Journal of Sustainable Marketing

ISSN: 2766-0117 | Open Access
Vol. 3, No. 1 | https://doi.org/10.51300/jsm-2022-53

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Review Article

A Review of Benefits, Constraints, and Research Opportunities in the Markets for Voluntary Offset Investments

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ABSTRACT
Voluntary offset investments provide the opportunity to compensate for the ecological consequences of consumption. Despite this opportunity, many entities do not purchase offset investments. We provide an overview of alternative carbon and biodiversity offset investments. We characterize the marketplace conditions, benefits, and constraints operating in the markets for voluntary carbon and biodiversity offset investments. We subsequently outline research implications inherent to these markets.

KEYWORDS
Sustainable marketing policy, voluntary biodiversity offsets, voluntary carbon offsets

ARTICLE HISTORY
Received: 9 May 2022
Revised: 24 May 2022
Accepted: 27 May 2022

1. Introduction

The mounting evidence of human-based climate change is a major concern for institutions and individuals (Perera & Hewege, 2018). Many firms and consumers want to do their part by conserving energy, reusing products, recycling, and engaging in other activities that lower their carbon footprints (Choi & Feinberg, 2018). When their action does not sufficiently or acceptably address influences on climate change or biodiversity, they are inclined to search for alternative solutions.

One means for reconciling one's influence on the environment is to compensate for this action via offsetting investments (ten Kate et al., 2004). Offset investments refer to action undertaken to counteract an influence on the environment via a compensating, equivalent influence. Offsets may include compliance-based programs administered by governmental bodies and voluntary programs run by non-governmental organizations. Our research focuses on the voluntary action undertaken to compensate for influences on the environment.

Governments, corporations, non-governmental organizations, and consumers may directly or indirectly purchase offsets, but corporations make most of these investments (Lovell et al., 2009). Organizations and individuals voluntarily reduce their influences on the environment via carbon offsets and biodiversity offsets. Carbon offset investments enable consumers to limit their environmental influence due to greenhouse gas (GHG) emissions. For example, many airline travelers purchase carbon offsets to compensate for the greenhouse gas emissions associated with flying. By contrast, biodiversity offset investments provide the opportunity to compensate for influences on the habitat of plants or animals. For example, developments in the oil and gas sector of Uzbekistan warranted investments to protect the habitat of the saiga antelope (Bull et al., 2014).

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Individuals that make these alternative payments ostensibly eliminate their influences on the environment. Despite the attractiveness of these strategies, analysts recognize several conditions that ultimately limit the efficacy of these efforts (Polonsky et al., 2010). Offset investors face substantial uncertainty establishing the costs of offsets as well as appropriate offsetting investments. The limitations in the implementation of offsets and reluctance to buy them curtail the extent to which offsetting contributes to reduced climate change and enhanced biodiversity. Markets provide the opportunity to offset environmental action, but prior research has not examined the rationales that enhance or detract from making these purchases. To the extent that these offset investments reduce greenhouse gas emissions and enhance habitats, they contribute to sustainable marketing. Effective implementation of these strategies requires an understanding of conditions that favor and limit their use, but prior marketing research has not reviewed the rationales inherent to offset investments.

The purpose of this study is to provide an overview of the markets for carbon and biodiversity offset investments. For each market, we characterize different forms of offsetting, describe inherent market conditions, outline the benefits of the investments, and highlight constraints that limit their use. We subsequently address implications of the review for research and public policy. Consider first carbon offset investments.

2. Voluntary Carbon Offset Investments

Carbon offset investments enable entities to limit their environmental influence due to the greenhouse gas emissions associated with behavior. ten Kate et al. (2004, p.12) describe carbon offsets as the practice "by which the impact of emitting a ton of CO2 can be negated or diminished by avoiding the release of a ton elsewhere, or absorbing a ton of CO2 from the air that otherwise would have remained in the atmosphere." The market for carbon investments exceeded US$ 850 million in 2021 (Reuters, 2022) and conservative estimates predict over US$ 5 billion by 2030 (Taskforce Members, 2021).

2.1. Types of Carbon Offsetting

Hamilton et al. (2008) describe four common offset projects employed in multiple countries throughout the world (see Table 1). Fossil fuel reductions refers to efforts to decrease fossil fuel usage by using the energy source more efficiently or via switching from fossil use to an alternative source that generates fewer emissions. Bio-carbon sequestration is a second form of carbon offsetting that relies on photosynthesis to transfer atmospheric carbon to tree biomass (roots, branches, trunks, and foliage) and soil (United States Department of Agriculture (USDA), 2016).

Bio-gas offsetting is a third type of carbon offsetting that involves the capture and destruction of methane from livestock, landfills or coal mines. Technological sequestration is a fourth form of carbon offsetting that employs expertise to constrain greenhouse gas emissions. Offset providers use a variety of technologies that inject carbon into geologic formations, enhance the efficiency of industrial processes or destroy greenhouse gases produced in industrial processes (Hamilton et al., 2008).

