DUKE UNIVERSITY NICHOLAS SCHOOL OF THE ENVIRONMENT

Master Project

Leveraging Market-driven Environmental Protection

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Dual Degree Class of 2025
Duke University Nicholas School of the Environment
Master of Environmental Management /
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24 April 2025

Executive Summary

Leveraging Market-driven Environmental Protection

By

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April 24, 2025

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Abstract

To explore innovative funding mechanisms for landscape scale conservation, we sought to assess the feasibility of biodiversity credits, market-based instruments that quantify and monetize conservation outcomes. A case study was derived by targeting the Big Thicket National Preserve for the National Parks Conservation Association (NPCA), a national independent organization that aims to protect America's National Parks for present and future generations. NPCA is interested in exploring park protection beyond its boundaries through potential investments on private land adjacent to national parks, with implications toward a portfolio of 20 park landscapes nation-wide. To ensure well informed decision-making, geospatial science mapping was deployed to measure and showcase bio-geophysical values of the Big Thicket landscape guided by the development of a unique Conservation Value Index (CVI). After a comparative analysis of biodiversity credits alongside established tools such as the umbrella species approach, conservation easements, and carbon credits, we recommend that NPCA should not pursue a strategy toward biodiversity credits at this time. NPCA should monitor the UK's Biodiversity Net Gain legislation for potential lessons and applicability over the next 3-5 years. Lastly, it should prioritize established conservation tools and a contribution-based approach to investing in biodiversity without relying on untested metrics. The U.S. currently lacks a legal framework and standardized measurement methodologies for biodiversity credits, and market-driven approaches risk prioritizing cost-efficiency over genuine conservation, potentially leading to overexploitation. In contrast, proven tools like conservation easements and direct contribution approaches offer more reliable and immediate conservation outcomes. The resulting strategy allows NPCA to maintain conservation effectiveness while remaining open to proactive conservation as global standards and regulatory frameworks for biodiversity credits mature.

Contents

Introduction

The dominant goal of market-driven environmental protection is to raise funds and scaling up efforts to improve the conservation of large landscapes. Between conservation easements and carbon credits, biodiversity credits can fill the gap in protecting biological diversity, which carbon credits fail to quantify. Boston Consulting Group (BCG, 2024) summarizes the market notion: biodiversity credits are now in the spotlight as a potentially promising instrument to unlock new sources of finance.”

Lately, corporations not only publish their annual sustainability reporting but also seek the goal of carbon neutrality. Amid an array of reasons for carbon-neutrality, a single metric across time and countries helps to both set clear goals and explain these goals to the public in the company's marketing materials. Biodiversity credits are attractive for the same reason: they could be a simple metric for companies to compare their investments to those of their competitors or their investments in the past. Therefore, there is an interest in using any available tools to help raise environmental protection funds.

The Client: The National Parks Conservation Association

The National Parks Conservation Association (NPCA) is an independent, nonpartisan organization dedicated to advocating for protecting America's National Parksfor current and future generations. Founded in 1919 by the same individuals who established the National Park Service in 1916, NPCA works to influence decision-makers about pressing issues facing national parks and has over 1.5 million members and supporters. While NCPA is independent of the federal National Park Service, with the goal of advocating for the protection of national parks, NPCA looks for ways to advance park protection – exploring all options in modern landscape conservation measures.

NPCA is specifically interested in better protecting habitat at the boundary of national park units by exploring and learning about new practices. The scope of this work looks at the application of biodiversity credits in the contiguous 48 states on private land

adjacent to national park units. This work doesn't include any direct legal or financial work with the National Park Service. The goal is to maximize the existing environmental protection of national parks by creating new protected areas that otherwise will be prone to uncontrolled timber harvests, excessive hunting and/or fossil fuels exploration. This project takes its foundation from collaborative work with NatureServe and NPCA and specifically aims to address three main questions:

- What is the market readiness of biodiversity credits as an emerging protection tool for large landscape conservation?
- Can biodiversity credits empower national park protection by collaborating with private landowners on land adjacent to national parks?
- What land is best suited for implementing biodiversity credits – beyond a protected area boundary?

International Non-binding Frameworks and Limitations

Scientifically grounded frameworks struggle to translate into tangible biodiversity protection outcomes without binding obligations. In Boston Consulting Group's report Corporate Commitment Meets Nature: The Reality of Biodiversity Credits (2024), BCG highlights GBF's vague terms like "significantly reduce extinction risk" that leaves room for interpretation and inconsistent implementation. The non-binding nature of global biodiversity agreements, such as the Kunming-Montreal Global Biodiversity Framework (GBF), undermines their effectiveness. Hughes and Grumbine (2023) state that, unlike legally enforceable treaties, these frameworks rely on voluntary national commitments, which lack mechanisms to ensure compliance or accountability. For example, GBF's predecessor, the Aichi Targets, failed to meet its 20 goals by 2020 due to ambiguous language and insufficient enforcement (Hughes, 2023).

Carbon Market Development as a Comparative Case

The evolution of carbon markets under Article 6 of the Paris Agreement highlights the challenges of creating globally accepted environmental frameworks. Finalized at COP29

in 2024 - nearly a decade after the Paris Agreement’s adoption - Article 6 established rules for international carbon trading, including mechanisms to prevent double-counting emissions reductions and ensure environmental integrity (World Resources Institute, 2023).

