UC SANTA BARBARA
Bren School of Environmental Science & Management

Evaluating the Biodiversity Implications of Nature-Based Carbon Credits

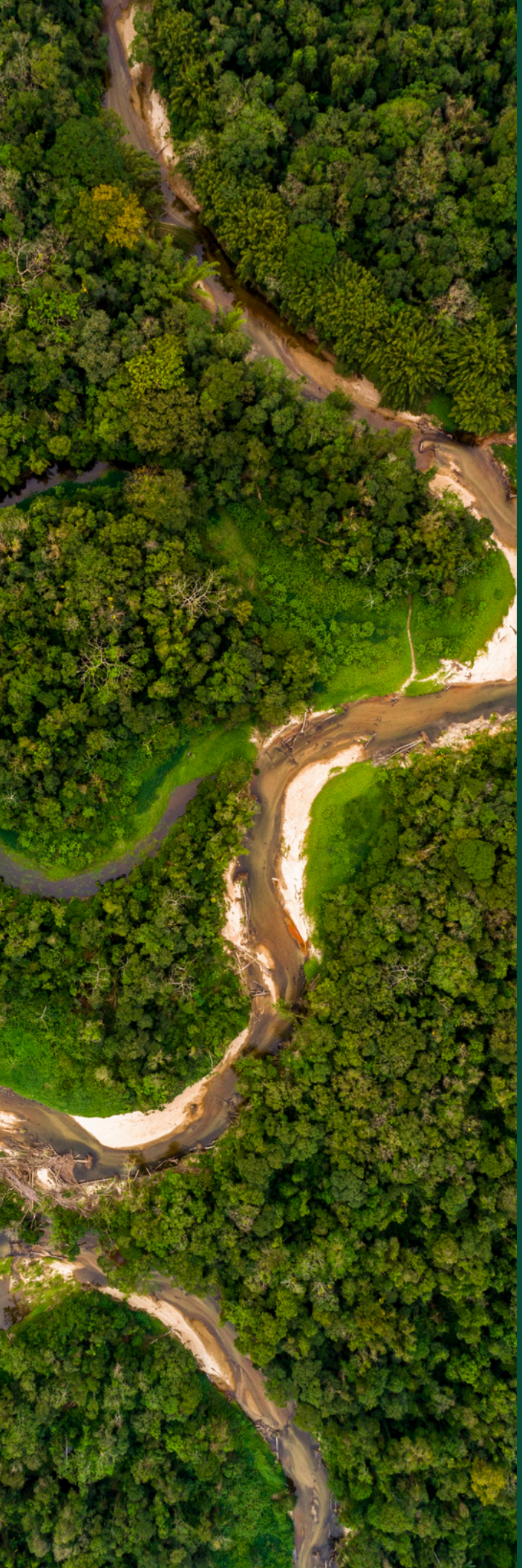
Sophie Bartley, Jackson Hayes, Dana Cohen-Kaplan, Anissa Stull, Kelsey Warren
Faculty advisor: Dr. Andrew MacDonald
Client: Carbon Direct

PROBLEM

Climate change and biodiversity loss are urgent global challenges. While carbon markets aid climate mitigation, large-scale solutions for biodiversity remain limited. Nature-based carbon credit projects can benefit biodiversity, but outcomes vary by project design and location. As demand grows for carbon credits with biodiversity co-benefits, especially those aligned with UN Sustainable Development Goals, the lack of a standardized framework for evaluating biodiversity outcomes poses a significant challenge. This project addresses that gap by investigating which project characteristics support or threaten biodiversity and exploring how biodiversity metrics can inform a decision support tool for carbon credit buyers seeking projects with substantial biodiversity benefits.

APPROACH

We selected a suite of metrics to assess carbon credit projects on their potential to support biodiversity based on their location and design. Some metrics are based on established consensus in biodiversity literature, while others stem from corporate reporting frameworks. We used three lenses to assess a location's potential: Species Presence, Species Threat, and Restoration Potential. Species Presence metrics show biodiversity levels in terms of species abundance and type. Species Threat metrics indicate how species and habitats are threatened by human degradation. Restoration Potential metrics assess how much the region could benefit from ecosystem restoration. Projects were also assessed for design elements that could negatively impact ecosystems, including invasive species, monocropping, and commercial activities. Additionality, or whether the biodiversity benefits would occur without the project, was also examined. Project metrics were aggregated to determine scores that indicate how different projects and locations may support biodiversity conservation.



KEY FINDINGS

UC SANTA BARBARA
Bren School of Environmental Science & Management

- Biodiversity is not often considered in carbon credit project creation, yet it plays a critical role in ecosystem function and in supporting long term ecological resilience.

- Carbon credit projects vary widely in their biodiversity impact. Some prioritize fast carbon returns over ecological restoration, while others incorporate intentional design elements that promote positive biodiversity impacts known as “co-benefits.”

- Projects with higher ecological degradation and potential for native ecosystem recovery offer the most significant opportunity for biodiversity benefits.

- Biodiversity increase may be limited in projects sited in regions with intact ecosystems, strong environmental regulations, or naturally biodiversity levels.

- Proximity to protected areas enhances biodiversity by improving habitat connectivity and reducing edge effects. Projects near protected or high-biodiversity areas can serve as critical habitat buffers or corridors. However, projects located within protected areas may provide limited additional benefits.