2.2. Marketplace Conditions

Several conditions characterize the market for voluntary carbon offsets. First, this market typically involves five participants (Hamrick & Gallant, 2017). Project developers are entities that create carbon offset projects. For example, ClimatePartner (2022) has established an offset project to develop wind power in Morocco. Standard bodies assess the criteria of projects and establish a registry that accounts for the issuing and retiring of carbon credits. Verra (2022), for instance, is a non-profit organization that operates the world's largest program for certification of GHG reduction projects. It is essential that offset projects conform to the accounting methods of the standards provider. Thus, auditors assess the process proposed for calculating emissions reductions. After implementation, a second audit focuses on determining the efficacy of greenhouse gas emissions. Intermediaries provide end users with advice concerning offsets and facilitate transactions. Brokers are intermediaries that do not take credit ownership whereas retailer intermediaries assume ownership. For example, NCX

Table 1. Forms of Voluntary Carbon and Biodiversity-based Offset Investments

Type of Offset	Description	Exemplary Projects
Carbon-offsets		
Fossil fuel reductions	Decrease fossil fuel usage by using the energy source more efficiently or via switching from fossil use to an alternative source that provides energy with fewer emissions	Commercial and individual buyers purchase offsets supporting the development of grid-connected renewable energy technologies in Turkey (Bonneville Environmental Foundation, 2022)
Bio-carbon sequestration	Relies on photosynthesis to transfer atmospheric carbon to tree biomass (roots, branches, trunks, and foliage) and soil	Forest carbon offsets associated with the conservation of forests in Zambia (Biocarbon Partners, 2022)
Bio-gas offsetting	Capture and destruction of methane from livestock, landfills or coal mines	Methane gas capture in active and abandoned mines (Terrapass, 2022)
Technological sequestration	Variety of technologies that inject carbon into geologic formations, enhance the efficiency of industrial processes or destroy greenhouse gases produced in industrial processes	Geologic storage of carbon (Puro Earth, 2022)
Biodiversity offsets		
Habitat-based	Estimate gains and losses based on measurement of area and habitat conditions	Wetlands mitigation plan in Utah, USA. Kennecott Utah Copper LLC constructs 1,011-hectare shorebird and waterfowl refuge (Barnard et al., 2017).
Species-based	Focus on the suitability of habitat for targeted species	California restoration of red-legged frog habitat (Madsen et al., 2010).

(2022) is a broker that enables buyers to purchase carbon credits to support North American forests. Finally, end users are the entities that purchase carbon credits. For example, Tribeca Investment Partners has purchased approximately US$ 100 million in carbon credits (Lee, 2021).

Second, the strategy to offset GHG emissions should operate in a mitigation hierarchy in which the firm first seeks to reduce energy, followed by renewal/replacement (Lovell et al., 2009). Firms should only consider carbon offsets when energy reduction, renewal, and replacement are not possible. When firms adopt this mitigation hierarchy, they can negate environmental consequences that they cannot feasibly correct.

Third, carbon offsets are not tangible products (Lovell et al., 2009). Consequently, end users directly only receive a certificate indicating ownership of the offset. The purchaser receives no tangible evidence of the offset or the efficacy it provides. Non-profit organizations provide certification of offset projects, but carbon regulation has not kept pace with growth in the industry (Kapnick, 2021).

Another distinguishing characteristic is the commodification of the offset. As Lovell et al. (2009, p. 2367) state, "the atmosphere does not mind where emission reductions are made because atmospheric gases mix globally." The process of calculating GHG emissions enables participants to treat carbon as a commodity while also enabling the exchange of credits within the market (Lansing, 2012). Thus, airline travelers generate GHG emissions in the stratosphere, but the offsetting compensation may take place in a forest.

2.3. Benefits

Investments in carbon offsets yield substantial benefits to the purchasers. First, the proper selection and purchasing of carbon enables the firm to make immediate strides toward achieving carbon neutrality (Lovell et al., 2009). Purchasing these offsets provides an immediate correction to environmental malfeasance. Due to the commodity nature of this market, firms can compensate for action in one setting by contributing to GHG reductions in another ecosystem. An auto traveler, for instance, can contribute to reforesting in Africa to compensate for cross-country travel in North America. Renewables, forestry and land use, and methane account for three fourths of the transactional volume with forestry and land use alone accounting for 47% of the market value of the transactions (Hamrick & Gallant, 2017).

A second benefit of voluntary carbon offsets is that they enable firms to act where their efforts are likely to have the greatest influence on emissions. Firms that seek to compensate in a mature economy (e.g., Germany) may find that their offset investments have greater influence in an emerging economy (Lovell et al., 2009). The technology in emerging markets may be basic, and consequently, enhancements to their technology may provide greater returns than available in mature economies.

In addition to these direct benefits, voluntary carbon offsets enable communities to yield indirect benefits. These include improved employment opportunities, enhanced air and water quality, reduced habitat conversion, improved energy access, and better access to community health (Broekhoff et al., 2019).