While the agreement provides a foundation, key questions regarding implementation – measurement frameworks, trade details, verification procedures, and payment structures - are left to national governments. As a result, the effectiveness of Article 6 will depend on how countries develop their domestic frameworks, align strategies with climate targets, and establish robust reporting and oversight processes. This experience suggests that biodiversity credit frameworks may face similar delays and complexities, as harmonizing stakeholder interests, methodologies, and governance across diverse ecosystems will require years of negotiation (The Nature Conservancy, 2024).

Recent Biodiversity Credit Developments and Stakeholder Implications

Recent efforts to operationalize biodiversity credits reflect lessons learned from carbon markets, particularly the financing models and collaboration among diverse stakeholders, such as Blue Marine Foundation, Blue Carbon, and Plan Vivo (2024). Credit where credit is due elaborates on adopting the Kunming-Montreal Global Biodiversity Framework (GBF). The report describes how its adoption has accelerated this momentum, spurring over 30 biodiversity credit pilot projects and inspiring the development of principles emphasizing high-integrity principles and standardized metrics. At COP16 in Cali, Colombia, the International Advisory Panel on Biodiversity Credits launched a comprehensive framework to guide the growth of high-integrity biodiversity credit markets, underscoring the need for verified outcomes for nature, equity for people, and effective market governance (IETA, 2024).

Despite this progress, the measurement of biodiversity remains a fundamental challenge. The World Resources Institute notes (2024), "There is no simple equivalent to the 'ton is a ton' premise on which the carbon market is built. While a ton of carbon is

the same everywhere, biodiversity is diverse by its nature, arguably lacking a 'common currency' that can be consistently measured, tracked and traded." The article describes leading methodologies, such as the UK-based Wallacea Trust's approach, which sets unique baselines and goals for each habitat and defines one "biodiversity unit" as a 1% improvement from the median. In an interview (2023), Dr. Dan Exton of the Wallacea Trust emphasized the business imperative for comparability: "Boil it down to a single number because companies want to compare. There needs to be a single underlying number that makes sense to a board of directors or shareholders; an investor wants to invest in measurable conservation practices."

Figure 1. COP16, Session in progress, author's photo

As seen in the debates at COP16, stakeholders continue to grapple with quantifying biodiversity gains in a scientifically robust and practical way for markets (Figure 1). Ultimately, while the infrastructure for biodiversity credits is rapidly advancing, the challenge of comparable measurement remains the key obstacle (IETA, 2024).

National Mandatory Frameworks

Biodiversity Net Gain (BNG) is a national mandatory framework in the United Kingdom (UK). UK's BNG is a set of legally binding policies designed to address gaps left by non-binding international environmental agreements. Enshrined in the Environment Act 2021, BNG mandates that developers in England deliver a minimum 10% improvement in biodiversity after development, ensuring habitats are measurably enhanced compared to pre-development states according to the Department for Environment, Food & Rural Affairs (DEFRA, 2024). This framework balances economic growth with ecological conservation by requiring habitat restoration, creation, or off-site compensation.

BNG is enforced through planning permissions, with compliance tracked via the statutory biodiversity metric tool, which calculates habitat value using size, quality, and ecological connectivity, writes F. Baker (2025) in his article *The impact of the biodiversity net gain requirement on the cost management of projects for Civil Engineering*. Local Planning Authorities approve biodiversity gain plans before development begins, ensuring adherence through legal agreements (Section 106) and public biodiversity gain sites register for off-site units. Ecologists or competent professionals conduct pre- and post-development assessments, while statutory biodiversity credits act as a last-resort funding mechanism (DEFRA, 2024).

Early challenges include the metric's complexity, developers' high costs, and the slow market uptake of off-site units (only nine sites registered by July 2024). Critics argue the framework overlooks species-level impacts and struggles with inconsistent local authority resources. Finally, the 30-year habitat management requirement raises concerns about long-term accountability and enforcement (Baker, 2025; DEFRA, 2024).

Related Concepts: Carbon Credits

This section explores the limitations and evolution of international biodiversity frameworks, focusing on how they compare to the development of carbon markets.

Merriam-Webster defines the word 'credit' as the provision of money, goods, or services with the expectation of future payment. CarbonCredit.com further elaborates that the Kyoto Protocol of 1997 and the Paris Agreement of 2015 laid the foundation for the contemporary emission goals. In turn, it leads to the formation of carbon markets by turning CO2 emissions into a commodity.

Barbara Haya directs the Berkeley Carbon Trading Project, which examines the outcomes of California's voluntary offset programs and performs outreach. In a Time Magazine article, she elaborates on incentives to “prioritize leniency over conservativeness.” If an organization straightens its standards, a developer can go to another. She says that without higher standards and stricter oversight, it is fueling a “race to the bottom.”

In the article Comprehensive Review of Carbon Quantification by Improved Forest Management Offset Protocols, Haya et al. (2023) found that current protocols often allow for substantial flexibility in baseline setting, additionality, leakage, and durability, leading to systematic over-crediting—where credits issued exceed actual climate benefits. For example, many projects are credited for avoiding hypothetical future emissions based on aggressive harvesting scenarios that may not reflect likely land management. However, accounting for leakage and carbon reversals remains inconsistent and often insufficient.

