BO cases and excluded studies from the marine environment. Our search resulted in 741 scientific articles of which 45 were chosen into analysis.

In the second article *The Intricate Diversity of Human–Nature Relations: Evidence from Finland* (II) we wanted to know how Finns conceptualise nature, what kinds of discourses mediate different ways in which Finns relate to nature and what kinds of embodied and emotional experiences emerged from participating in a site-specific walking performance. We planned data set in multi-disciplinary team consists of experts in the fields of environmental social sciences, sustainability science, art history, and performative arts. We used mixed methods to collect quantitative and qualitative data. We conducted a public online survey targeted to Finnish speaking adults, and it was open from 7 August to 2 November 2020. The questionnaire consisted of 21 questions divided into 11 sections. Sections contained parts on the respondent’s background information, general questions on their relationship with nature and statements that were grounded in literature on human–nature relations, environmental humanities, conservation, and sustainability. The survey included a collection of textual data where respondents’ subjective nature conceptualisations through two open-ended questions were gathered. The survey responses were used as our quantitative data and open-ended questions as a qualitative dataset. The second qualitative dataset included interview answers on people’s deeper relationship with nature that we collected after a walking performance in the Hitonhauta gorge, in Laukaa, Finland. In the interviews, we asked people about their experiences of the performance space, what kind of thoughts the performance evoked and how interviewees perceived the role of nature in the performance. The performance timing, arranged on 22 and 23 August in 2020, overlapped with the survey opening time. We ended up with 71 interviewee and 726 respondents in the survey.

In the third article *What are Citizen-Level Nature Amends? Rescaling Biodiversity Offsetting from a Citizen Perspective* (III), we arranged co-creation workshops for citizens in four municipalities in Southern Finland: Helsinki, Lappeenranta, Yläne (part of Pöytyä) and Jyväskylä. We had in total 36 participants. Participants co-developed biodiversity offsetting for the citizen level through brainstormed ideas, resources and concerns. The workshop day included two main sessions, where the participants first independently wrote down their own thoughts on citizen-level biodiversity offsetting and then discussed them together as a group. In the second session the participants tagged the most interesting ideas from the earlier discussion and chose the six most promising themes and developed them further via a printed table identifying the strengths and weaknesses of the chosen themes. Discussions were recorded in three of the workshops. In this article the post-it notes, summary tables and researcher notes from all the workshops and transcribed discussions from three workshop were analysed.

In the fourth paper *Gardens’ Potential as a Place for Biodiversity: A Case Study among Garden Enthusiasts* (IV), we collected survey data from the members of three garden associations which were located around middle-sized cities in Finland: Seinäjoki, Jyväskylä and Joensuu. A public e-survey was built on three sections: the first dealt with respondents’ owned garden information such as location and size,

the second included claims about pro-biodiversity actions and the third section collected respondents' background information. The survey was open from 10 to 26 May 2019. The number of responses that were included in the analyses was 200.

2.3 Data analysis

The research questions, data, and analysis methods used in this dissertation are summarized in Table 2.

TABLE 2 The summary of analysis methods and data used for different articles.

Article #	Main research question	Used data	Analysis method
I	How are local people engaged when planning or conducting offsetting and what are the identified social and cultural impacts of biodiversity offsetting implementation?	Academic publications from scientific journals n = 741, included for analysis n = 45	Descriptive review, qualitative content analysis
II	RQ1: How do Finns conceptualize nature? RQ2: What kinds of discourses mediate the different ways in which Finns relate to nature? RQ3: What kinds of embodied and emotional experiences emerged from participating in a site-specific walking performance?	Transdisciplinary mixed-method dataset including survey (n = 726) and interviews (n = 71) in Finland	Exploratory factor analysis, nature-related concepts derivation, qualitative content analysis
III	RQ1: How do citizens understand their own possibilities to conduct biodiversity offsetting? RQ2: What implications do the perceptions and suggestions of citizens have on biodiversity offsetting and mitigation hierarchy?	Group discussion data from co-creation workshops arranged for citizens in four municipalities in Finland (36 participants, data coded in analysis n = 226)	Inductive content analysis
IV	RQ1: How do garden enthusiasts perceive biodiversity conservation and the possibilities to compensate for biodiversity loss in their gardens? RQ2: Which biodiversity attributes garden enthusiasts prefer in their gardens? RQ3: What kind of biodiversity-benefiting actions are garden enthusiasts willing to conduct in their gardens?	Survey (n = 200)	Exploratory factor analysis

2.3.1 Qualitative analyses

Qualitative analyses methods were used in three out of four articles. Articles I and III build on qualitative approaches and in article II qualitative methods were used together with quantitative approach. Here I present the qualitative analysis choices.

In the review article (I) we used qualitative content analysis. We carefully read the articles, identified their types and the subject related to the social aspects of biodiversity offsetting. We ended up with three categories of article types: empirical case studies of biodiversity offsetting, analyses of biodiversity offsetting policies and review articles, including conceptual papers. Related to the social aspects we further classified the articles into four themes: social impacts, societal impacts, procedural development, and social acceptability.

In article II we analysed survey textual data with qualitative thematic grouping. We identified the attributes associated with nature and grouped them under the same themes. Analysis of the interview data proceed as follows: the first round we transcribed verbatim interviews. We also did content analysis which included deductive coding of the transcript, developing the code system in between the transcription and the coding stages. Then I used the query tool in Atlas.ti to search for overlapping and neighbouring co-occurrences of the code groups Emotions, Actions, Place and Walking Performance. I coded these parts again, now with inductive content analysis, according to emergent themes.

In paper III I started data analysis with thematical coding which followed the thematic structure of the workshops: ideas, resources, concerns. This was the first round of analysis and after completing it, I identified two main actors in the data: individual and community. I also observed a variety of themes relating to sustainable lifestyle instead of direct pro-biodiversity actions (see the research questions in Table 2) and due to this I conducted the second analysis round targeting the differences in the data both as actor and direction of suggestions.

2.3.2 Quantitative analysis

Exploratory factor analysis was used in two articles (II and IV). In addition, short descriptive quantification was used in article I to describe numerical variables of the data.

In paper II we analysed the survey's quantitative data by using exploratory factor analysis. There we assumed that quantifiable patterns of the respondent's statement agreement and disagreement could be transformed into shared discourses. We calculated a Spearman correlation matrix from the statement data and factored it using the maximum likelihood method. We chose the six-factor solution for further analysis based on scree plotting, factor eigenvalues, factor communalities, and coherence of factor interpretation. The main content of the discourses was interpreted based on statement associations within each factor and the examination of statements with high loadings to each factor.

In article IV we used explorative factor analysis as well. There we were interested in biodiversity attributes describing garden enthusiasts' motivation

and willingness to conduct biodiversity enhancing actions in their own garden. We assumed the responses to the survey can be translated into shared opinions, patterns, on the private gardens' role in biodiversity conservation. We ran three-factor analyses. All three factor analyses were based on a Spearman correlation matrix and used minimum residual factoring. We chose the oblimin rotation that allows for factor-to-factor correlations, as we expected that the resulting factors would not be exclusionary in their content, but rather complementary to each other. We used parallel analysis to guide the choice of the number of factors. We interpreted the main content of the factors by examining the statements that had high loadings to the factor (with a value over +/- 0.4).

3 MAIN FINDINGS OF THIS DISSERTATION

3.1 Social impacts of biodiversity offsetting: A review

In article I we studied how biodiversity offsetting as a procedure acknowledges social aspect, difficult-to-calculate immaterial values (Intrinsic value of nature) and recognises local people as actors in offsetting.

We identified three methodological categories in the articles – (a) case study, (b) policy analysis, (c) review – and four categories via which the social aspects were approached in the articles – (1) social impacts, (2) societal implications, (3) social acceptability and (4) procedural development (Fig. 3). The majority of the studies were empirical case studies (20), followed by 13 policy analyses articles and 13 wider reviews on the conceptual development of biodiversity offsetting. The most common theme of the articles was the procedural development of offsetting (grey in Fig. 3), which included conceptual discussions as well as reviews about the needs to develop biodiversity offsetting to better include social aspects. The second largest theme was social impacts (blue in Fig. 3). Less common themes were social acceptability (yellow in Fig. 3) and wider societal implications (orange in Fig. 3).

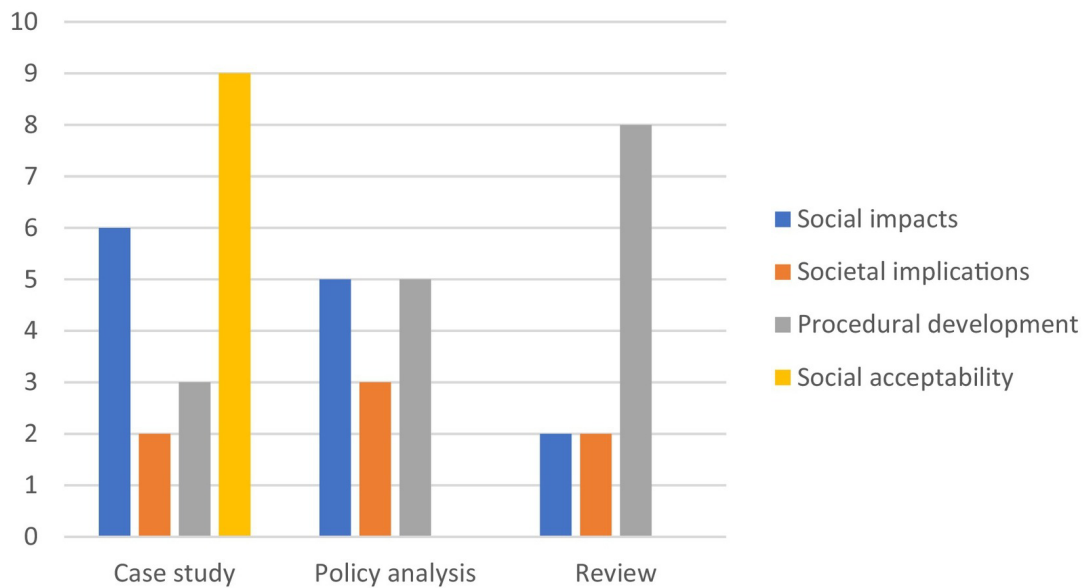


FIGURE 3 Article types and subjects of the research in article I. Y-axis shows number of articles classified in each category. (Source: article I)

In the studies reviewed “social” meant most often mainly economic or livelihood security. The participatory elements in biodiversity offsetting case studies were rare and made mostly by asking about local people’s perspectives on, for example, impairment of the nearest green area and how it will affect their way of living. Involvement of local people in the reviewed case studies were passed off as making an interview afterwards. We found no active searching of ways to do things better. In addition, we found no paper describing the whole offsetting procedure from the inclusion of the local people in the planning process together with biodiversity values to the participatory phase and ending up with the establishment of offsetting area and follow-up discussions with locals about how the process affected their lives and how they felt influenced the process. Instead, we found many demands to do so.

The social impacts category (1) was divided into two sub-categories: Threats to livelihoods and Place-based cultural and recreational values. In relation to livelihoods, the reviewed articles described different ways local people’s source of income have been negatively affected because of biodiversity offsetting – either in the impacted area or the established offsetting area. Negative impacts on people included threat to food security, profound economic and cultural disruption, and rapid environmental change combined with demands to adjust new sustainable fishing practices introduced by a mining company.

Offsets can displace people in both the Global South and Global North. On the other hand biodiversity offsetting can be used to secure important land areas for their owners, like the case was with indigenous people in Canada (Hackett 2015). In some of the studies, farmers whose livelihoods are quickly affected by land constraints were subject to financial compensation conditional on the production of biodiversity values on the land they own.

Place-based cultural and recreational values are values, which usually matter the most to people. These are spiritual and cultural connections to a

certain area and are called a bit differently depending on continent and cultural histories. Biodiversity offsetting, the impacted area and offsetting area, can both affect the place-based values of local people. Spiritual values are the most challenging to offset, since they are inherently unique in connection to a particular place. Recreational values, instead, are more easily replaceable. Anyhow, the social and financial price can be high.

In our study, place-based spiritual values were harmed in Uganda in a dam construction project (Griffiths *et al.* 2020), as was the cultural identity of locals in the UK where additional housing was planned to be built (Scholte *et al.* 2016). The social acceptability of biodiversity offsetting if placed in another country was seen as something to be resisted while local people's attachment to a place was regarded as important when local biodiversity values were to be secured locally (Burton *et al.* 2017).

The societal implications category (2) describes a situation where the biodiversity offsetting process shapes societal practices, languages used, and the ways nature conservation is understood. Using offsetting and its market-based logic raises a question of what kind of societal development offsetting represents. Some studies highlighted the risks of neo-liberal management governance, where measurable economic efficiency can override other, less easily measurable values (Hackett 2015, Apostolopoulou *et al.* 2018).