2.4. Constraints

Voluntary carbon offsets offer potential advantages to firms, yet these firms also face constraints when they attempt to offset their influences on the environment. The initial challenge lies in attempting to establish the environmental impact of GHG emissions. In the absence of universal standards, purchasers must rely on the estimates made by the standard bodies or providers. The offset calculations provided by these firms vary markedly (Latta et al., 2016). In the airline industry, for example, airlines use a variety of strategies to determine emissions (Becken & Mackey, 2017). Whereas some firms add a fixed price to offset a flight, other firms use airline-specific data on fuel consumption, fleet composition, and other factors. In addition to these methods, firms may use an externally developed algorithm or provide an external link to a carbon calculator. Regardless of the method, the calculations are typically estimates that cannot account for the unique conditions of a discrete event. Compensation for air travel, for instance, uses estimates for a trip and cannot account for the atmospheric conditions endemic to a particular flight.

The calculations for the offsets are similarly challenging to estimate, and buyers often have some latitude in their selection of an offset. As noted previously, firms have some latitude to allocate offsets to energy-related projects, forestry, and other GHG reduction. They also can invest in reductions in multiple settings in multiple geographical locations (Becken & Mackey, 2017). For example, buyers of Ecologi (2022) offsets can contribute to tree planting programs in Mozambique, Madagascar, Nicaragua, Kenya, Uganda, Australia, UK, and USA.

Although offsets provide an immediate resolution to GHG emissions, their availability may limit the firm's efforts to mitigate emissions (Lovell et al., 2009). If firms do not employ the mitigation hierarchy and elect solely to offset for their ecological influences, then they offer limited progress in their efforts to mitigate climate change. The mitigation hierarchy calls for offsetting only after the firm has reduced resource usage and renewed or replaced factors that lead to GHG emissions.

In addition to attending to the mitigation hierarchy, the firm must address other factors that increase the likelihood of securing high quality voluntary carbon offsets (Broekhoff et al., 2019). For carbon offsets to contribute to GHG reductions, projects must reflect incremental additions to efforts to reduce GHG emissions (Hamrick & Gallant, 2017). In most cases, attributing offsets to programs already in place does not offer additional environmental assistance (Broekhoff et al., 2019). If it is a nascent program requiring additional funding, however, the offset provides additional ecological mitigation. Offset projects should also not reflect double-counting in which multiple parties take credit for the reductions in GHG emissions. Since carbon emissions are long-lived, the offsets should be permanent. Standard convention considers offsets permanent when carbon remains out of the atmosphere for 100 years (Fearnside, 2002). Finally, the firm should ensure that the carbon offsets do not otherwise harm social or environmental conditions. Standard bodies such as Social Carbon (2022) and Climate, Community and Biodiversity Alliance (2022) provide assurance that projects certify that carbon offsets provide social, environmental, and economic benefits to local stakeholders.

3. Voluntary Biodiversity Offset Investments

The second category of offsets directly addresses biodiversity. Biodiversity offsetting refers to "a market where credits from actions with beneficial biodiversity outcomes can be purchased to offset the debit from environmental damage. Credits can be produced in advance of, and without ex-ante links to, the debits they compensate for, and stored over time." (Hannis and Sullivan, 2012, p. 12). These programs seek to mitigate or compensate for influences on habitat (Ives & Bekessy, 2015).

3.1. Types of Biodiversity Offsetting

Two primary types of biodiversity offsets include habitat-based and species-based investments (Bull et al., 2014). Habitat-based approaches calculate gains and losses based on assessment of habitat conditions. For example, a wetlands mitigation project in Utah, USA involved the construction of over 1400 hectares of shorebird wildlife refuge (Barnard et al., 2017). Species-based approaches rely on a measure of the suitability of habitat for a targeted species. For example, California has developed a plan to enhance the habitat of red-legged frogs (Ford et al., 2013).

Voluntary biodiversity offsets also vary based on whether the effects are in-kind or out of kind. In-kind refers to compensatory mitigation that provides functions, values, habitat, and other factors similar to those affected by development (Mckenney & Kiesecker, 2010). By contrast, out-of-kind compensation allows for different forms of mitigation. For example, Bull et al. (2014), characterize two ways to compensate for vegetation loss due to development. In-kind restoration involves compensation by re-seeding an equivalent area of vegetation elsewhere. Out-of-kind restoration provides compensation through procedures such as the funding of poaching patrols in a region.

3.2. Marketplace Conditions

Biodiversity and carbon offsets similarly seek to compensate for ecological disruption, but there are notable differences in the market conditions for each form of offsets. First, the participants in the voluntary biodiversity offsets market are similar to those in the voluntary carbon offsets market, but the difference lies in greater community participation in the voluntary carbon offsets setting. Since voluntary biodiversity offsets are necessarily associated with conditions in a local ecosystem, members of the community seek to influence the design and implementation of voluntary biodiversity offsets.

Similar to voluntary carbon offsets, voluntary biodiversity offsets employ a mitigation hierarchy based on a sequence of avoiding impacts, followed by minimizing impacts before compensating for residual impacts (Mckenney & Kiesecker, 2010). The commodity nature of the voluntary carbon offsets market, however, simplifies the compensation process because the form of carbon has little bearing on decision making (Ives & Bekessy, 2015). By contrast, biodiversity is not amenable to commodification. Unique elements of a habitat have inherent value to communities. Although commodification facilitates conversion to monetary value for voluntary carbon offsets, it is infeasible to place monetary value on biodiversity (TEEB, 2010). Not only is this process viewed as an unethical process, it can lead to less preservation of biodiversity. Local stakeholders recognize that restrictions in biodiversity may be irreversible, and consequently, significant scrutiny surrounds the assessment of how firms avoid and minimize their impact on habitats.