Related Concepts: Conservation Easements

A conservation easement is a voluntary legal agreement that allows landowners to limit the type or amount of development on their property to achieve specific conservation goals, such as preserving agricultural land, forests, or open space. In the United States, these agreements can be permanent or temporary and often transfer management and compliance responsibilities to a land trust or government agency. Conservation easements are implemented by setting clear, enforceable restrictions tailored to the property’s conservation value and are monitored regularly to ensure compliance. They can provide tax benefits to landowners and are widely used to protect water quality and

natural habitats by restricting impervious surface development and maintaining natural hydrology (EPA, 2021).

Related Concepts: NC Stream Restoration Credits

The North Carolina Stream and Wetland Mitigation Program is a regulatory framework designed to offset unavoidable impacts to streams and wetlands from development projects, focusing on stream credits. North Carolina Division of Water Quality (2011) dictates that when a project exceeds established impact thresholds - such as 300 linear feet of perennial stream - developers must provide compensatory mitigation before site occupancy or road opening. This can be achieved through three main mechanisms: purchasing stream credits from approved private mitigation banks, making payments to the state's Division of Mitigation Services through an in-lieu fee program, or implementing permittee-responsible mitigation projects on- or off-site (NCDWQ, 2011).

The North Carolina Division of Water Resources tracks and enforces compliance, which requires proof of mitigation before project completion. While this approach supports the federal goal of "no net loss" of aquatic resources and provides flexibility for developers, studies have found that the success of mitigation projects is typically measured by regulatory compliance rather than true ecological or functional restoration. Limitations include challenges in verifying long-term environmental outcomes, the potential for net loss of stream function, and the complexity of tracking credits and project performance across multiple sites (NCDWQ, 2011).

Rationale for Biodiversity Credits

Biodiversity credits are gaining attention for their potential to harness market mechanisms for conservation, offering a tradable tool to channel funding toward biodiversity protection. Unlike carbon credits, which focus narrowly on emissions, biodiversity credits aim to address a broad range of ecosystem services (WRI, 2024). Their primary appeal lies in creating universal, measurable metrics that attract investment from large corporations seeking clear ways to achieve conservation

outcomes (BCG, 2024). Biodiversity credits can unlock a more holistic approach to environmental protection but their effectiveness will depend on the development of robust measurement standards and legal frameworks.

Methods

Using a mixed-methods approach that included conducting a literature review, qualitative interviews with experts, a collaborative effort on geospatial science, a site visit to Big Thicket National Preserve in Texas, and a series of meetings with National Parks Conservation Association (NPCA) staff, I addressed three research questions:

- What is the market readiness of biodiversity credits as an emerging protection tool for large landscape conservation?
- Can biodiversity credits empower national park protection by collaborating with private landowners on land adjacent to national parks?
- What land is best suited for implementing biodiversity credits – beyond a protected area boundary?

By partnering with NatureServe, a global authority on biological diversity, and leveraging NPCA's expertise in national parks and corporate sustainability market trends, I examined the voluntary biodiversity market's potential as a scalable landscape conservation solution.

Qualitative Assessment Interviews

I conducted semi-structured qualitative interviews with subject matter experts to assess the feasibility, stakeholder perspectives, and implementation barriers related to biodiversity credits as an environmental protection tool. I had a list of questions specific to each expert. This approach allowed for in-depth exploration of participants' experiences and viewpoints while maintaining flexibility to explore relevant topics as they emerged.

Participants were identified and recruited through a combination of initial contacts at the National Parks Conservation Association (NPCA), which was recommended by my advisor, Dr. Ryan Valdez, and faculty at Duke University, beginning with my advisor, Dr. Nicki Cagle. We identified additional participants using snowball sampling. The 35 interviewees represented a range of expertise, including ecologists, conservation finance experts, local practitioners, Texas office representatives, and carbon credit specialists. Participants were drawn from academia and NGOs across the US (primarily North Carolina and Texas), the UK and Switzerland, ensuring diversity in geographic, institutional, and disciplinary backgrounds.

Interviews were conducted in person - when possible, such as in North Carolina or during travel - and via Zoom for international participants and most NPCA staff. Most Zoom interviews lasted about 30 minutes, while in-person interviews typically lasted one hour. I did not record interviews. Instead, I took handwritten notes, which I later typed and organized into a single file. When preparing the publicly available StoryMap, I highlighted select quotes and obtained explicit permission from participants for their use. Sensitive information, including off-the-record comments or references to specific organizations' practices, was omitted to ensure confidentiality but helped shape my understanding.

Site Visit

Big Thicket National Preserve in Texas was selected as a case study field site early in the research process based on recommendations from interview participants and its identification by NatureServe as one of 20 priority landscapes. Additional factors included the abundance of private land surrounding the preserve and the presence of an active and supportive NPCA regional team in Texas. The field visit included NPCA staff, a local biologist, and a landowner and focused on site introductions, initial ecological assessment, and learning about local conservation dynamics. Observations revealed that the landscape was not visibly degraded, prompting questions about how to measure biodiversity change over time and how to frame expectations for natural

fluctuations. Photos and visuals were collected in a StoryMap and presentations, further informing the broader analysis of biodiversity credit implementation in similar contexts.