The expert-led process and used technical language is often inaccessible to local people and can restrict the abilities of the public to participate and influence decision-making about their living environment. The lack of transparency and participatory procedures creates distrust of biodiversity offsetting. The offsetting procedure is criticised because of utilitarian ethics and rejection of ethical barriers. Increasing use of the biodiversity offsetting can reduce public funding of nature conservation and boost privatisation of green areas. On the other hand, market-oriented nature conservation can offer new benefit local communities economically, especially in Global South.

Stronger societal actors can use the nature question as a justification to force their own values over weaker societal actors. Offsetting policy is not class neutral if green areas are available only for those who live in executive houses or villas with large private gardens and nearby green areas for the lower class are built over.

Social acceptability (including also general preferences and motivation to participate) (3) includes only case studies and thus describes a variety of situations where attitudes towards biodiversity offsetting have been studied. Acceptability and preferences are highly dependent on context as the scope and impacts of biodiversity offsetting as well as development projects vary greatly.

Farmers in Switzerland were willing to take part in biodiversity agri-environmental biodiversity offset schemes (where farm land is used as an offset area by increasing the level of biodiversity) if they had a suitable economic situation, higher education or the suggested biodiversity offset actions fitted into the existing farming system. Social norms affected motivation: farmers who thought agricultural institutions have a positive opinion on needed changes to farming practices or already experienced about the actions were more likely to participate (Calvet *et al.* 2019, Ruoso and Plant 2021).

In Uganda the acceptability of biodiversity offsetting was related to economic compensation, since income from tourism is an important livelihood there and compensation was demanded for the whole village rather than for targeted individuals. More educated people suspected that revenue-sharing might not be equal and resisted revenue-sharing more than the poorest people did (Griffiths *et al.* 2019).

People preferences in Australia for shorebirds favoured endangered species more than non-endangered. People also showed more trust in third-party or government-led implementation biodiversity offsetting projects than in private sector projects and respondents in the study preferred direct biodiversity-enhancing activities over indirect ones, such as research programmes (Rogers and Burton 2017). Respondents were also strongly against placing offset elsewhere than where the harm occurred.

Acceptance of biodiversity offsetting is also related to local cultural identities. Loss of familiar landscape with high emotional value in East Lothian (UK) residential area caused strong opposition to additional housing (Scholte *et al.* 2016). The suggested woodland offsetting area was rejected due to the threat of local people's own cultural identity.

Procedural challenges and limitations (4) consist of limitations related to accounting for the social and societal impacts and the involvement of local people. It is not clear who should have the right to be involved into biodiversity offsetting procedure, regarding what questions and at which stages of the procedure the involvement should take place.

Expected success and procedural variety of offsetting and its social impacts are partly connected to the strength of governance. The structures that influence success are i) different legal context, ii) different social context (different levels of poverty), iii) different environmental context and iv) dependence on natural resources and ecosystem services for subsistence (Bidaud *et al.* 2017). Legal context determines variation in the harm caused to local people and is thus important. Strong legal context helps to protect rights of local people and can enable participatory opportunities to them. This also makes difficult to move procedures designed in a certain legal context, such as biodiversity offsetting, into another setting of legal requirements without ad hoc application. Especially indigenous people or other vulnerable and less influential groups are not heard as stakeholders.

We found several reasons why the involvement of locals is not achieved in biodiversity offsetting. For one, there were no studies describing the whole procedure of participation from design to results and implementation. Especially no follow-up studies were found which would have studied how citizens reorganised their lives after the process or area restrictions. The inclusion of stakeholders into the process may also be limited and this creates both distrust and possible biased outcome from the project.

One recognised problem is the baseline of biodiversity offsetting itself: offsetting is provided for the nature species, not to the local people. Biodiversity values are not obstacles themselves but the limitations they place on the involvement of social aspects can cause an experience of unfairness and understatement. Since offsetting as a process leans strongly on ecological

knowledge and the expertise of natural scientists, practitioners in biology may not see any critical problems in the procedure itself; the needs for understanding social and cultural values related to nature may not even come into their mind (Brown *et al.* 2014). These kinds of aspect are significant barriers to make biodiversity offsetting consider its potential social impacts.

Most of the social aspects are related to activities in either the development area or biodiversity offset area, and the process associated with the location of both sites (Fig. 4). lack of involvement causes experiences of inequality. Economic compensation is in some cases used instead of direct access to substitutive nature areas – compensation for lost nearby green areas might not be considered at all.

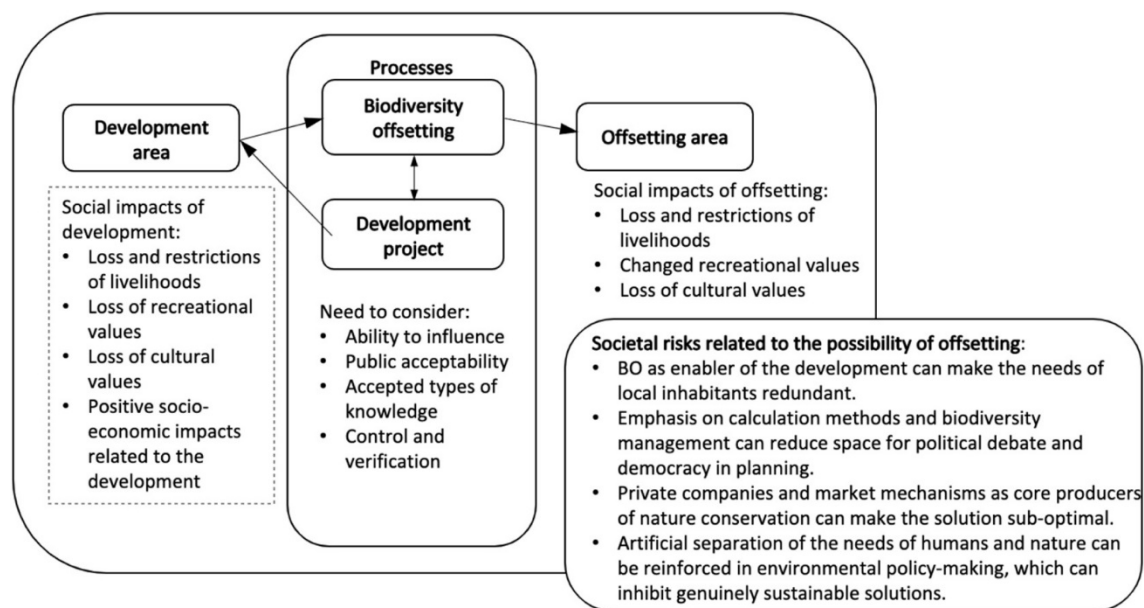


FIGURE 4 The social implications of biodiversity offsetting in a development area, an offset area and in the process itself, and risks related to the possibility of offsetting. (Source: article I)

Spiritual values are unique and inherent and extremely hard to compensate for. We found hardly any studies describing concrete real-life case studies on involvement of locals in the process. Criticism of the biodiversity offsetting for enabling economic development also calls into question its further development and use in nature conservation. This may paradoxically hamper the interest in improving the method and make it more socially and culturally compatible.

One of our main interests was to determine what kind of opportunities have been offered for local people in biodiversity offsetting projects. Here we detected a clear research gap, as participation in the offsetting process was very rarely provided. According to our understanding, local people are not consulted because biodiversity offsetting does not originally include participatory aspects. Involvement requires extra time and money on the developers' side and the education of stakeholders, because they need to orientate themselves to the difficult biological-technical language of the discussion.

Based on our results, procedural development is needed to achieve equitable outcomes for biodiversity and humans. As long as parallel

participatory and evaluation approach of social perspectives is lacking, socially just alternatives are most likely to be found at earlier steps of the mitigation hierarchy.

3.2 The intricate diversity of human–nature relations: Evidence from Finland

Supporting biodiversity requires understanding of human–nature relations, which we addressed in this article as social constructions that can be studied through nature-related discourses. A public survey (n = 726) and post-performance audience interviews (n = 71) gave in-depth understanding on how nature is conceptualised in Finland, what discourses emerged and what the embodied and emotional nature experiences were after participating in a site-specific performance.

Respondents in the survey came from all the provinces of Finland but 64.2% lived in the country's four highest populated regions: Uusimaa, Central Finland, South-Western Finland, or Pirkanmaa. Most respondents (82.1%) lived in an urban or village environment whereas rural inhabitants were fewer (17.9%). Respondents were typically middle-aged, employed female with higher education, living in a city or village.

More than half of respondents visited nature regularly and the two most recurrent activities in nature were spending leisure time or exercising. Walking in peace in nearby nature was the most favoured way of engaging with nature (Fig. 5).

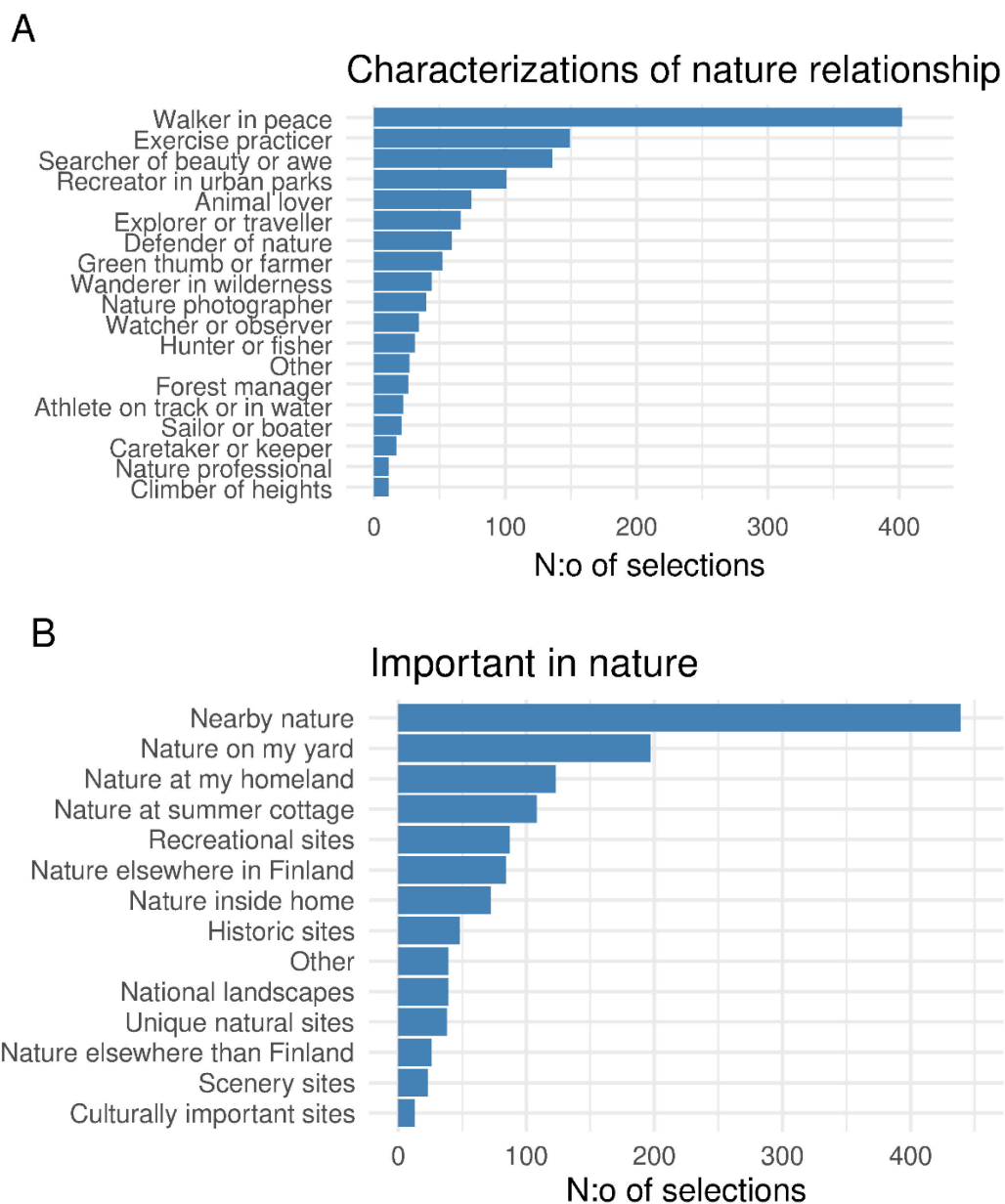


FIGURE 5 Characterisation of respondents' nature relationship (A) and components they regarded as the most important in nature (B). (Source: article II)

The conceptualisations of nature resulted in nine groups: (1) Ecological elements (e.g. plants, animals, water), (2) Sensed and valued (e.g. beauty, greenness, silence), (3) Essence of life (e.g. life, continuity, strength), (4) Living systems (e.g. change, connection, place), (5) Wild and free (e.g. wilderness, formidability, freedom), (6) Source of wellbeing (e.g. peace, purity, safety), (7) Related to culture (e.g. integrity, nature, human), (8) Provider for people (e.g. air, breathing, nutriment) and (9) Unbuilt environment (e.g. dualism, path/routes, building).