The observable consequences of voluntary biodiversity offsets also differ from voluntary carbon offsets. In the commodity market of voluntary carbon offsets, the buyers have limited tangible evidence that they have contributed to reductions in GHG emissions (Lovell et al., 2009). The voluntary biodiversity offsets setting, however, provides greater opportunity to observe evidence of restoration, particularly when the offset is in-kind. For example, Kennecott Utah Copper compensated for wetlands removal by development of a wildlife sanctuary roughly three times the size of the environmental loss (Barnard et al., 2017).

3.3. Benefits

Biodiversity offsetting concerns the unavoidable and predictable residual influence of a project (Weissgerber et al., 2019). The goals of biodiversity offset are to achieve no net loss and, where possible, a net gain of biodiversity regarding species composition, ecosystem function, habitat structure, and cultural values associated with biodiversity (BBOP, 2012b). Although policy makers often assume that the transition from no net loss to net gain is a straightforward question of the compensation provided, there are striking differences in these objectives (Bull & Brownlie, 2017). The European Commission (2022) defines no net loss as settings in which "conservation/biodiversity losses in one geographically or otherwise defined area are balanced by a gain elsewhere provided that this principle does not entail any impairment of existing biodiversity as protected by EU nature legislation." Net gain refers to biodiversity gains that "exceed a specific set of losses" (BBOP, 2012a, p.2). The philosophical orientation of the objectives differ given that no net loss seeks to achieve a neutral outcome whereas net gain seeks for an improvement in biodiversity. These different frames of reference influence stakeholder perceptions of the offset. Stakeholders may have more confidence that a project can yield no net loss rather than achieving a net gain. Moreover, uncertainties in achieving no net loss complicate efforts to assert when an offset transitions to net gain (Bull & Brownlie, 2017). One response to this uncertainty is to design compensation measures that exceed the level of development. For example, the Shaw's Pass road project in South Africa sought to offset 30 hectares. The offset project not only compensated for the acreage associated with the road development but also secured an additional 30-40 hectares (Barnard et al., 2017).

Voluntary biodiversity offsets also offer appreciable ancillary benefits. The adoption of an environmental practice focused on one species likely influences multiple environmental goods and services (Lankoski, 2016). For example, converting cropland to perennial grasses not only improves vegetation, it also improves water quality and increases soil carbon sequestration. Voluntary biodiversity offsets have the potential to enhance relationships among project funders, regulators, communities, and other stakeholders while also speeding up regulatory processes (Dickie et al., 2013).

3.4. Constraints

There are appreciable constraints limiting the ability to achieve the benefits sought in voluntary biodiversity offsets (Gardner et al., 2013; Walker et al., 2009; Bull et al., 2014). These include issues related to measurability, equivalence, reversibility, and temporal considerations. Consider each in turn.

The lack of a common metric complicates efforts to measure the efficacy of voluntary biodiversity offsets (Bull et al., 2014) . Research underscores that the use of a single metric such as an "area of habitat" does not adequately capture the complexity of an offset (TEEB, 2010). Researchers recommend the use of multiple metrics, but policy makers must decide the extent to which offsets compensate for biodiversity, ecosystem services or ecosystem functions (Bull et al., 2014) . The lack of a comprehensive metric also complicates the ability to assert whether a project achieves no net loss or net gain. The dynamism of the ecosystem further complicates these efforts as the determination of a baseline level of biodiversity can be difficult to establish (Gardner et al., 2013).

A related concern is the ability to establish equivalence between the ecological influence and compensation. Determining an equivalent level of compensation is complicated when the biodiversity components differ in type, location, and temporal delivery of services (Gardner et al., 2013). Historically, governments have preferred in-kind replacement because it compensates the same ecosystem functions, habitat, and services. In some settings, however, research indicates that out-of-kind services provide greater opportunity to compensate for losses. For example, Bull et al. (2014) identify conditions under which out-of-kind restrictions on poaching provide a better response to development than in-kind restoration of vegetation.

Firms seeking to compensate for development also need to consider whether their action is reversible. Some decisions are effectively irreversible. For example, dams constructed to provide hydroelectric power are unlikely to face deconstruction due to influences on habitats. Although the ideal situation is to reduce all biodiversity losses through offsets, the market does not provide an objective measure of reversibility (Bull et al., 2014). Similarly, governments must determine acceptable levels of thresholds for granting offsets. The extinction of a species, for instance, is an irreversible threshold that society would not accept, but temporary reductions in a species habitat would likely be acceptable.

Temporal considerations also constrain the efficacy of voluntary biodiversity offsets. Consequently, offset providers should identify how long ecological corrections should last (Mckenney & Kiesecker, 2010). Protection may remain in perpetuity when the impact of the influence is irreversible. By contrast, finite protection presumes that there is potential to reverse the damage associated with a site. A related issue is the lag between the influence of development and the returns provided by the offset program (Bull et al., 2014) . Although pre-emptive action enables firms to offset the effects of development, they complicate efforts to compensate on a "like-for-like" basis (Mckenney & Kiesecker, 2010). Anticipatory approaches also result in substantial upfront costs when there is limited opportunity for financiers to raise funds by releasing credits.