We compared the insights from the interviews with the information from the field site visit. Through this process, I recognized how difficult and costly it can be to conduct biodiversity assessments or collect regular data solely for metric production, especially when such efforts may not directly contribute to conservation outcomes. This analysis reinforced my awareness of the uncertainties and legal challenges that complicate the development of effective biodiversity credit frameworks.

Literature Review

The goal of the literature review was to understand the current state of knowledge on biodiversity credits and related conservation finance mechanisms. Specifically, the review sought to identify gaps such as the limited application of these tools at the landscape scale, challenges in policy readiness, and a lack of insight into stakeholder perspectives.

For the literature review, I conducted searches using databases such as Science Direct for peer-reviewed articles on topics like carbon credits and biodiversity net gain (BNG) and consulted official sources for current events (e.g., COP16) and market trends (e.g., Boston Consulting Group reports). I focused on publications from the last three years for rapidly evolving topics like biodiversity credits and up to fifteen years for foundational subjects such as conservation easements and carbon credits. I used Boolean operators and search combinations (e.g., “carbon credits” OR “environmental protection”) to refine results. Inclusion criteria limited sources to English-language publications focusing on terrestrial ecosystems. We also excluded the water value water component as it would skew the biodiversity credits, as Dr. McColly suggested (Participant 1, pers.comm., July 2023). Specifically, in the Southern States of the US, the monetary value of water for residential consumption is high. It’s critical to consider such value in evaluating the value of biodiversity as water in itself could have multiple times higher prices.

Boolean operators

List of Boolean operators for searches on applications of biodiversity credits:

- Biodiversity credits
- Carbon credits
- Offset
- Net-zero
- Biological diversity
- Kunming-Montreal Global Biodiversity Framework (GBF)
- Habitat
- Large landscape conservation
- Conservation finance
- Ecosystem services
- National park protection
- Landscape connectivity
- 30x30 initiative
- Protected areas
- Habitat linkage
- Conservation incentives
- Conservation Value Index (CVI)
- Biodiversity hotspots
- Protected area buffers
- High-value habitats

Results and Discussion

In this study, we used a mixed-methods approach: qualitative interviews, a site visit, and a literature review to assess the prospects and challenges of biodiversity credits as a market-driven environmental protection tool focusing on National Parks Units adjacent land.

- Through interviews with a diverse group of experts, I found broad recognition of the urgent need for biodiversity protection as well as significant skepticism about the feasibility of biodiversity credits in the US, citing unresolved issues around measurement, legal frameworks, and potential for market exploitation.
- The site visit to Big Thicket National Preserve highlighted the practical difficulties and costs of conducting biological diversity assessments on the ground.
- The literature review confirmed that biodiversity credit markets remain nascent and fragmented, lacking standardized definitions, enforceable agreements, or robust quantification methodologies.

Overall, interviews, case study, and literature review suggested that while proactive conservation tools are emerging, their application remains limited.

Interview Highlights

Individually and on occasions with NPCA staff members, I interviewed a diverse group of conservation practitioners, scientists, market developers, and local stakeholders, revealing a nuanced perspective on the prospects for biodiversity credits as a finance mechanism for environmental protection. Through the conversations, participants consistently emphasized the fundamental differences between biodiversity and carbon markets. Carbon is quantifiable as a single commodity where offsets can be made anywhere, and what matters is a bottom-line carbon dioxide equivalent reduction in the atmosphere. Unlike carbon, biodiversity is inherently location-dependent and difficult to distill into standardized, tradable units. This complexity poses significant challenges for measurement, verification, and market integrity, with several interviewees noting that attempts to replicate carbon market models for biodiversity are fraught with risk and may lead to unintended negative consequences.

A recurring theme was skepticism about the feasibility of implementing biodiversity credits at scale in the United States. While there is optimism about the potential for private land conservation and the use of credits to incentivize stewardship, participants highlighted major obstacles, including the lack of established legal frameworks, the

challenge of ensuring long-term permanence, and the difficulty of engaging local landowners who may distrust their government, specifically in Texas. Several interviewees stressed the importance of developing robust methodologies that account for local ecological and social contexts and warned against “double counting” or stacking credits. A combination of biodiversity and carbon credit came up in one of the interviews in the context that we should use any available mechanisms that help to raise money: “If we can capture the money, call it whatever. We want to avoid eucalyptus monoculture to capture carbon” (Participant 3, Pers. Comm., 2023). However, what remains unclear is the line between the necessity of stacking two types of credits versus adhering the existing framework of carbon credits to higher standards (e.g., avoid mono plantations).

Participants also discussed the need for credits to deliver real and lasting benefits for both biodiversity and local communities, especially Indigenous peoples who have historically acted as stewards of the land. Some interviewees described promising pilot methodologies such as multi-metric “baskets” tailored to specific ecosystems but noted that the market remains in its infancy. Finally, several participants advocated for a pragmatic, “conservation realist” approach: biodiversity credits should be viewed as one potential tool among many.