In general, positive valuations of nature dominated in the data. Nature as "ecological elements" or "living system" represented a natural scientific perspective and these took a value-neutral stance on nature. However, this did not apply to the rest of the ideas. We derived two ecocentric ideas that underlined

nature's intrinsic value. One of these perceived nature as "wild and free" and describes strong normative claims towards untouched and undisturbed nature, defining it as "primordial, pure, unspoiled environment". A softened version of these we named as "unbuilt environment" and this conceptualised and valued nature as something outside of human influence: "Nature is what is outside of the walls". Both two ecocentric ideas were dualistic as they strongly positioned people and nature against each other.

Non-dualistic views about nature were also found, such as "essence of life", which adopted a holistic perspective - seeing people as part of nature. In addition, three ideas inclined towards anthropocentrism relating to experience of nature connectedness ("sensed and valued") and varying levels of utilitarianism ("source of wellbeing" and "provider for people"). Finally, the idea defined as nature "related to culture" revealed the intellectual struggle and conceptual wavering of what nature actually is.

After factor analysis, the survey data resulted in six discourses (Table 3). The general consistency of the statement data was high (Cronbach's $\alpha = 0.94$), and indicates strong reliability. The cumulative overall variance explained by the six factors was 0.36, and the mean item complexity was 2.4.

TABLE 3 Factor properties. Discourses were named grounded on the interpretation of factors. The numerical columns give key statistics for each factor (var. = variance). Factor contents are generally exemplified in associated survey topics column, based on the statement-to-statement correlation matrix. In ML6 the negative correlations demonstrate disagreement with the listed statements. (Source: article II)

Factor	Discourse name	Initial eigenvalue	Sum of squared loadings	Proportion of overall variance accounted for	Cumulative overall variance accounted for	Relative amount of variance explained by the factors	Associated topics in the survey	Statements with polarized loadings
ML1	Wellbeing	18.06	6.57	0.08	0.08	0.21	Nature connectedness, positive impacts on personal level	Nature brings me joy (+0.73), nature invigorates me (+0.73), nature calms me down (+0.72).
ML4	Natural habitat	4.69	5.78	0.07	0.15	0.19	Conservation value of different habitats	Baltic Sea coast (+0.66), mires (+0.65), rock outcrops and scree (+0.65)
ML6	Ecoanxiety	3.01	5.73	0.07	0.21	0.19	Environmental concern, intrinsic value of nature, human-nature dualism	People are more important than nature (-0.54), I think environmental issues are exaggerated (-0.54), I also want to see a human handprint in the landscape (-0.53).
ML3	Pro-environmentalism	2.11	5.33	0.06	0.28	0.17	Pro-environmental habits and policies, environmental concern	I'm willing to pay more for environmentally friendly products (+0.64), I'm ready to compensate the harm I do to nature (+0.64), I'm ready to reduce car driving for environmental reasons (+0.52), I have to change my consumption habits for nature's benefit (+0.52).
ML5	Outdoor activity	1.59	4.15	0.05	0.32	0.13	Activities in nature, access to nature	I go into nature despite bad weather (+0.55), camping is the best part of my nature excursions (+0.51), going out to collect mushrooms and/or berries is important to me (+0.50), I like to go boating and/or paddling (+0.50).
ML2	Enjoyment	1.45	3.23	0.04	0.36	0.10	Positive impacts on personal level, sensing of nature	The best things in nature are sounds, smells, sensations, or tastes (+0.61), the best things in nature are colors, views, or sceneries (+0.56), I forget my worries and troubles when I'm in nature (+0.43).

The most widespread factor (ML 1 wellbeing) indicates a discourse concentrating on individual-level impacts of nature, including mental and physical benefits and health effects. It was followed by factors which we interpret to belong to a discourse of overall conservation values of varying natural habitats (ML4 natural habitats) and a discourse on strong environmental concern connected to intrinsic valuation of nature and human-nature dualism (ML 6 ecoanxiety). The latter was similar to the next factor in line, ML3 pro-environmentalism, due to its focus on environmental issues. A difference between these two was the distribution of the more pessimistic statements into the ecoanxiety discourse, and the pro-environmentalist discourse focused on lifestyle- and solution-oriented topics.

We interpreted the last two factors into an action-oriented discourse (ML5 outdoor activity) and a discourse on the positive impacts of being in and sensing of nature (ML2 enjoyment). In the outdoor activity discourse, access to nature and being in direct contact with nature were important – the emphasis was on *doing*. In the enjoyment discourse, conversely, the emphasis was on *being* in nature. The enjoyment discourse focused on the transient character of nature experience but also shared content on the restorative impacts of nature with the wellbeing discourse (ML 1). The wellbeing discourse was more about the consequences of contact with nature compared to the enjoyment discourse.

Based on the high-scoring respondents' nature definitions, we observed that several ideas of nature were connected to each discourse. The interpreted ideas were compared with the theoretical background used in the article (Fig. 6). For example, the wellbeing discourse was connected to ideas of nature as a source of wellbeing, related to culture, the unbuilt environment, and as a provider for people.

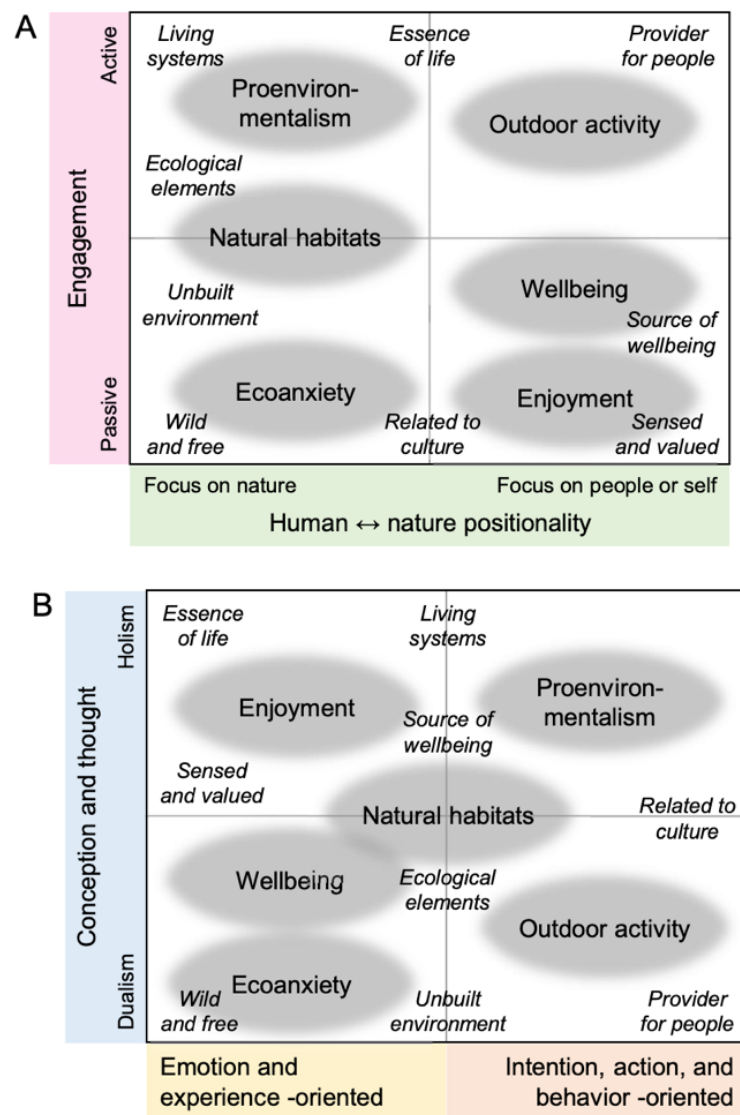


FIGURE 6 Interpretation of the survey results according to the dimensions of human-nature relations. Grey ovals represent nature-related discourses and nature ideas are shown in italics. The positioning of the discourses and ideas is based on their content in relation to the dimensions shown (A: nature- or people-centered positionality vs. passive to active engagement; B: emphasis either on emotion and experience or intention, action, and behavior vs. dualistic or holistic conception). The proximity of the discourses and the ideas indicate close connection; however, the actual distances between the items are not explicit. (Source: article II)

Post-performance audience interviews deepened our understanding of difficult-to-verbalise experiences of nature and especially the embodied and emotional nature experiences shaken by the site-specific performance. Together 140 persons attended the performance in the Hitonhauta gorge area (Laukaa, Finland) and 71 persons participated in the research interview.

In addition to the performance and their nature experience, participants also brought up intimate topics relating to emotions, philosophical and spiritual

views, and wellbeing. The deductive content analysis of interviews resulted in three high frequency groups: Emotions (emotional reactions and sensory experiences in relation to the performance and the site), Walking performance (mentions of the acts of the performance or the artwork as a whole), and Place (observations regarding the nature location, such as weather events).

The rest of the interview content referred to diverse aspects of human-nature interactions. Participants noted people's actions and behaviour in nature and their own habits and preferences to spend time in nature (code group Actions). Participants described their ideas of nature and different characterisations of personal to societal relations to nature (code group Views and conceptions). For example, issues related to conservation, health, utilitarianism, culture, religion, and mythology were discussed. Participants noted the positionality between humans and nature and discussed this through nature's agency, people seen as part of and dependent on nature, and respect towards nature (code group Human-nature). Considering the dimensionality of the human-nature relations, the content of the interviews supported the survey results.

We continued the analysis of the interview data by using inductive coding to target a specific part of the interview data, and to indicate co-occurrences among the code groups Walking performance, Place, Emotions, and Actions. We found five categories of nature-related experiences that emerged from participation in the site-specific walking performance:

1. Sensory experience
2. Sense of connectedness
 - human-nature connection
 - human-human connection
 - connection to self
3. Feelings and other inner experiences
4. Values and norms
5. Sense of place

Each category describes a different experiences. The first group, sensory experience, included ways of being, perceiving, moving, and halting: staying still, in silence, focusing on the moment, and a slow pace of walking.

The second category describes how participants felt connected to nature, other participants and themselves. Depending on the direction of the bond, we divided the second category into three sub-categories. Despite attending the performance as individuals, social experience, involving connection to other humans in a group, became important. Participants felt involved in the group as they walked together along a challenging path in the gorge area.

Participating in the walking performance and watching the scenes raised various emotions and a third group, Feelings and other inner experiences, resulted in the highest number of codes. The participants expressed, for example, feelings of calmness, mercy, respect, being grounded, relaxation, and healing.

Some acts felt like they were made for me, they allowed me to look at myself as if from the outside; through the performers and the nature. There was that huge rock wall, it was exactly like the feelings that I've been going through lately.

Category number four, Values and norms, relies on practices of working with nature, culturally shared values and Finnish ways of relating to nature, as participants described in the interviews. The topics covered themes such as traditions and memories, conservation and the global ecological crisis. Nature was seen as a place of holiness and harmony, along with a source of livelihoods, material benefits, and wealth.

The [ecocentric] monologue at the end spoke about things that I already had started to think about: how this industrial world has gone out of control and we have lost our connection to nature; I guess it is the idea of control over nature...that idea has been a mistake and now we see how our relations to nature have changed.

The walking performance guided participants literally walking through the gorge area and while doing so participants experienced the place through their senses. They paid attention to how the location played a key role in the performance and described cases when performance, place and nature seemed to merge together. Participants also reflected on nature's agency and felt that nature took the leading role, leaving the human performers aside.

Our results showed variety of human-nature relations co-existing within a relatively restricted context. In modern Finland, nature is to a great extent viewed positively and considered important for the quality of people's life. Qualities such as peacefulness, beauty and integrity are often associated with nature. Consciousness of environmental problems reflects a broad concern about the state of nature. These general findings relate to two recent public surveys on nature relationship in Finland (Sitra and Kantar 2021, Ministry of the Environment and Finnish Environment Institute 2022). However, our analysis opens up a broader range of views of nature and also demonstrates the contradictions in the human-nature relations. This supports the argument by Björklund *et al.* (2022) that the conception of single type of "Finnish nature relationship" is misleading.