4. Implications for Research and Practice

The evolution of offsets has provided substantial opportunities to compensate for ecological influences. Nevertheless, there are substantial opportunities to engage in research that contributes to research, public policy, and practice. In this section, we highlight opportunities for research in both forms of offsets as well as sector-specific action in the markets for voluntary carbon offsets and biodiversity offsets.

4.1. Research Implications for Both forms of Voluntary Offsets

A recurring theme in voluntary carbon and biodiversity markets concerns the ability to measure the influences on the environment accurately. This lack of precision includes the determination of the ecological influence as well as the ecological correction. Research should therefore seek to refine the metrics associated with these factors. Disparities in the estimates for carbon offsets complicate the decision-making process for carbon (Johnson et al., 2010) as well as biodiversity (Bas et al., 2016). This variance in estimates reduces the likelihood of purchasing offsets.

The likelihood of purchasing offsets should be related to the form of offsetting available to the purchaser. Public policy would benefit from marketing research that uncovers the effectiveness of alternative offset mechanisms and research that identifies the conditions leading to the greatest investment in offsets. Research could investigate which forms of carbon offsets offer the greatest efficacy (e.g., bio-carbon sequestration) and investigate which forms of offsets lead to the greatest likelihood of purchasing the investments. Similarly, research should consider whether habitat versus species-based biodiversity offsets are more effective while also considering which of the offsets maximizes the purchase of offsets. The need to consider the efficacy and marketability of alternative offsets warrants cross-disciplinary research. Scholarship examining the effectiveness of alternative offsets informs environmental science whereas understanding of market potential informs marketing thought and practice. Effective mitigation derives from research provided by both disciplines.

The philosophical orientation of decision makers should influence their purchase of offsets, yet research has not addressed these orientations. A teleological approach focuses on the consequences of action and often strives to generate the greatest good (Malhotra & Miller, 1998). The utilitarian may use a cost-benefit analysis to determine the consequences of alternatives and select the outcome that has the greatest benefit. By contrast, a deontological approach refers to a family of philosophies focused on the moral commitments or obligations that should be necessary for proper action (Ferrell et al., 2017). Individuals that employ a deontological approach look for guiding principles or rules to guide behavior. The emphasis placed on maximizing returns suggests that a utilitarian approach to the purchase of offsets, but other stakeholders (e.g., community leaders) may adopt a deontological approach to lowering carbon offsets. These stakeholders may be more inclined to exhaust alternatives in the mitigation hierarchy prior to purchasing offsets. Thus, the ethical perspectives adopted by stakeholders warrants empirical analyses.

Offset investments seek to provide a solution to ecological malfeasance, but limited research has addressed conditions under which offsetting exacerbates environmental issues. To the extent that purchasers bypass a mitigation hierarchy and go directly to offsets, they do not address factors that yield negative consequences for the environment (Gardner et al., 2013). Under these circumstances, offsets can lead to greater ecological upheaval. Research should therefore examine the decision-making process of offset purchasers to identify the usage of a mitigation hierarchy and the resulting consequences for the environment. Institutional economics' (Bergen et al., 1992; Williamson, 1979) treatment of incentives and self-interest seeking behavior should provide marked insight into these settings. Similarly, institutional economics offers insight into the ex ante efforts to ensure that offsets are additional and not duplicated. In addition, this stream of research can provide insight into ex post measures employed to monitor the implementation of offset procedures.

The level of uncertainty is a common theme that influences the decision making for carbon and biodiversity offsets. Uncertainty can constrain the likelihood of decision making and the confidence associated with decisions. Kujala et al. (2013) characterize three forms of uncertainty that affect decisions related to climate change. These include linguistic uncertainty about the meaning of language and expressions, epistemic uncertainty concerning incomplete knowledge, and human decision-making uncertainty arising from subjective human preferences, judgments, and beliefs. Practitioners, researchers, and public policymakers could benefit from empirical work that examines the influences of these forms of uncertainty on the decision-making practices of multiple stakeholders.

4.2. Research Implications for Voluntary Carbon Offsets

The study of voluntary carbon offsets has generated a sizable stream of research (e.g., Ritchie et al. , 2021). Nevertheless, much of this research focuses solely on consumer airline travel. Empirical research should consider the contrasting decision making contexts faced by consumers and industry. Although business-to-business and business-to-consumer markets engage in offsetting investments, the motivations for offsetting vary considerably between these settings. There is potential to offset many forms of carbon usage, and research should broaden the scope of empirical efforts to consider other contexts. In the travel industry, for instance, empirical efforts should consider non-airline forms of travel that account for the majority of GHG emissions. Research would also benefit from analysis of conservation related to significant life events such as weddings, babies, and funerals (Lovell et al., 2009).

The intermediaries in the supply chain for carbon offsets include brokers (who do not take title to offsets) and retailers (who take title to offsets). Research should examine how opportunism, asset specificity, uncertainty, and transactional frequency outlined in institutional economics (Williamson, 1979) influence the selection of an intermediary as well as the efficacy of the intermediary.