Site Visit Outcome

With the team from NPCA, including representatives from the Texas Regional Office and colleagues from Washington, DC, I visited the site alongside the local biologist and a landowner. The parcel we examined was not adjacent to a paved road and was accessible only by driving through an area temporarily used by a local farm. As we observed the local ecosystems, it became clear to me that no single metric could adequately capture the complexity and dynamics of nature. Broadly, I identified two

Figure 1. En-route to the exact site location. Hunting tower. The example of necessity to consider mixed use of land where even in the protected area some activities must be permitted as they support local communities.

types of land in the area: some parcels were heavily influenced by anthropogenic activities such as residential development, hydrocarbon exploration, and timber harvesting, while others appeared relatively healthy to the naked eye, though this impression could not be confirmed without detailed on-site assessments of species richness or other ecological indicators.

The site we visited comprised two tracts, one of 627 acres and another of 939 acres, with the smaller tract showing more visible signs of degradation. Based on these observations and conversations with more experienced colleagues, I concluded that biodiversity work in such landscapes should proceed in at least two phases: restoration and maintenance. It is unrealistic to expect the same degree of change or improvement in species richness on land undergoing significant restoration - such as a single-time massive tree planting campaign and species reintroduction - as on land left to recover passively.

Overall, each context requires a tailored approach, and my experience on the ground reinforced the need for flexible, context-sensitive metrics and management strategies

when designing biodiversity credit projects. This understanding led to the realization that simply creating such a metric, albeit reinforcing it, could be unreasonably costly compared to conventional landscape protection practices.

Figure 2. Site visit in the Big Thicket area close to the borders of the Big Thicket National Preserve, author's photo.

Literature Review Finding

The literature review underscores the nascent state of biodiversity credit markets, which currently lack standardized definitions, enforceable international agreements, or robust quantification methodologies (Participants 1 & 2, pers. comm., 2023; Hughes, 2023). While frameworks like the Kunming-Montreal Global Biodiversity Framework set voluntary targets, their non-binding nature limits accountability - a critical gap given the complexity of measuring biodiversity compared to carbon equivalents.

Multiple startups and climate finance are entering the space. The Nature Tech for biodiversity sector map published by Nature Tech Collective and Conservation International (2025) highlights 650 organizations distributed across the five major themes (Figure 2): measurement (280), Modeling (164), Market Pressures (106), Material Change (70), and Monetization (114).

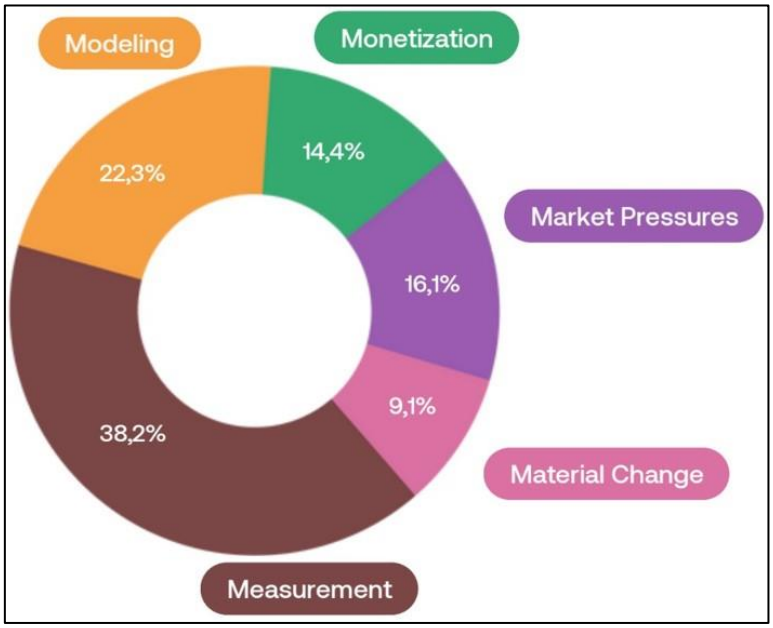
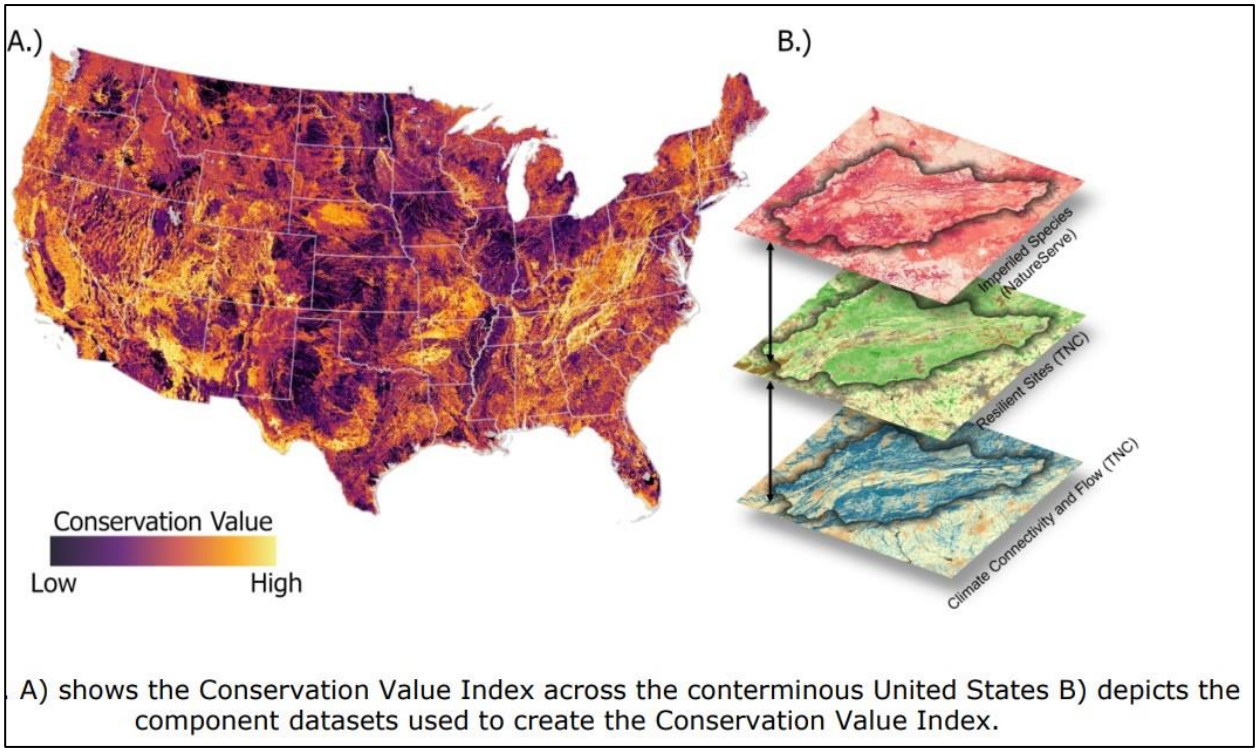