Because human-nature relations change over time (Williams 1980), it is important to acknowledge various conceptions of nature that are coexisting and approach nature as an evolving concept. The dynamism of human-nature relations has led to a situation in which people embrace parallel worldviews (e.g., IPBES 2022). We observed how the wilderness-oriented dualistic separation between people and nature can go along with holistic ideas of nature as the essence of all life (people included) as well as more contemporary systemic views on nature. Diverse approaches are thus needed to mainstream pro-environmental mindsets and behaviours that support sustainability (Braito *et al.* 2017, Ives *et al.* 2017, Muradian and Pascual 2018, IPBES 2022b).

We found six different nature-related discourses which are common in Finland. Interesting observations here are the emphasised dominance of mental and physical wellbeing and health benefits obtained from nature. Wellbeing discourse also emerged in the results of qualitative analyses and earlier studies in Finland (Sitra and Kantar 2021, Ministry of the Environment and Finnish Environment Institute 2022). This indicates strong wellbeing discourse in Finland when talking about nature.

Another interesting finding is that in the conservation discourse, despite long and heated discussions in Finland, we found no prioritisation of forest conservation, but all the alternative habitats received almost identical support from respondents.

In addition, we discovered human–nature relations present in either active doing (outdoor activity discourse) or sensing and being present in nature (enjoyment discourse). There was also a connection between outdoor activity and the pro-environmentalist discourse as they both adopted an action-oriented viewpoint and supported engagement with nature (Fig. 7). We argue that synergies between these two discourses could hold underrated potential in mainstreaming sustainability.

Finally, our qualitative data showed that experiencing a connection with nature is essential for enjoying it. This highlights the importance of pluralistically enhanced nature contact in strengthening nature connectedness (Lumber *et al.* 2017). We contend that emotional experiences grow many times unconsciously from contact with nature. All human experiences are mediated by senses and thus human–nature relations build on sensual events which transform into various conscious and unconscious processes within the human mind-body. In other words, people are not aware of all the ways in which they relate to nature.

3.3 What are citizen-level *nature amends*? Rescaling biodiversity offsetting from a citizen perspective

In this article we were interested in citizens' attitudes on conducting biodiversity offsetting and implications of their perception of biodiversity offsetting and mitigation hierarchy. The result was a two-dimensional sphere of citizen level pro-biodiversity actions. Citizens called for a variety of easy-to-choose and ready-made options and suggested more indirect than direct actions (Fig. 7). Direct actions refer to hands-on actions in biodiversity enhancing. 70% of the suggestions were indirect and 30% were direct. The division between the spheres of actors was not as polarised as between the tendency of suggestions. Community-related suggestions covered 61% and individual-related ones 52% of the coded data. The importance of community-based actions was repeated in the discussions despite the workshop introduction that guided participants to think about individual action.

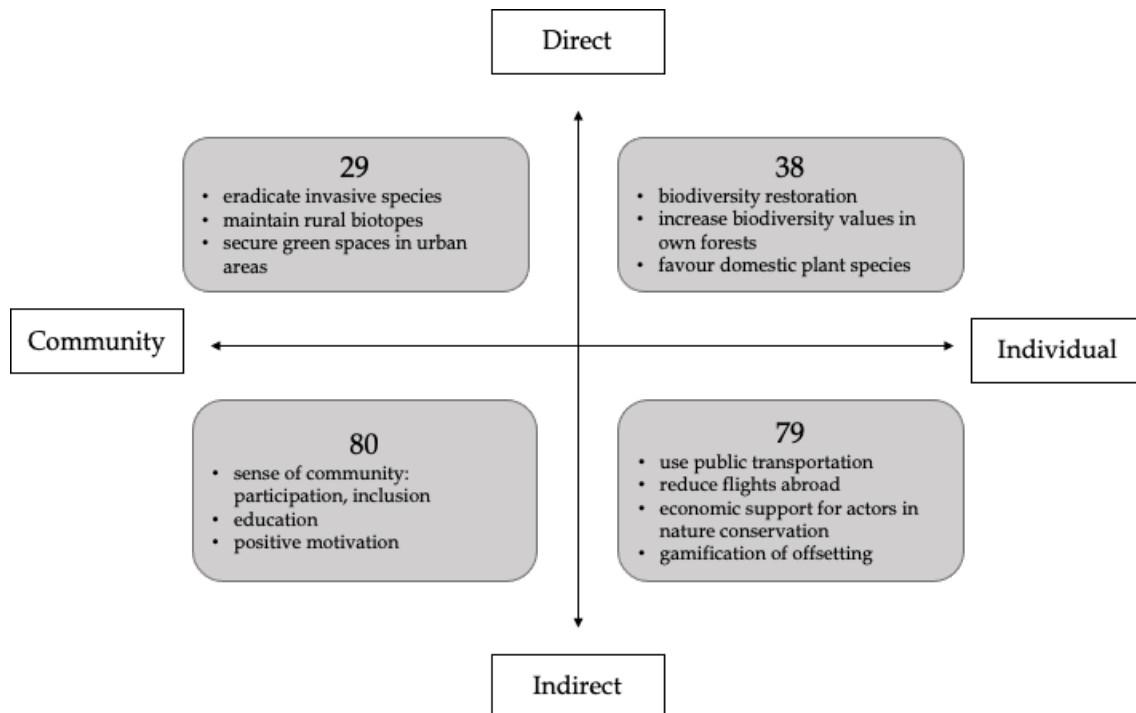


FIGURE 7 Sphere of suggestions created in co-creation workshops for citizen-level nature amends. 'Direct' actions relate to hands-on activities in biodiversity enhancing whereas 'Indirect' relates to a variety of other actions, e.g. a sustainable way of living. Suggestions produced by citizens were also divided on the actor level – individual or community. (Source: article III)

Community direct actions were related to land, natural areas, or work to maintain those. Suggestions in this category included restoration actions such as creating and maintaining rural biotopes, pilot biodiversity offsetting projects, eradicating invasive species, and creating green roofs. The way of action was proposed to be mostly voluntary. Direct influence on large forest owners appeared in the discussions. Some direct community actions related to maintaining green areas in municipalities such as parks and playgrounds, citizens also recognised a need for aesthetic rethinking as a basis for change in maintenance work.

Individual direct actions covered similar themes as community ones, but described actions targeted to a smaller area or resulted in smaller or mostly local impacts. The most common suggestions in this category were biodiversity restoration ideas including lawn to meadow, adding deadwood to one's yard, nesting boxes or bee hotels, buying a piece of old field and reforesting it, and increase biodiversity values in one's own forests. Discussions included some suggestions of obligatory pro-biodiversity actions in the case when privately owned property borders commonly owned land. In Finland there is great amount of land owned privately by individuals, especially forests (Metsäkeskus 2022).

Indirect community actions included themes such as monetary or economic support for biodiversity, knowledge building, education and information sharing, broad sustainability in everyday life or in consumption, and political influence. New environmental taxes, product-based eco-taxes, sharing economy, better public transportation, and reduction of private cars in city centres were

also suggested. Workshop participants called for a sense of community through themes such as enhanced participation and the inclusion of local people into discussions and decision-making, a communal way of living, and public discussion events. Education was a widely discussed topic in every workshop on the school system and early childhood education but also through general learning topics such as ‘enlightenment of all levels’ and ‘talk about topic’. Participants called for easy and adjustable biodiversity offsetting options and recognised needs for the visibility of a new operating model: to establish a new normal and to be valued, publicity is needed. In contrast to obligatory requirements, participants expressed a need for especially positive motivation towards topic.

Individual indirect biodiversity actions varied at the level of action from small impact (use bicycle) to major, even unconscious, impact (‘strengthening human–nature relations’). Concrete suggestions here were related to a moderate and sustainable way of living including e.g. reduction of flights abroad and using public transportation. In addition, ideas such as remote work, avoiding plastic packaging (plastic strike), repairing broken items and clothes, recycling and buying local food were often endorsed. Economic support for biodiversity conservation was discussed in the workshops. A resource bank where one can list ones’ own skills for others to ask your ‘know-how’ was also introduced. In addition, citizens innovated new services such as management of biodiversity on a certain land area via customer payment and a mobile application where a user could the development of a degraded site toward its natural state by adding pictures and information collected in the app.

Participants presented both old and new ideas as securing biodiversity on citizen level. Old ones described means of sustainable ways of living and forms of collective actions while new ones represent mobile applications, gamification and leadership to pro-biodiversity actions and biodiversity offsetting through famous influencers.

We found that citizens wanted effective and customisable offset actions for individuals and communities. Citizens recognised ecological pressure caused by consumption habits and suggested a great number of indirect actions to compensate for these.

The correlation between caused harm and actions suggested were rarely linked. This reflects the complexity of biodiversity and natural habitats as concepts but also unawareness of the negative impacts to biodiversity caused by current lifestyles. Related to this, we found that biodiversity offsetting and mitigation hierarchy are complex to understand. We need development of the language and scalable options for citizen, who show potential and willingness to conduct pro-biodiversity actions according to our results. Since the requirements of legal biodiversity offsetting cannot be fulfilled on citizen level, we suggest ‘*nature amends*’ to be used when describing citizen level pro-biodiversity actions.

A broader approach than ecologically oriented biodiversity offsetting is needed. We compared our results to the mitigation and conservation hierarchy presented by Milner-Gulland et al. (2021), which is a useful framework in the light of our results. The four steps of the framework, *refrain–reduce–restore–renew*, can be all found from our results. *Refrain* (avoid) was less discussed in our data,

but suggestions related to more sustainable living and making ecologically better consumption choices, such as using public transportation, create a continuum to second step *reduce* (minimise). These two first steps mainly associate with direct action conducted by individuals in our data. The third step, *restore* (rehabilitate), can be connected to removal of invasive species, maintaining rural biotopes and securing green spaces in urban areas. These include both actor levels, either individuals or community, and mostly direct action suggestions, but also some indirect actions can be categorised here, such as donations to conservation NGOs. The *renew* (offset) step in our data consists of a variety of actions to increase biodiversity values, for example turning lawns into meadows, favouring domestic plant species in private gardens and creating new urban green spaces.

In contrast with the mitigation and conservation hierarchy, our results included a considerable amount of mostly indirect community-level action, which does not fit the current forms of mitigation and conservation hierarchy suggested for citizens or NGOs. To make these noticeable, we introduce a new R, *reinforce*, and include there all the supporting and enhancing actions proposed to reinforce the capacities of individuals and communities to conduct pro-biodiversity action. These are important in combatting biodiversity loss and their role should be made more visible while promoting the different possibilities to act. When these actions cannot be directly set into mitigation hierarchy thinking, we propose them as overarching activities that are related to supporting all the steps (Fig. 8).

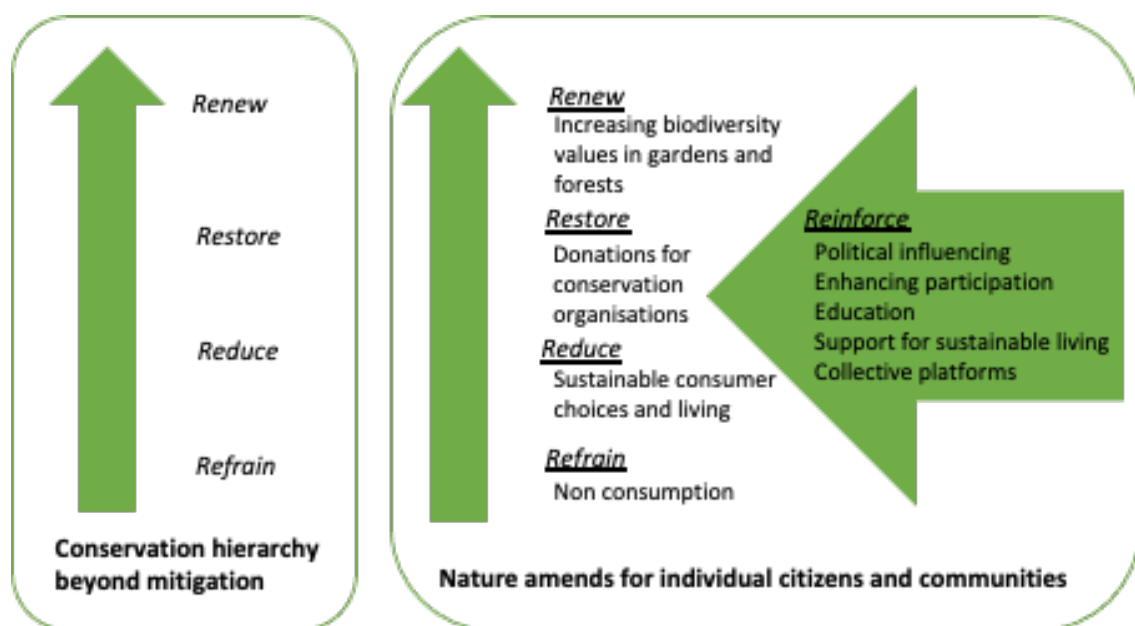


FIGURE 8 Development of mitigation and conservation hierarchy to better consider community-level actions which include supporting and enhancing actions proposed to reinforce the capabilities of communities and individuals. (Source: article III)

3.4 Gardens' potential as a place for biodiversity: A case study among garden enthusiasts

We were interested to know how garden enthusiasts perceive biodiversity conservation and the possibilities to compensate for biodiversity loss in their gardens (RQ1), which biodiversity attributes garden enthusiasts prefer in their gardens (RQ2) and what kind of biodiversity-benefiting actions garden enthusiasts are willing to conduct in their gardens (RQ3). An exploratory factor analysis resulted in three factors for every research question. We named three factors answering to RQ1: the value of biodiversity (F1.1), the importance of conservation (F1.2) and the responsibility of others (F1.3).