The options available to counteract carbon production vary from quick response techniques (removal of incandescent lighting) to long-term strategies (e.g., planting trees to increase carbon sequestration). Researchers can provide insight into this context by identifying which practices lead to the greatest reductions in GHG emissions. In addition, research could analyze the extent to which buyers prefer immediate corrections to more long-term strategies. Cross-disciplinary research that informs offset efficacy and marketability enables environmental scientists and marketers to implement programs that simultaneously lower GHG emissions and enhance corporate revenue.

4.3. Research Implications for Voluntary Biodiversity Offsets

Voluntary biodiversity offsets seek to achieve no net loss or net gain to biodiversity. Although net gain orientations offer more robust goals to move beyond current biodiversity conditions, stakeholders may have less confidence in the ability to achieve net gain strategies (Bull & Brownlie, 2017). Research can contribute by examining conditions under which net gain strategies lead to greater biodiversity. Since skeptical stakeholders may illustrate more confidence that firms can achieve no net loss, policy makers would also benefit from research that examines whether no net loss or net gain strategies lead to increased purchase of biodiversity offsets.

The primary forms of voluntary biodiversity corrections are habitat-based and species-based offsets. When both forms are available in a market, firms and policy makers would benefit from knowing which type offers the greatest efficacy and which type leads to the greatest adoption by purchasers. Similarly, researchers should contrast in-kind corrections with out-of-kind corrections. Although reciprocity suggests that in-kind procedures offer a sense of equity, there are conditions under which out-of-kind offsets outperform in-kind alternatives (Bull et al., 2014) . Research should investigate conditions under which these strategies maximize biodiversity. In addition, research should investigate buyer preferences for in-kind versus out-of-kind offsets. The need to consider the efficacy of alternative biodiversity offsets and their marketability underscores the insights provided by cross-disciplinary collaboration. Understanding of the effectiveness of alternative offsets informs environmental science whereas knowledge of market potential informs marketing theory and practice. Effective, on-going mitigation derives from enhanced understanding of objectives pursued in environmental science and marketing.

The ability to issue voluntary biodiversity offsets prior to ecological infringement enables financiers to receive some compensation a priori. Empirical efforts could contribute to this research by examining whether this pre-emptive action influences the efficacy of the offset. The need to appropriate funds may lead financiers to ignore facets of the mitigation hierarchy leading to increased damage to biodiversity. Policy makers and strategists could gain insight into research examining the conditions under which a priori granting of biodiversity offsets leads to enhanced biodiversity.

5. Conclusions

The purpose of this paper has been to provide an overview of the markets for voluntary carbon and biodiversity offsets. For each form of offsets, we outlined the types of offsets, marketplace conditions, benefits, and constraints. We subsequently described research opportunities with potential to enhance understanding of these programs. We hope that the study provides insight to research, public policy, and practice.

Funding statement

The author received no financial support for the research, authorship, and/or publication of this article

Conflict of interest

No potential conflict of interest was reported by the author.

Cite as

Dahlstrom, R. (2022). A Review of Benefits, Constraints, and Research Opportunities in the Markets for Voluntary Offset Investments. *Journal of Sustainable Marketing*, 3(1), 72-82. https://doi.org/10.51300/jsm-2022-53

References

Barnard, F., Davies, G., McLuckie, M., & Victurine, R. (2017). Options and financial mechanisms for the financing of biodiversity offsets [White paper]. Capital Conservation. Retrieved from https://static1.squarespace.com/static/57e1f17b37c58156a98f1ee4/t/5a80ccf50852294ef6073bea/1518390521805/Financing+of+Biodiversity+Offsets.pdf

Bas, A., Jacob, C., Hay, J., Pioch, S., & Thorin, S. (2016). Improving marine biodiversity offsetting: A proposed methodology for better assessing losses and gains. *Journal of Environmental Management*, *175*, 46-59.

BBOP (2012a). Resource Paper: No Net Loss and Loss-Gain Calculations in Biodiversity Offsets. Washington, D.C.: BBOP. Retrieved from https://www.forest-trends.org/wp-content/uploads/imported/bbop_resource_paper_nnl_21_march-2012_final-pdf.pdf

BBOP (2012b). Standard on Biodiversity Offsets. Washington, D.C.: BBOP. Retrieved from https://www.forest-trends.org/wp-content/uploads/imported/BBOP_Standard_on_Biodiversity_Offsets_1_Feb_2013.pdf

Becken, S., & Mackey, B. (2017). What Role for Offsetting Aviation Greenhouse Gas Emissions in a Deep-cut Carbon World? *Journal of Air Transport Management*, *63*, 71-83. https://doi.org/10.1016/j.jairtraman.2017.05.009

Bergen, M., Dutta, S., & Walker, O.C. (1992). Agency relationships in marketing: A review of the implications and applications of agency and related theories. *Journal of Marketing*, *56*(3), 1-24. https://doi.org/10.1177/002224299205600301

Biocarbon Partners (2022), Our work. Retrieved from https://biocarbonpartners.com/our-work/our-work/

Bonneville Environmental Foundation (2022), Bonneville Environmental Foundation. Retrieved from https://www.b-e-f.org/