Figure 3. Nature Tech Collective (2025): Sector map of over 600 organizations across the '5M Framework'

In their survey, more than 100 organizations provided additional details. They identified that 63% of surveyed organizations report the presence of a single target species, with fewer currently measuring metrics like species richness, ecosystem health or species abundance (Nature Tech Collective, 2025).

In contrast to the Nature Tech Collective (2025), which focuses on summarizing the organizations working in the biodiversity space, Moy et al., in their article Empowering National Park Landscape Conservation by Connecting Science and Advocacy (2025) on the ways to quantify conservation value, which includes biodiversity component. Moy et al. write that the Conservation Value Index (CVI) scores cumulative biodiversity, climate resilience, and climate flow values (Figure 3). The result is a “*straightforward yet*

comprehensive output that identifies areas suitable for prioritizing conservation planning."



A) shows the Conservation Value Index across the conterminous United States B) depicts the component datasets used to create the Conservation Value Index.

Figure 4. Moy et al. (2025) Conservation Value Index.

CVI emerges as a science-driven tool to identify the best location to prioritize landscape conservation. Developed through collaboration between the National Parks

Conservation Association (NPCA), NatureServe, and The Nature Conservancy, the CVI quantifies three pillars essential for strategic prioritization:

- At-risk biodiversity Aggregates Range-size Rarity
- Climate resilience and human modification metrics to assess ecosystem durability under climate change
- Climate connectivity maps

However, quantifying the conservation value addresses only the measurement side. On the other hand, a literature review reveals that biodiversity credit markets are still in *their infancy* (Participants 1 & 2, pers. comm., 2023). The lack of a universally accepted

definition and any legally binding international agreement (Hughes, 2023) prevents the formation of a single marketplace where credits can be recorded, traded, retired and transferred.

Compared to carbon credits, which have benefited from a straightforward, standardized metric (CO_2 equivalents) but suffered from a “race to the bottom” in quality and oversight, biodiversity credits are even more challenging to measure due to the complexity and context-specific nature of biodiversity, making standardization and market integrity difficult to achieve (Figure 5). Policy frameworks like the UK’s Biodiversity Net Gain represent early examples of mandatory national action. However, these are exceptions rather than the rule, and their long-term effectiveness remains to be seen. Literature suggests that, with robust legal systems and a single, credible measurement approach, biodiversity credits could support large landscape conservation. However, due to their inherent non-fungibility and local specificity, they