In perceptions on biodiversity and motivations for nature amends, the exploratory factor analysis resulted in three factors. Factor 1.1., which we named the value of biodiversity, explained 23 % of the variance and comprised of five statements related to the general importance of increasing or maintaining biodiversity. Positively written claims loaded in this factor were in strong favour of respondents whereas negatively formed claims gained strong disagreement. Also in whose responsibility (F1.3) claims were formed negative way and the responses were strongly disagreeing or disagreeing, meaning that the majority of respondents were in favour of protecting biodiversity (Fig. 9). F1.2 which we named Importance of compensation was loaded with the two statements on describing the need of people to compensate the negative impacts they have caused to nature (Fig. 9). The two statements loaded here were strongly in favour of compensating human actions (Fig. 9).

Factors reflecting the value of biodiversity (F1.1.) and importance of compensation (F1.2.) were positively correlated with each other and negatively correlated with the third factor, which took a stance on whose responsibility conservation actually is (F1.3.). Since the statements associated with responsibility were written to emphasise the responsibility of other people and respondents answered by strongly disagreeing to those views, this factor was negatively correlated with two others (Fig. 9). In other words, those people who valued biodiversity and considered compensation important were also willing to take responsibility for protecting biodiversity themselves.

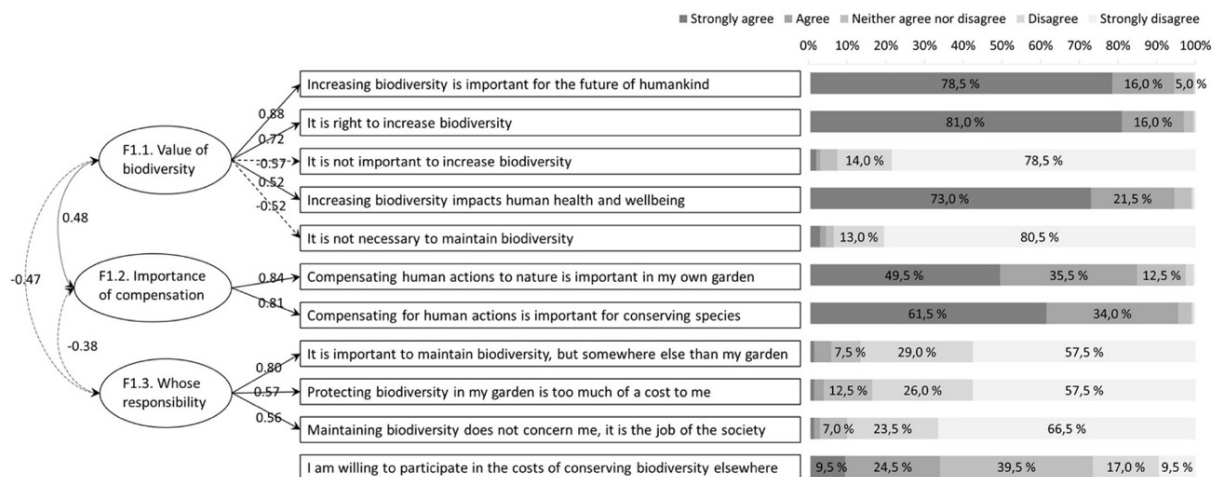


FIGURE 9 Opinions on biodiversity supporting relating to the three factors, and the distributions of responses according to the analysed statements, on a 5-step Likert scale. Only percentages larger than 5% are shown as numbers. (Source: article IV)

Preferences for various biodiversity attributes resulted again in three factors: plants and all species (F2.1), pollinators, birds, and soil (F2.2), reptiles, mammals and invertebrates (F2.3). Here garden enthusiasts’ opinions varied between respondents (Fig. 10). The respondents were mostly positive or neutral towards the three statements associated with plants and all species (F2.1) and very positive toward pollinating insects, birds and soil well-being of their garden (F2.2) (Fig. 10). In three factors associated with reptiles, mammals and invertebrates (F2.3), the views varied strongly about increasing the number of reptiles and mammals, while invertebrates (other than pollinator) received mostly positive views (Fig. 10).

In general, preferences for different biodiversity attributes varied between respondents, excluding the three attributes of pollinators, birds and soil (F2.2), which were viewed positively by most respondents (Fig. 10). All factors were positively, though not strongly, correlated with each other.

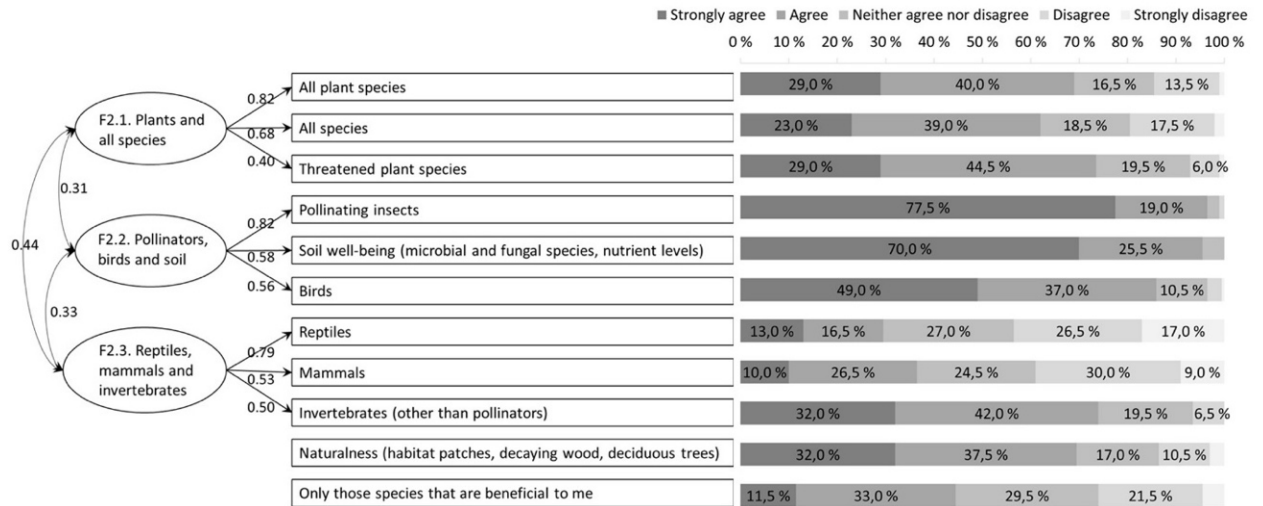


FIGURE 10 Opinions on biodiversity attributes relating to the three factors, and the distributions of responses to the analysed statements, on a 5-step Likert scale. Only percentages larger than 5% are shown as numbers. (Source: article IV)

The third and final factor analysis revealed the preferences for various nature amends garden enthusiasts are willing to make. The nature amends factor was divided into three factors: creating habitats (F3.1), reducing chemicals (F3.2) and supporting nesting (F3.3) (Fig. 11). Creating habitats was characterised by five actions where the gardener adds habitats in order to support species richness (Fig. 10). The actions associated here were viewed positively by at least half of the respondents and neutrally by approximately one fourth, but negative views were also given, especially for “native trees and bushes” (9.0 % disagreed) and “decaying wood” (8.5 % disagreed) (Fig. 11).

Reducing chemicals (F3.2) was associated with actions increasing biological control and nutrient recycling in the garden (Fig. 11). Respondents had a positive attitude about replacing pesticides completely and increasing nutrient recycling. Supporting nesting (F3.3) included the provision of nest places and shelters for birds and insects (Fig. 11). The respondents were positive about adding both of these (F3.3).

Most respondents were interested in making nature amends in their garden. Especially the statements associated with reducing chemicals (F3.2) and supporting nesting (F3.3) received mostly positive responses. The actions associated with creating habitats (F3.1.) were viewed positively by at least half of the respondents but also less interest towards some claims was shown here.

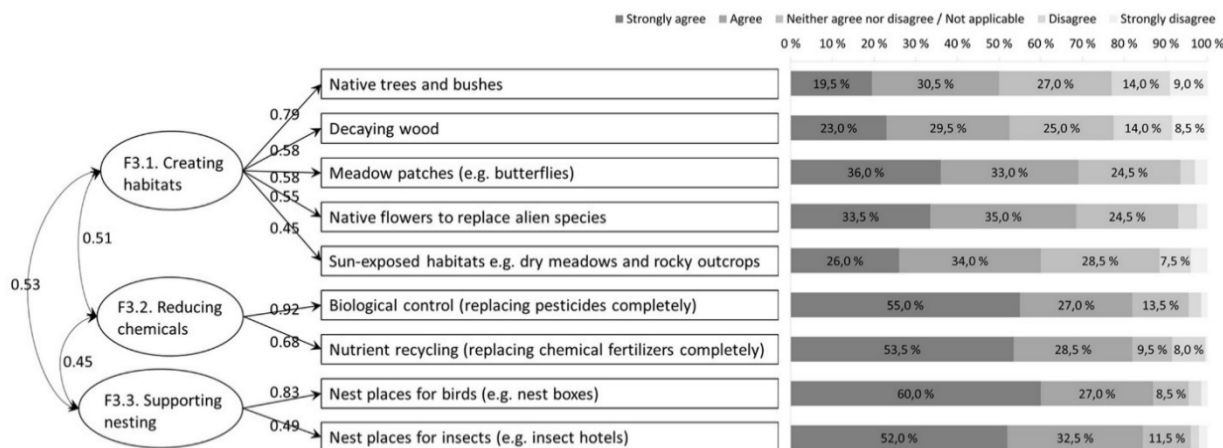


FIGURE 11 Nature amends relating to the three factors, and the distributions of responses to the analysed statements, on a 5-point Likert scale. Only percentages larger than 5% are shown as numbers. (Source: article IV)

We found that, in general, garden enthusiasts showed a positive attitude toward supporting biodiversity in their gardens and for making nature amends. The respondents were especially willing to conduct small-scale actions to increase species richness in their gardens. The respondents were very positive about maintaining and increasing biodiversity, and they see it is important for human health, wellbeing, and future to do conservation work today. These views are similar to those found in previous studies (White *et al.* 2023, Felderhoff *et al.* 2023). When we zoomed in on the garden enthusiasts' yards and the biodiversity attributes offered to be placed there, we found that that garden enthusiasts are generally willing to enhance biodiversity in their own gardens, but their willingness to act varies between different species groups. Most of our respondents were positive towards increasing all plant species, threatened plant species or all species. Pollinators and soil well-being were also very positively preferred. This was a predictable finding of this study, since we can assume garden enthusiasts prefer plants and gardening-supportive actions to be increased in their gardens. Birds were also a popular choice. Garden enthusiasts might consider birds to be beneficial for insect control or as simply interesting to watch (Goddard *et al.* 2013, White *et al.* 2023). We argue that the recent visibility of bird and pollinator campaigns in the Finnish media have probably affected their popularity among garden enthusiasts who were informed about their distress (see e.g. YLE 2016).

We detected that respondents' willingness dropped when less known species groups were in question. Enthusiasts' attitudes varied towards reptiles (13% strongly agreed, 17% strongly disagreed) and mammals (10% strongly agreed, 9% strongly disagreed). The difference most likely reflects variance on how individual reptile and mammal species are perceived. Invertebrates received more positive views but were associated with the same factor as reptiles and mammals, indicating that some garden enthusiasts repelled all of these three species groups, and the pattern seems to be driven by a dislike of reptiles. In a previous study, creating habitats for lizards was connected to a householder's

earlier engagement in wildlife gardening activities (van Heezik *et al.* 2020). The proportion of respondents who wanted to increase the number of reptiles, mammals and invertebrates was much smaller than the proportion that agreed with the general value of biodiversity, indicating that education is needed on the value and importance of species groups that are found repellent or poorly known by the public.