Broekhoff, D., Gillenwater, M., Colbert-Sangree, T., & Cage, P. (2019). Securing climate benefit: A guide to using carbon offsets. Stockholm Environment Institute Greenhouse Gas Management Institute. Retrieved from http://npm.pixeledge.io.s3.amazonaws.com/images/2828fa14-963b-41eb-85d0-9a02fc27ae0d/1605018809-guide-to-buy-carbon-offsets.pdf

Bull, J.W., & Brownlie, S. (2017). The transition from no net loss to a net gain of biodiversity is far from trivial. *Oryx*, *51*(1), 53-59. https://doi.org/10.1017/S0030605315000861

Bull, J.W., Milner-Gulland, E.J., Suttle, K.B., & Singh, N.J. (2014). Comparing biodiversity offset calculation methods with a case study in Uzbekistan. *Biological Conservation*, *178*, 2-10. https://doi.org/10.1016/j.biocon.2014.07.006

Choi, S., & Feinberg, R.A. (2018). The LOHAS lifestyle and marketplace behavior: establishing valid and reliable measurements. In S. Dhiman, & J. Marques (Eds.), *Handbook of Engaged Sustainability* (pp. 1069-1086). . Cham, Switzerland: Springer International Publishing. https://doi.org/10.1007/978-3-319-71312-0_10

Climate, Community and Biodiversity Alliance (2022), Climate, Community and Biodiversity Alliance. Retrieved from https://www.climate-standards.org/

ClimatePartner (2022), Offset projects. Retrieved from https://www.climatepartner.com/en/climatemap/offset-projects

Dickie, I., Mcaleese, L., Pearce, B., & Treweek, J. (2013), Marine biodiversity offsetting - UK scoping study. Retrieved from https://www.researchgate.net/publication/279951206_Marine_Biodiversity_Offsetting_-_UK_Scoping_Study/link/559f6c5008aeb40ee93c4234/download

Ecologi (2022). About Ecologi. Retrieved from https://ecologi.com/about

European Commission (2022), No Net Loss. Retrieved from https://ec.europa.eu/environment/nature/biodiversity/nnl/

Fearnside, P.M. (2002). Why a 100-year time horizon should be used for global warming mitigation calculations. . *Why a 100-year time horizon should be used for global warming mitigation calculations. Mitigation and Adaptation Strategies for Global Change*, 7(1), 19-30. https://doi.org/10.1023/A:1015885027530

Ferrell, O.C., Fraedrich, J., & Ferrell, L. (2017). *Business ethics: Ethical decision making & cases*. Stamford, CN: Cengage Learning.

Ford, L.D., Van Hoorn, P.A., Rao, D.V., Scott, N.J., Trenham, P.C., & Bartolome, J.W. (2013). *Managing rangelands to benefit California red-legged frogs and California tiger salamanders*. Livermore, California: Alameda County Resource Conservation District. Retrieved from http://www.elkhornsloughctp.org/uploads/files/1398206521ManagingRangelandsCRLF_CTS.pdf

Gardner, T.A., von Hase, A., Brownlie, S., Ekstrom, J.M.M., Pilgrim, J.D., Savy, C.E., ... ten Kate, K. (2013). Biodiversity offsets and the challenge of achieving no net loss. *Conservation Biology*, *27*(6), 1254-1264. https://doi.org/10.1111/cobi.12118

Hamilton, K., Schuchard, R., Stewart, E., Waage, S., Rau, A., Bayon, R., & Hawn, A. (2008). Offsetting emissions: A business brief on the voluntary carbon market. In *Ecosystem Marketplace and Business for Social Responsibility*. San Francisco, CA: . Retrieved from https://www.

bsr.org/reports/BSR_Voluntary-Carbon-Offsets-2.pdf

Hamrick, K., & Gallant, M. (2017). Unlocking potential: State of the voluntary carbon markets 2017. Forest Trends. Retrieved from https://www.forest-trends.org/publications/unlocking-potential/

Hannis, M., & Sullivan, S. (2012). Offsetting Nature? Habitat Banking and Biodiversity Offsets in the English Land Use Planning System. Technical Report. Retrieved from https://www.researchgate.net/publication/294876022_Offsetting_Nature_Habitat_Banking_and_Biodiversity_Offsets_in_the_English_Land_Use_Planning_System

Ives, C.D., & Bekessy, S.A. (2015). The ethics of offsetting nature. *Frontiers in Ecology and the Environment*, *13*(10), 568-573. https://doi.org/10.1890/150021

Johnson, M., Edwards, R., & Masera, O. (2010). Improved stove programs need robust methods to estimate carbon offsets. *Climatic Change*, *102*(3), 641-649. https://doi.org/10.1007/s10584-010-9802-0

Kapnick, S. (2021), The global carbon market: How offsets, regulations and new standards may catalyze lower emissions and create new opportunities. J.P. Morgan Asset Management. Retrieved from https://am.jpmorgan.com/us/en/asset-management/adv/insights/portfolio-insights/sustainable-investing/the-global-carbon-market/

Kujala, H., Burgman, M.A., & Moilanen, A. (2013). Treatment of uncertainty in conservation under climate change. *Conservation Letters*, *6*(2), 73-85. https://doi.org/10.1111/j.1755-263X.2012.00299.x