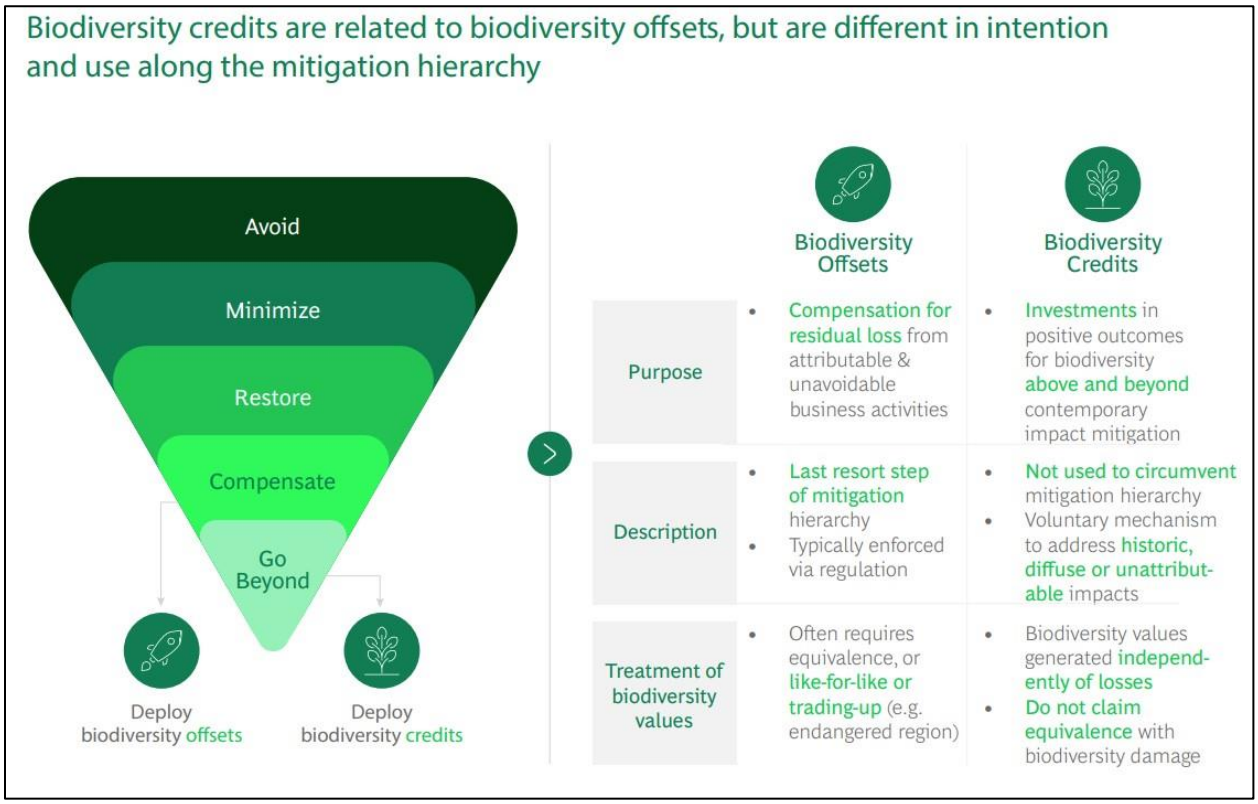


Figure 5. Source (from BCG, 2024): Biodiversity Consultancy - Exploring Design Principles for High Integrity and Scalable Voluntary Biodiversity Credits (2022).

are unlikely to become as liquid or globally commoditized as carbon credits even under optimal conditions.

NPCA seeks a proactive approach to conservation. I found no disagreement on the drastic decline in biological diversity. World Health Organization states that biodiversity loss is occurring at an alarming rate, and species extinctions are currently ten to one hundred times higher than the natural baseline (2025). Many organizations are introducing novel ways to direct finances toward conservation. The Nature Conservancy recently announced a trailblazing initiative to make thriving coastal blue carbon ecosystems a pillar of economic success using blue carbon plus collaboration (TNC, 2025). Conservation International brings nature tech for biodiversity (2025). It is generally agreed that we should use any available tools to protect the environment.

One noticeable bias in the biodiversity credit space is the tendency of parties to promote the tool. Barbara Haya says it is a ‘race to the bottom’ (White, 2023). Despite several interviews with international experts, I focused on the US regarding geographical gaps. The literature review or informational interviews do not focus on any region besides the Texas colleagues involved in the case study.

Limitations

Gaps in the study and unresolved questions include a more comprehensive overview of available tools, such as conservation easements and the potential of its expansion based on the current legal system. Another unresolved question is to structure and compare the Conservation Value Index (Moe et al., 2025) and available biodiversity credit measurement systems starting from the Wallacea Trust (The UK) and Terrasos (Colombia) methodologies, as they were the most prominent examples brought up by experts. Another unresolved question would be a deeper dive into the inefficiencies of the carbon credit system and pathways to avoid such mistakes.

Dr. Dan Exton from The Wallacea Trust and rePLANET succinctly summarized the essence of biodiversity credits for landscape conservation: ‘Boil it down to a single number because companies want to compare. “There needs to be a single underlying

number that makes sense to a board of directors or shareholders; an investor wants to invest in measurable conservation practices” (Zlenko & Valdez, 2023). As such, the primary motivation factor in purchasing biodiversity credits is a simple, measurable unit comparable to the reasons behind the voluntary carbon credit market. As such, a corporation can make marketing statements on sustainability practices while the funds are directed at local communities and conservation practices.

Potential Generation of Biodiversity Credits: Big Thicket Case

We examine the buyer's side. On the other hand, funds are funneled into enhancing species protection, restoration practices and improved biological diversity. Regarding the examined pilot in Big Thicket, several steps must be taken before conducting the fieldwork to enhance environmental protection.