When we asked respondents about their willingness to take direct action and to make nature amends in their own gardens, we noticed that all the suggested actions were desirable to more than half of the respondents. However, our results suggest that the popularity of the actions is not related to the potential ecological impact but rather to how easy or beneficial it might be to the gardener (similar results in Larson *et al.* 2022). The five actions for creating habitats (F3.1) (adding native trees and bushes, decaying wood, meadow patches, native flowers, and sun-exposed habitats) were the least popular among the respondents, although 69.5% of the respondents were willing to increase the level of naturalness in their garden (non-associated statement in Fig. 10). Creating habitats requires quite a lot of effort, time and space. They also have great positive impact on biodiversity if conducted with biological knowledge. On the other hand, social pressure from neighbours might repel gardeners from making visibly different choices, especially in densely built neighbourhoods. Friends and neighbours were recognised as the most important influence on gardening activities in two earlier studies (Goddard *et al.* 2013, van Heezik *et al.* 2020).

Based on our results, garden enthusiasts prefer easy, effortless and quick nature amends. We observed a preference towards adding elements that benefit gardening. Most of the respondents were motivated to make simple nature amends in their garden but education on species groups less known but important and possibly advantageous for gardening is needed.

The positive attitude of garden enthusiasts to carry out diverse nature amends indicates that there is potential for citizens to act on all levels of the mitigation and conservation hierarchy (Milner-Gulland *et al.* 2021). For this reason, we see a need for improvement in environmentally conscious gardening at multiple stages, starting from planning new gardens in a more biodiversity-based manner, to increasing the publicity of ecologically effective actions in existing gardens, such as planting native trees and retaining or adding decaying wood. Relying on our results, campaigning and community programs, such as garden nursery visits and yard assessments (Larson *et al.* 2022), education of private garden owners to increase their awareness of potential nature amends that have a positive effect on biodiversity would probably be beneficial in the future to tackle biodiversity loss.

4 CITIZENS AS ALLIES IN BIODIVERSITY CONSERVATION

4.1 Citizen participation in biodiversity offsetting

Ecological crises limit our time frame to act against negative impacts, be it climate change or biodiversity loss. Governmental actors are usually perceived to be slow (Hegger *et al.* 2022), and 'slow' is not what is needed with biodiversity issues. Governmental processes and tradition can also limit citizens' contribution, for example, climate actions, as happened in the Netherlands (Hegger *et al.* 2017). Nature conservation in Finland, as in most Global North countries, is done through national or regional conservation area planning (Ban *et al.* 2013). Furthermore, in Finland we have the METSO programme (2008–2025) as an additional option for private forest owners to protect their forests (Ministry of Agriculture and Forestry in Finland 2023). Many Finns are forest owners: 43% of forests are owned by individual people in Finland (Metsäkeskus 2022).

Biodiversity offsetting is an example of a legislation-guided, administrative-level process. According to the results, there are two pathways for citizen participation in biodiversity offsetting: (1) the formal, usually legislation-guided procedure, if it enables involvement of local people's aspects and (2) individually conducted pro-biodiversity actions – nature amends.

The original offsetting process and developers driving it rarely recognise social aspects in decision-making or in the determination of the offset area. And when the social aspect is rarely counted, people still do not feel they have been heard (I). This increases distrust in both the project promoter and the offsetting itself and may prevent a socially acceptable outcome.

Biodiversity offsetting on a large scale, if increasingly used for nature conservation purposes, needs to consider a couple of things. One, it must avoid developing in a weak sustainability direction where it discursively diverts attention away from more transformative action and thus makes it harder to stop biodiversity loss (Damiens *et al.* 2021). Two, offsetting needs to acknowledge social impacts and seek parallel consideration of biological and social values (I). Acknowledging could ease the processes and improve inclusiveness of locals,

and increase people's understanding of the topic. Awareness can be partly distributed via more nuanced communication between project promoter and local people in biodiversity offsetting process.

The biodiversity offsetting process is related to language and terminology in use (Apostolopoulou and Adams 2017). Enhanced participation of citizens requires either education or more understandable speech for non-experts of the topic. One suggestion for this is *nature amends* (III), by which I describe citizen and community-led pro-biodiversity actions. Nature amends relates to individually conducted restoration actions; the second option is the development of the offsetting process to be more inclusive for local people in the future (I).

Nature amends broaden the mitigation and conservation hierarchy (Milner-Gulland *et al.* 2021), as I and my co-authors suggest in article III. To include indirect community-level actions in the hierarchy, we suggest a fifth R, *reinforce*, to ensure the capacities of communities and individuals to conduct nature amends. These capacities include political influencing, enhanced participation, education, support for sustainable living and collective platforms (III).

A change in organisations' attitudes – that is, of both public organisations and the private companies that actually carry out the compensations – and caution in the limitations the formal biodiversity offsetting process currently places on local people, may be a starting point for more inclusive offsetting processes. This could create the ability to think more broadly than usually and to see citizen involvement as a possibility rather than as a threat (Taherzadeh and Howley 2017). Biodiversity offsetting should have a simultaneous process for the participation of local people and include tried and tested methods for social dialogue. Opening biodiversity offsetting to citizens via the nature amends concept widens hopes for tackling biodiversity loss.

4.2 From identifying nature relations to exploiting them

Behind the motivation for pro-biodiversity actions is one's own nature relation, which evolves through a person's whole life. Nature relation comes in multiple forms and describes a variety of attitudes useful for supporting biodiversity (II). Nature relations can include contrary dimensions as well. Registering these will help to strengthen those dimensions which are essential for biodiversity enhancement. Typically, women are more positive about nature conservation than men are (see e.g. Vainio and Paloniemi 2013), which is partly visible in this dissertation as well (II, III, IV) where participants and respondents were most often women than men. Influencing especially men could be an important addition to increase success in biodiversity conservation.

Despite the call for environmental education in the case of biodiversity offsetting (III), recent studies have proven environmental education to be inefficient in increasing pro-environmental behaviour and people-perceived connectedness to nature (Lumber *et al.* 2017, Barragan-Jason *et al.* 2022). Thus, increasing awareness by education is not necessarily the best way inspire people or encourage them. Instead, access to nature and the increase of experiences in

and with nature can have a positive effect on recognising its importance for, among other things, one's wellbeing (II), but also becoming better aware of biodiversity in general and its value to self (IPBES 2022a). Emotional connection is important in building a nature relation and by taking people to outdoors in a guided way it is possible to deepen their nature relation (Lumber *et al.* 2017, II). By employing different discourses on nature, for example outdoor activity, enjoyment, ecoanxiety and valuation of natural habitats, information on ways to support biodiversity can be targeted to different groups of actors in a way that is relevant to them (II).

Citizen motivation for nature conservation has been studied also through citizen science method. In a study by Day *et al.* (2022), the deeper engagement with nature conservation activity required especially experiencing a sense of contribution. Together with it, social interactions and cultural experiences were important (Day *et al.* 2022). Similar withdrawals were made by participants in the citizen workshops when they called for many collective actions (III). Experiencing an emotional connection with both other people and nature strengthens the nature relation and thus people's willingness to engage in biodiversity conservation.

Participants in the workshops innovated several ways how to downscale biodiversity offsetting to the citizen level. They proposed ideas within the scope of the individual's capacity to act, mirroring one's own nature relation and discourses of nature.

4.3 Voluntary citizen, voluntary actions

Forms of voluntary work can be roughly divided into two dimensions in biodiversity enhancing context: the old, where a group of people gather at the same place at the same time and work together for a common good (see e.g. Rautio 2011), and the new, typically virtually gathering or contributing groups, which may never meet live.

The old version of voluntary work is interesting to those who have earlier experience of it and gained positive feelings and positive social interactions with other volunteers (Rautio 2011, Marjovu 2014, Kamkeris 2022). Nature management work, for instance the removal of invasive species to improve the condition of habitats or water management work, are examples of this kind of voluntary group work (Väänänen 2019). These kinds of actions citizens suggested in the co-creation workshops as direct actions (III). Citizens in co-creation workshops also underlined the need for social approval and discussed how one's own tribe supports and gives you social currency (III). Social dimensions, including teamwork, social enjoyment, learning and getting inspired by others, has been found to be important for conservation engagement (Day *et al.* 2022).

New forms of voluntary work are groups that involve gathering or contributing virtually and which may never meet live. Examples of these are variety of hobby groups in social media platforms, where participants share

knowledge and good practices to other members. One example of digitalised activity is the creation of Wikipedia and its content. Virtual voluntary work groups work can take place at different times in different places. Citizens in co-creation workshops presented these forms of action, such as a mobile application game for following an offsetting area's rehabilitation success (III).

Proposals of indirect actions (actions that do not happen in a certain location) were abundant in the workshops (III). Many of the ecological impacts of our lifestyle occur via secondary routes and direct compensation of those is challenging. Suggested indirect actions for citizen activity outlined choices for people living an individualistic life in the middle-class: economic support for NGOs, mobilising residents' associations, and a sustainable way of living – all choices which are possible mostly for those who are better off. Volunteering is also increasing among the better off in society (see e.g. Fields 2021).

The emphasis on community-conducted actions frames eco-crises as shared problem, which need participatory rather than individual solutions. For me the numerous suggestions for community-based actions were surprising. Firstly, in the workshops citizens were asked to think specifically about individual solutions. Moreover, the contemporary world is very individual-oriented, yet, the proposals were for collective action. In addition to the indirect impacts of consumption habits, taking individually responsibility of caused harm and admitting 'Yes, I am part of the problem' is hard. Results may thus reflect an avoidance of individual responsibility and therefore the need to work together was highlighted in the responses.

Biodiversity conservation, especially in the Global North, requires an aesthetic update: what is valued as beautiful, acceptable and worth preserving on privately owned properties such as yards, and in public green spaces, such as city forests and parks. Public discussion during the past four to five years has highlighted small-scale pro-biodiversity actions such as insect and bird boxes and favourable flowering plant species supporting pollinators in private gardens (YLE 2020, 2016). The decreased amount and variation of biodiversity has pushed people to take action and participate, for example, in demonstrations (Metsämarssi 2022).

To be successful, biodiversity conservation needs long term commitment, and volunteering that is perceived as meaningful provides the readiness and motivation to make a long-term dedication.

Concrete, pro-biodiversity actions can be taken on one's own land. This applies to cities, communities, companies, and citizens. On a societal level, public green spaces owned by cities and municipalities are potential places for biodiversity restoration and enhancing. Privately owned land is also to a large extent found in residential areas: 38% of Finns live in a detached house and 13.5% in a row house (InfoFinland 2023, Stat 2023). This means that together 51.5% of Finns own some size of yard where pro-biodiversity projects are possible. In addition, we have over 508,000 second apartments in Finland, which also have a yard (Stat 2023).

Private gardens provide one possibility where citizens can take pro-biodiversity actions. Garden enthusiasts showed very positive attitudes toward nature amends (IV), although nature amends have not previously been linked to

gardening in Finland. Wildlife gardening and environmental stewardship have been the subject of previous studies, and these themes come close to nature amends (Cerra 2017, García-Antúnez *et al.* 2023). Survey statements received, on a general level, very positive responses, but the closer the questions got to the concrete, the more the gardeners' answers began to differ depending on the species group and the type of nature amends. Campaigning, community programmes and the education of citizens of pro-biodiversity actions that have the greatest positive impact on biodiversity would be valuable in the future.

In the bigger picture, citizen-level actions, one's own nature relation and the biodiversity offsetting process are interlinked (Fig. 12). Nature relations provide the basis for the mindset and values of individuals and societies alike. The potential of citizens to stop biodiversity loss is an under-utilised resource that needs to be focused on in the future, alongside other means. However, simply "going green" is not enough: the scale of the action must be recognised and compensated for. The degradation caused can be outlined through the mitigation hierarchy, which also makes it possible to identify opportunities for avoidance and to specify when biodiversity offsetting is needed.