Lankoski, J. (2016). *Alternative payment approaches for biodiversity conservation in agriculture. OECD Food, Agriculture and Fisheries Papers*. Paris: OECD Publishing. https://doi.org/doi.org/10.1787/18156797

Lansing, D.M. (2012). Performing Carbon's Materiality: The Production of Carbon Offsets and the Framing of Exchange. *Environment and Planning A: Economy and Space*, *44*(1), 204-220. https://doi.org/10.1068/a44112

Latta, G.S., Adams, D.M., Bell, K.P., & Kline, J.D. (2016). Evaluating land-use and private forest management responses to a potential forest carbon offset sales program in Western Oregon (USA). *Forest Policy and Economics*, *65*, 1-8. https://doi.org/10.1016/j.forpol.2016.01.004

Lee, A. (2021). Carbon offsets are next big bet for $3.2 billion Tribeca Fund. Bloomberg.com. Retrieved from https://www.bloomberg.com/news/articles/2021-09-01/carbon-offsets-are-next-big-bet-for-3-2-billion-tribeca-fund

Lovell, H., Bulkeley, H., & Liverman, D. (2009). *Carbon offsetting: Sustaining consumption? Environment and Planning*, *41*(10), 2357-2379. https://doi.org/10.1068/a40345

Madsen, B., Carroll, N., & Brands, K.M. (2010). State of Biodiversity Markets Report: Offset and Compensation Programs Worldwide. Retrieved from http://www.ecosystemmarketplace.com/documents/acrobat/sbdmr.pdf

Malhotra, N.K., & Miller, G.L. (1998). An integrated model for ethical decisions in marketing research. *Journal of Business Ethics*, *17*(3), 263-280.

Mckenney, B.A., & Kiesecker, J.M. (2010). Policy development for biodiversity offsets: A review of offset frameworks. *Environmental Management*, *45*(1), 165-176. https://doi.org/10.1007/s00267-009-9396-3

NCX (2022), Carbon-smart companies. Retrieved from https://ncx.com/carbon-buyers/

Perera, C., & Hewege, C. (2018). Climate change risk perceptions among green conscious young consumers: Implications for green commodity marketing. *Journal of Consumer Marketing*, *35*(7), 754-766. https://doi.org/10.1108/JCM-01-2018-2537

Polonsky, M.J., Grau, S.L., & Garma, R. (2010). The new greenwash? Potential marketing problems with carbon offsets. *International Journal of Business Studies: A Publication of the Faculty of Business Administration, Edith Cowan University*, *18*(1), 49-54. https://doi.org/10.3316/ielapa.595548008968609

Puro Earth (2022), Puro earth carbon removal standard, registry and marketplace. Retrieved from https://puro.earth/

Reuters (2022), Global carbon markets value surged to record $851 bln last year-Refinitiv. Retrieved from https://www.reuters.com/business/energy/global-carbon-markets-value-surged-record-851-bln-last-year-refinitiv-2022-01-31/

Ritchie, B.W., Kemperman, A., & Dolnicar, S.S. (2021). Which types of product attributes lead to aviation voluntary carbon offsetting among air passengers? Tourism Management. *Tourism Management*, *85*, 104276-104276. https://doi.org/10.1016/j.tourman.2020.104276

Social Carbon (2022), Social Carbon. Retrieved from https://www.socialcarbon.org/

Taskforce Members (2021). Taskforce on Scaling Voluntary Carbon Markets - Final Report. Retrieved from https://www.iif.com/Portals/1/Files/TSVCM_Report.pdf

TEEB (2010). The Economics of Ecosystems and Biodiversity for Local and Regional Policy Makers. Retrieved from http://www.teebweb.org/wp-content/uploads/Study%20and%20Reports/Reports/Local%20and%20Regional%20Policy%20Makers/D2%20Report/

TEEB_Local_Policy-Makers_Report.pdf

ten Kate, K., Bishop, J., & Bayon, R. (2004). Biodiversity offsets: Views, experience, and the business case. London, UK: IUCN, Gland, Switzerland and Cambridge, UK and Insight Investment. Retrieved from https://www.iucn.org/sites/dev/files/import/downloads/bdoffsets.pdf.

Terrapass (2022), Projects overview. Retrieved from https://terrapass.com/projects/project-overview

United States Department of Agriculture (USDA) (2016), Carbon Sequestration. Retrieved from https://www.fs.fed.us/ecosystemservices/carbon.shtml

Verra (2022), Verified carbon standard. Retrieved from https://verra.org/project/vcs-program/

Walker, S., Brower, A.L., Stephens, R.T.T., & Lee, W.G. (2009). Why bartering biodiversity fails. *Conservation Letters*, *2*(4), 149-157. https://doi.org/10.1111/j.1755-263X.2009.00061.x

Weissgerber, M., Roturier, S., Julliard, R., & Guillet, F. (2019). Biodiversity offsetting: Certainty of the net loss but uncertainty of the net gain. *Biological Conservation*, *237*, 200-208. https://doi.org/10.1016/j.biocon.2019.06.036

Williamson, O.E. (1979). Transaction-cost economics: The governance of contractual relations. *The Journal of Law and Economics*, *22*(2), 233-261. https://doi.org/10.1086/466942