1. Identify viable, privately owned parcels adjacent to Big Thicket using NatureServe GIS analysis;
2. Identify, quantify and calculate the conservation value of these areas (Figure 6);
3. Define metrics and values of biodiversity as they apply to Big Thicket applying one of the methodologies from the methodology section (e.g., The Wallace Trust? Other?)
4. Explore the willingness of local communities to engage in conservation using biodiversity credit methodology leveraging NPCA representation in Texas;
5. Decide on a metric to measure success and consecutive progress over the decided time horizon of 20 years. "How long does credit have to be in place to matter? Ideally, in perpetuity, but with climate change, changes are coming, and we cannot predict that could change how we define success. Hence the answer is decades" Michael Washburn, Washburn Consulting (Zlenko & Valdez, 2023)

Work was conducted with the NPCA Texas team to explore on-site engagement and identify restoration practices focusing on key species like red-cockaded woodpeckers and longleaf pine trees (Tian, 2023)

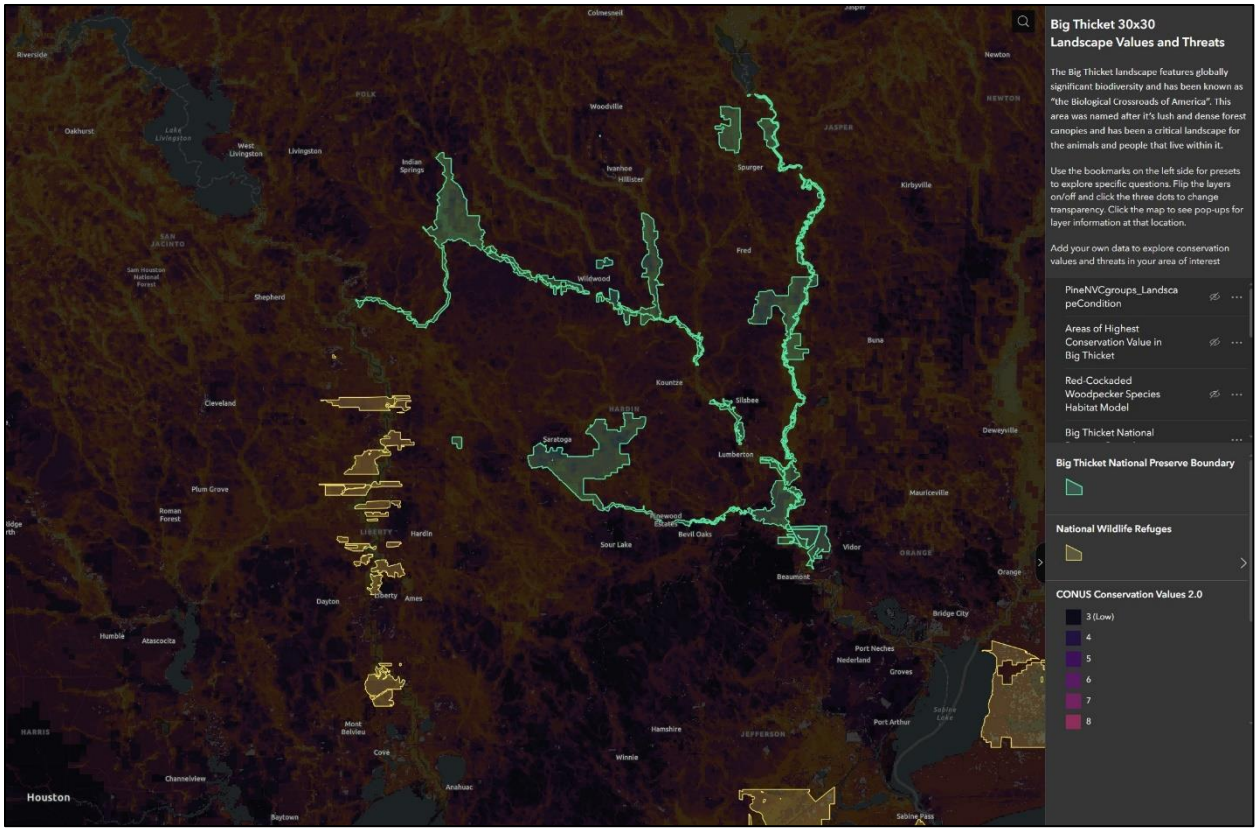


Figure 6 Amy Tian, ArcGIS application, Big Thicket National Preserve boundaries (in green), national wildlife refuges (in yellow) and conservation value index (background), National Parks Conservation Association and The Nature Conservancy (NPCA & NS, 2023).

Recommendations

I recommend not moving forward with biodiversity credits as a market-driven environmental protection tool at this moment in the US:

1. Absence of legal framework or widely accepted measurement methodology.
2. The market is meant to create the most cost-efficient mechanisms, which are prone to overexploitation despite third-party verification.
3. The administration is not supportive of environmental initiatives.

Instead, I recommend focusing on measurable contributions to existing 'conventional' environmental protection tools.

Conclusion

In summary, the National Parks Conservation Association should prioritize conventional environmental protection approaches and defer engagement with biodiversity credits at this time. The absence of a legal framework and widely accepted measurement methodology for biodiversity credits poses significant challenges. Additionally, despite third-party verification, the market's focus on cost efficiency can lead to overexploitation. Furthermore, the current administration's lack of support for environmental initiatives complicates the implementation of such credits.

However, there is potential for biodiversity credits in the future if regulatory conditions change. For instance, the UK's recent adoption of biodiversity legislation demonstrates that legal frameworks can be established. While the market's efficiency-driven nature may persist, it could still be leveraged effectively, as seen with investment banks' interest in biodiversity bonds in the EU. Lastly, shifts in political support for environmental initiatives could occur over time, potentially creating a more favorable environment for biodiversity credits. Therefore, while NPCA should focus on traditional tools for now, it should remain vigilant for future opportunities in biodiversity credits.

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