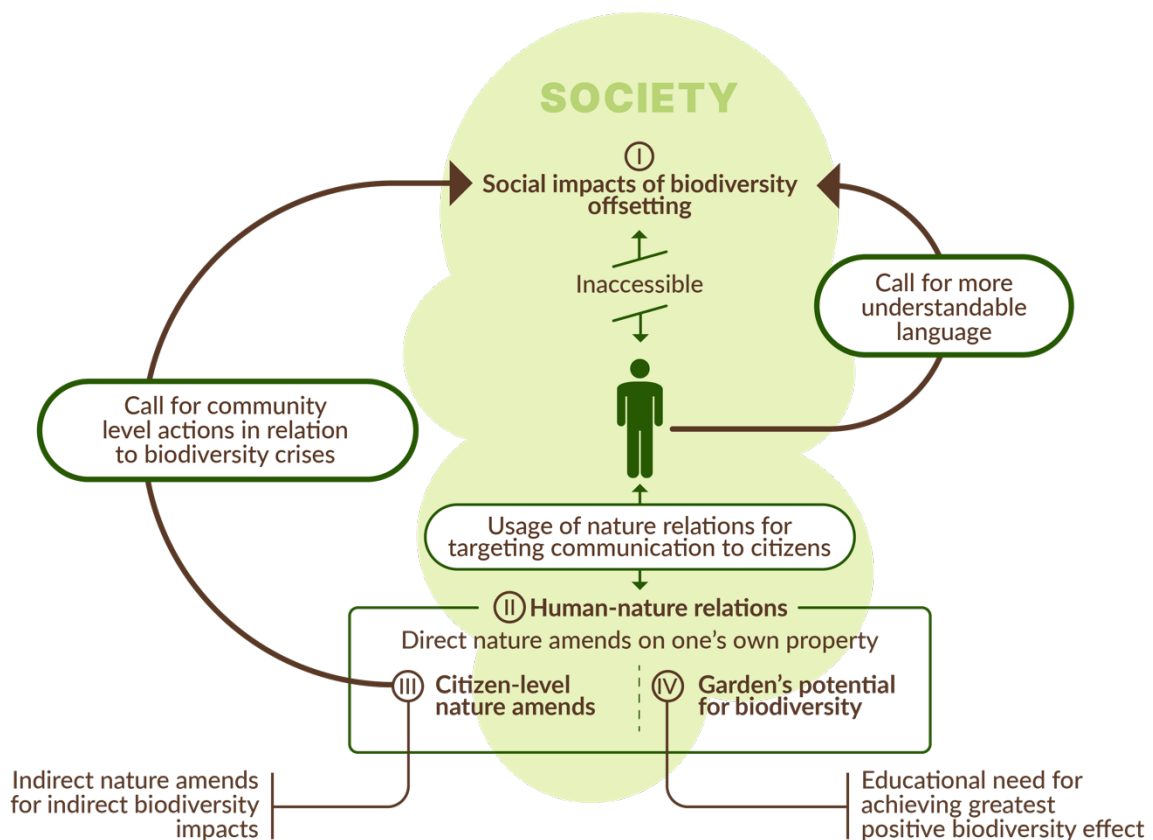


FIGURE 12 Interlinks between the articles and main results (green text). Citizen is placed in the middle and directions of observations are presented with arrows. Above is placed the study from procedural point of view. Below the citizen are three case studies to which nature relations were seen as the unifying factor. All the discussions that relate to biodiversity offsetting or nature relations happen within the society.

4.4 Looking for common ground and recommendations for further research

This thesis is part of the development of broader thinking to address the biodiversity crisis. Due to many research areas included in this work, there was only a limited possibility to discuss deeply on every topic. There are various possible avenues for further multidisciplinary research of this kind. Here I offer some examples of interesting fields for future research.

Biodiversity offsetting as such seems to belong to discussions of ecology or neoliberalism rather than, for example, planning studies. But when attention is on, say, the social aspect of biodiversity offsetting, planning and location of development projects as well as offset areas becomes valid. The attention in nature conservation is more or less only on natural habitats and spatial research that prioritises biodiversity values (Ban *et al.* 2013). In planning there are many targets on the table at the same time and acknowledging both biodiversity and social values would be possible. In the current situation in Europe it seems to be that planning, biodiversity conservation and social issues are separated from each other at least in practice (Scholte *et al.* 2016, Taherzadeh and Howley 2017, Apostolopoulou 2020).

With cooperation and a multidisciplinary approach, there are possibilities to understand challenges that hinder rapid implementation of sustainable transition. I recommend looking for common ground, interests and joint study projects between sociology, environmental sciences, environmental social sciences, ecology, economic studies and planning. On the other hand, in my mind, linking the study of commons into themes of biodiversity offset areas or the identity of places or residential area ecological restoration (through biodiversity offsetting) would be interesting (see e.g. Stewart *et al.* 2013).

Precisely in relation to the research topics of this dissertation, I recommend collaborative research between, for example, wildlife gardening, environmental stewardship and nature amends. I would be highly interested to see studies about aesthetic values on urban public and private green areas combined with verified biodiversity targets: what is seen as beautiful and if that is not biodiversity rich, could these values be changed and how?

The consideration of individual self-organisation in municipal decision-making (as an example of the involvement of local people in organisation decision-making) on nature questions should be taken into account in future studies. In general, it would be useful to examine the receptiveness of the administration to new interventions and the public's understanding of the role of the administration. A two-way connection is needed.

Last but not least, future research should focus on finding the best ways to inform citizens about the mitigation hierarchy and on developing templates to illustrate which citizen-level actions can be classified as, for example, mitigation and which as compensation.

5 CONCLUSIONS

Participation of citizens as active individuals in biodiversity offsetting has not been studied before. General social aspects of biodiversity questions have been in the scope of some scientific papers, but more research is conducted either on procedural development of offsetting (Bull *et al.* 2017b) or citizen motivation generally on nature conservation (Admiraal *et al.* 2017, Day *et al.* 2022). This dissertation gives a first insight into active, participating citizens in biodiversity offsetting.

The effectiveness of pro-biodiversity actions varies and easy or small actions only rarely, if ever, have a significant positive impact on biodiversity (IV). We need more discussion on actions regarding biodiversity conservation on a small scale and the effectiveness of different actions. Although education was called for in many of the workshop discussions (III), I would see that the best ways to provide training and information need to be carefully considered without forgetting the importance of an emotional connection to nature (II). In my mind the key words for training for citizens are speed, proper targeting and presentation format. Active citizens, and researchers as well, may have a major effect on public opinion and can influence the way private land is used or managed. Famous influencers (individuals or groups) can shape the emerging trends in this topic.

Feeling connected to nature and enabling the growth of one's own nature relation, supports citizen willingness for pro-biodiversity actions (II). Citizens have the potential to help in enhancing biodiversity when motivated and guided right. Here I have presented ideas, willingness, and direction of motivation for citizen-level nature amends (III; IV).

Even though there are rare chances for individuals to participate in nature conservation practices (Ban *et al.* 2013), traditional nature conservation remains important for protecting larger areas and taking control of the bigger picture of conservation. However, scalability is required between actors: if society is the only one to be seen responsibility of conservation actions, a lot of potential continues to be non-utilised. The involvement of local people into conservation planning and practices delivers more successful outcomes (Berkes 2021).

According to this dissertation, there is both a demand and momentum for multiple options for enhancing biodiversity outside traditional conservation. I argue that we need an aesthetic update: there should be more nuanced consideration of what we think about non-conservation areas. This means a variety of modes in the use of natural areas, more options for restoration activities and more views of beautiful gardens: smaller direct pro-biodiversity actions which can enhance biodiversity spot by spot, yard by yard, and increase biodiversity in, for example, residential areas, where actions can potentially have local-level impact and they can be verified and monitored. By utilising the findings presented here, it is possible to create new forms of participation in biodiversity conservation and strengthen already existing processes to be more participatory.

Here I have discussed what we can all do to stop biodiversity loss and what the potential of biodiversity offsetting is from a citizen perspective. Offsetting or nature amends as a concept are needed to show, with the help of the mitigation hierarchy, the scale of different harm caused to nature and the possibilities to, among other effects, avoid and minimise the harm. Biodiversity offsetting highlights the unacceptable negative impacts which need to be compensated for. Without the mitigation hierarchy or offsetting procedure, there is a risk of simply 'going green' and important biodiversity values are not fulfilled. Citizens' willingness, values, and thirst for knowledge (II, III, IV) create possibilities to develop new forms of participation in biodiversity conservation through, for example, nature amends. Bringing new forms of action to the toolkit gives hope for an ecologically more secure future. To be successful, biodiversity conservation needs citizen allies.

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YHTEENVETO (SUMMARY IN FINNISH)

Tutkielma kansalaisten roolista ekologisessa kompensaatiossa

Teollistumisesta liikkeelle lähtenyt yhteiskuntien voimakas kasvu ja luonnonvarojen lähes rajaton hyödyntäminen on kestämatöntä. Ihmisen levittäytyminen kaikille maaekosysteemeille niin asumisen, ruuantuotannon kuin infrastruktuurinkin merkeissä on tarkoittanut alati väheneviä elinympäristöjä muille lajeille. Olemme vakavien ekokriisien äärellä ja meillä on ihmiskuntana viimeiset hetket vaihtaa kurssia ja välttää peruuttamattomat muutokset maapallon luonnontilassa ja ilmastojärjestelmissä.

Viitteitä toimintahalukkuuteen ja -kykyyn on. Muiden muassa YK:n biodiversiteettikokous linjasi joulukuussa 2022 keskeisiksi tavoitteiksi suojella 30 % maapallon maa-, meri-, rannikko- ja sisävesialueista, vähentää roimasti haitallisia verotukia sekä puolittaa ruokajätteen määrä globaalisti. Myös EU julkaisi kesällä 2022 ehdotuksen ennallistamisasetuksesta, jonka tarkoituksena on palauttaa heikentyneitä ekosysteemejä kohti alkuperäistä tilaansa.

Kansainväliset sopimukset nojaavat paljolti tuttuihin, länsimaisiin toimintatapoihin, mm. suojelutavoitteisiin. Niitä tarvitaankin alueellisen tason tavoitteiden asettelussa ja laajempien kokonaisuuksien muodostamisessa. Esimerkiksi biodiversiteettisopimuksilla on jo pitkät olemassaolon perinteet, mutta tavoitteita ei silti ole saavutettu. Tarvitaankin erilaisia työkaluja ja lähestymistapoja, jotta ekokriisit mm. luontokato, saadaan hallintaan.

Tässä väitöskirjassa tutkin biodiversiteetin turvaamisen mahdollisuuksia kansalaisnäkökulmasta käsin. Kansainvälinen poliittinen taso tuntuu helposti varsin kaukaiselta ja tarjoaa vain vähän konkreettisia ehdotuksia, joita toteuttaa tai soveltaa käytännössä. Eri toimijatasoille soveltuvia vaihtoehtoja tarvitaan siis sekä tavoitteiden kansalliseksi saavuttamiseksi, mutta myös kansalaisten ottamiseksi mukaan yhtenä toimijaryhmänä.

Yksi vaihtoehto luontokadon pysäyttämiseksi on hyödyntää paremmin lievennyshierarkiaa. Hierarkia on toimintamalli ja päätöksentekojärjestelmä, jossa on neljä askelmaa: välttä-minimoi-ennallista-kompensoi. Välttäminen voi tarkoittaa luonnon tilaan vaikuttavan hankkeen kokonaan toteuttamatta jättämistä, aluevalinnan uudelleen kohdentamista tai rajaamista, tai ajallista haitan aiheuttamisen välttämistä. Minimointi tarkoittaa aiheutetun luontohaitan määrällistä minimoimista. Ennallistamisella viitataan luontoarvojen palauttamiseen haittapaikalla ja se tarkoittaa usein maisemoinnin kaltaista loppuvaiheen toimintaa: haitan aiheuttamisen päätyttyä kohde ennallistetaan kohti alkuperäistä tilaa. Ekologisella kompensatiolla, hierarkian neljännellä portaalla, tarkoitetaan luontohaitan korvaamista toisessa sijainnissa. Tällöin haitta on useimmiten pysyvä tai niin vakava, ettei paikan päällä ennallistaminen ole joko riittävää tai se ei onnistu ollenkaan. Tällöin kompensaaation periaatteiden mukaisesti korvaava alue voidaan etsiä menetetty luontotyyppi huomioiden toisesta sijainnista.

Biodiversiteetin turvaamista ekologisen kompensaaation keinoin ei ole aiemmin tutkittu kansalaistasolla. Tässä tutkielmassa lähestyn aihetta sekä laajan

kirjallisuuskatsauksen että tapaustutkimusten avulla. Olen kiinnostunut miten ekologisen kompensaation prosessi antaa sijaa kansalaistoimijoille, ja toisaalta mitä kansalaiset itse ajattelevat kompensaation käsitteestä ja toimintaperiaatteesta. Tutkin myös suomalaista luontosuhdetta sekä kansalaisten halukkuutta tehdä konkreettisia luontohyvityksiä hallinnoimallaan maalla.

Kompensaatioprosessi ei saamieni tulosten mukaan ole saavutettava yksittäisille kansalaisille, eikä se toisaalta huomioi aiheutettuja sosiaalisia vaikutuksia. Prosessi ei siis tunnista ihmisiin kohdistuvia vaikutuksia (en tosin tarkoita, että ihmisenäkökulman tulisi ohittaa ekologiset tarpeet), mutta se ei myöskään ole saavutettava paikallisille ihmisille teknis-luonnontieteellisen kielensä ja toimintaperiaatteensa vuoksi. Prosesseissa mukana olleet ihmiset eivät ole kokeneet tulleen kuulluiksi, vaan heidän näkemyksensä jäivät helposti asiantuntijavetoisessa prosessissa sivuun.

Koska ekologinen kompensaatio, kuten muutkin toimet yhteiskunnassamme, heijastelevat asiaan liitettuja ja tunnustettuja arvoja, tutkin tässä työssä yhdessä kanssakirjoittajien kanssa myös luontosuhteita suomalaisessa kontekstissa. Saimme tulokseksi, että luontosuhteen diskursseja eli jaettuja käsityksiä on nyky-Suomessa monia erilaisia, ja yksi ihminen voi käyttää useita diskursseja riippuen siitä millaisissa tilanteissa ja millä tavalla hän luontoa kokee. Löytämämme diskurssit olivat hyvinvointia luonnosta, suojelunarvoinen elonkirjo, ympäristöahdistus, ympäristötietoisuus, luonnossa liikkuminen ja luonnosta iloitseminen. Luontoon liitettuja sanoja olivat mm. rauha, kauneus, eheys, vihreys, puhtaus ja muutos.

Luontosuhde tai -suhteet selittävät osaltaan suhtautumistamme luontoon ja valmiuksiamme tehdä luontoa auttavia tekoja. Ekologisen kompensaation kansalaistyöpajoissa osallistujat suhtautuivat luontokatoon ratkaisukeskeisesti ja ehdottivat lukuisia toimia kansalaistason ekologiseksi kompensaatioiksi. Aineistosta hahmottuivat suorat (suoraan luonnon tilaan vaikuttavat teot esim. vieraslajien poisto) ja epäsuorat toimet (esim. koulutus) ja kaksi toimijaryhmää: yksilöt ja yhteisöt. Koska epäsuoria toimia annettiin eniten, tulkitsimme suorien tekojen olevan jollain tapaa haastavia toteuttaa yksittäisille kansalaisille. Lisäksi termistö koettiin hankalaksi ja kansalaisten kanssa toimiessa tulisikin käyttää ymmärrettävämpää kieltä ja puhua selkeyden vuoksi luontohyvityksistä kompensaatioiden sijaan. Suuri määrä yhteisöllisyyttä korostavia tekoja alleviivaa lisäksi yhteistä vastuuta maapallon tilasta ja tarvetta vahvistaa kansalaisten osallistumismahdollisuuksia luontohyvitysten toteuttamiseen mm. koulutuksen, osallistumisen ja yhteisöllisten alustojen, esimerkiksi erilaisten kohtaamisfoorumien kautta.

Viimeisenä osatyönä tutkin puutarhaharrastajien konkreettista valmiutta luontohyvityksiin omissa puutarhoissaan. Tutkimukseen osallistui kolmen suomalaisen puutarhaseuran jäseniä. Tulosten perusteella voidaan todeta, että mitä yleisemmän tason väitteistä oli kyse (esim. luonnonsuojelu on tärkeää) sitä enemmän se sai kannatusta, ja mitä tarkemmin väitteet koskivat esim. eri lajiryhmien tukemista puutarhoissa, sen enemmän vastauksissa oli hajontaa. Yleisesti ottaen puutarhaharrastajat suhtautuivat erittäin positiivisesti biodiversiteetin tukemiseen ja luontohyvitysten tekemiseen. Erityisesti

pienialaiset tai pienellä vaivalla toteutettavat teot (kuten lajimäärien lisääminen) saivat kannatusta. Vähemmän tunnetut lajiryhmät kuten matelijat tai suuresti luonnon monimuotoisuutta kasvattavat teot kuten lahopuun tai paahdeympäristön lisääminen jakoivat vastaajien mielipiteitä. Tulostemme mukaan eri toimien ekologinen vaikuttavuus ei ollut vastaajien valintojen perusteena, vaan ennemminkin toimien helppous, vaivattomuus ja toteutuksen nopeus.

Kokonaisuudessaan väitöskirjani tulokset osoittavat, että kansalaisilla on selkeä potentiaali olla aktiivinen osa biodiversiteetin suojelua eikä vain esimerkiksi sääntelyn tai hallinnoinnin kohde. Ekologisen kompensaation prosessia tulisi avata ymmärrettävästi muillekin kuin alan asiantuntijoille. Tämä lisää prosessin tuntemusta ja auttaa kansalaisia myös arvioimaan lopputuloksia nykyistä paremmin. Muun muassa termistön kansantajuistaminen tukee kouluttamisen ohella kompensaation ymmärtämistä. Isoissa hankkeissa biodiversiteetin turvaaminen tulee olla ekologisen kompensaation ensisijainen tavoite, mutta rinnakkaista toimintamallia, joka huomioi myös sosiaaliset vaikutukset, tulee harkita. Samalla tulee pitää huolta, ettei kompensaatioprosessi kehity heikon kestävyiden suuntaan.

Luontosuhteiden moninaisuuden tunnistaminen on tärkeää, jotta kaikkia ihmisiä ei laiteta vahingossa samaan muottiin, mutta myös siksi, että tunnistettujen luontosuhteiden kautta voidaan ohjata luontoposiitivista toimintaa. Monesti peräänkuulutettu ympäristökasvatus ei tutkimusten mukaan ole ollut tehokas tapa lisätä ympäristömyönteistä toimintaa. Luontosuhteen vahvistaminen puolestaan todetusti lisää ihmisten ympäristömyönteisyyttä. Hyödyntämällä eri luontosuhdetyyppisiä voidaan kohdentaa tietoa eri ihmisryhmille heitä kiinnostavalla tavalla.

Yhteisöllisesti toteutettujen luontohyvitysten tarve korostaa yhteistä ongelmanratkaisua yksilötason toiminnan sijaan. Biodiversiteetin käytännön turvaaminen, esimerkiksi luonnonhoitotoimin, vaatii pitkäaikaista sitoutumista, joka voidaan saavuttaa osallistamalla paikallisia yhteisöjä, joilla on mahdollisuus kehittää ja toteuttaa pitkän tähtäimen tavoitteita paikallisesti. Konkreettisia luontohyvityksiä taas voi tehdä vain hallitsemallaan maalla, esimerkiksi puutarhoissa. Kansalaisten tietoisuutta on syytä lisätä ekologisesti eniten hyödyttävistä toimenpiteistä, joilla saavuttaa suurimman positiivisen vaikutuksen biodiversiteettiin. Yli puolet suomalaisista asuu omakoti- tai rivitaloissa, joissa on oma piha, ja lisäksi metsänomistusta on paljon. Maa-alaa on siis käytettävissä monimuotoisuustoimiin, jos niin halutaan.

Väitöskirjani perusteella voin sanoa, että on sekä tarve että tilaisuus laajentaa biodiversiteetin suojelun keinoja ja toimijajoukkoa. Väitän, että tarvitsemme myös esteettisyyskäsitysten päivittämistä, sitä, minkä arvotamme kauniiksi, toivotuksi ja kivaksi. Meidän tulee tarkastella kriittisesti mitä ajattelemme kaikista niistä alueista, jotka eivät ole osia perinteisistä luonnonsuojelualueista. Mahdollisuuksia biodiversiteetin turvaamiseksi on laajemmin kuin osaamme kuvitellaan. Lievennyshierarkian avulla voidaan tunnistaa eri tekojen merkittävyyssasteita ja hahmottaa toimiemme vakavuutta luonnolle. Kansalaisten kiinnostus ja tiedonjano luontohyvityksiä kohtaan

antavat hyvät mahdollisuudet uusien toimintamallien kehittämiseksi. Ne luovat toivoa ekologisesti kestävämmästä tulevaisuudesta.

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ORIGINAL PUBLICATIONS

I

SOCIAL IMPACTS OF BIODIVERSITY OFFSETTING: A REVIEW

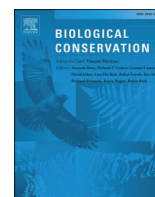
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Review

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

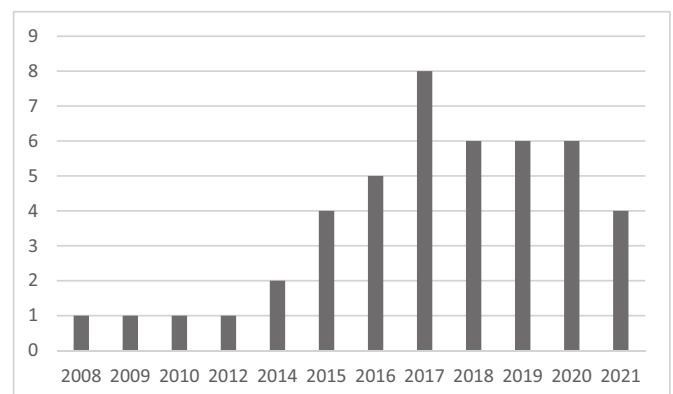


Fig. 1. Publication year and the yearly number of the papers ($n = 45$).

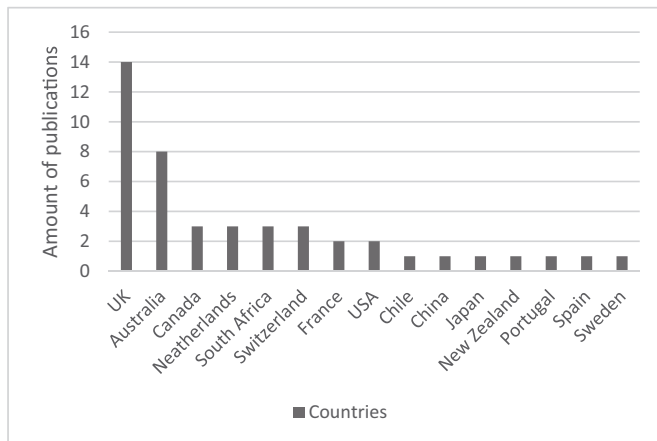


Fig. 2. Publication location by the first author country ($n = 45$).

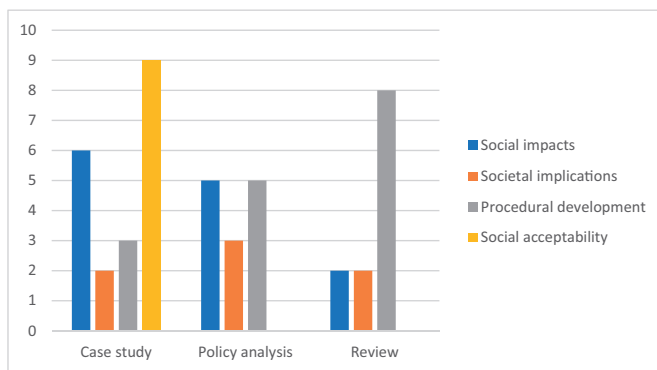


Fig. 3. Articles classified based on the type of the article and subject of the research. More detailed classification in Supplement, Table 3.

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

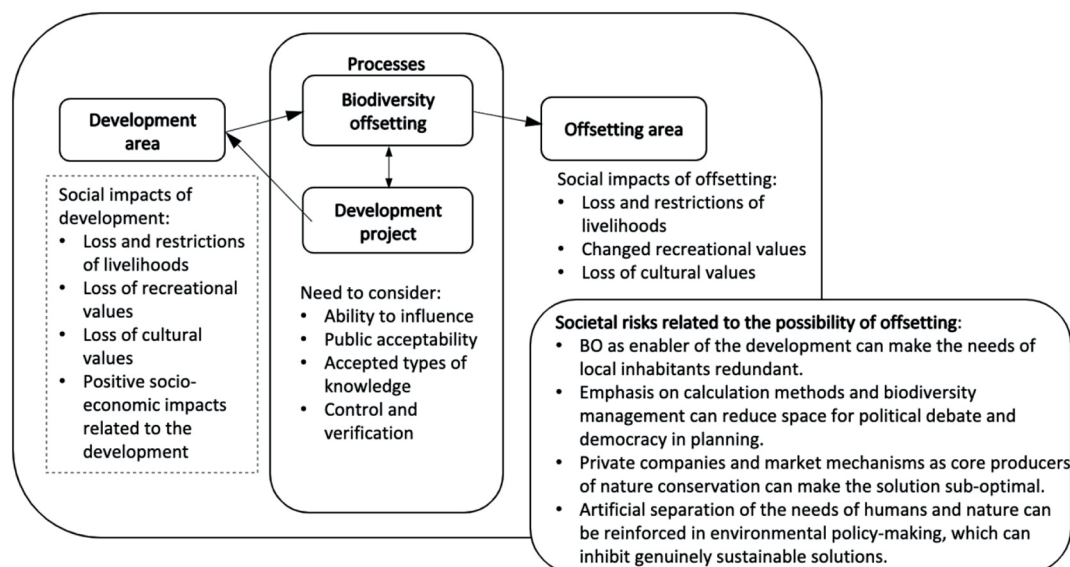


Fig. 4. The social implications of biodiversity offsetting.

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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II

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