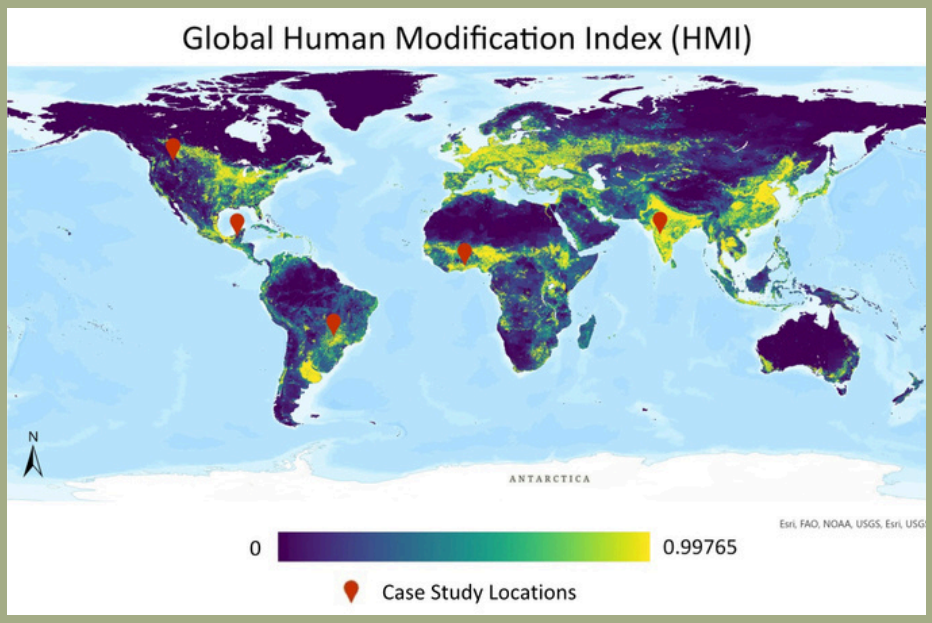
- Projects that emphasize native species, natural regeneration, diverse ecosystems, and biodiversity monitoring have more potential for biodiversity co-benefits than those that focus solely on carbon metrics or use monocultures.

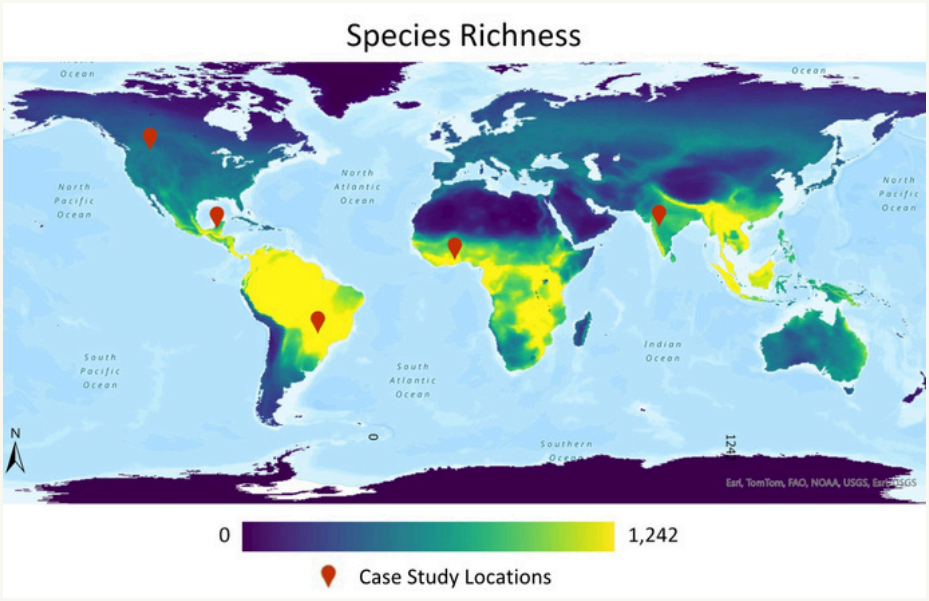
- Additionality applies to both carbon and biodiversity. Biodiversity-positive projects should demonstrate that their ecological and social benefits would not have occurred without the carbon finance intervention.

KEY FIGURES

UC SANTA BARBARA
Bren School of Environmental Science & Management

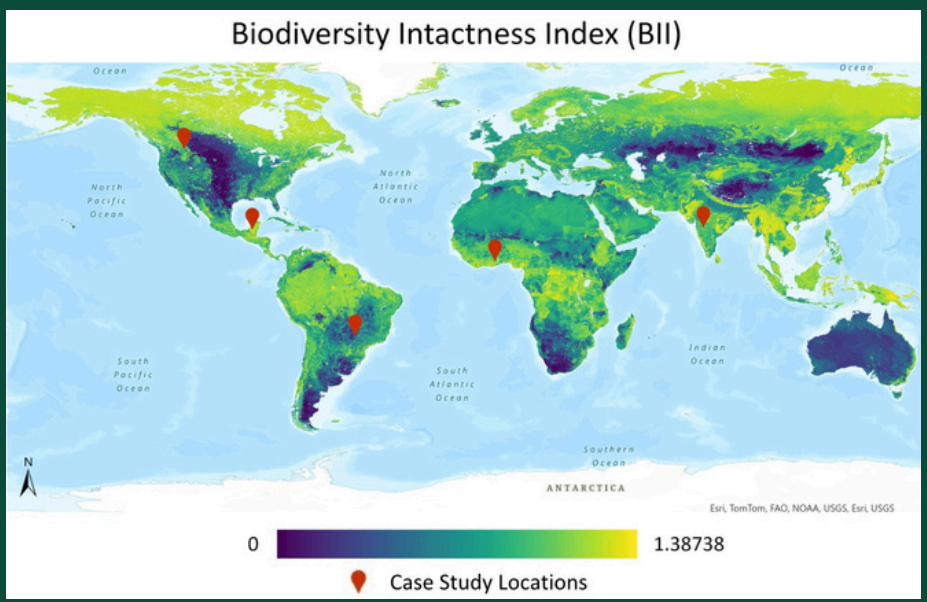
The HMI metric measures the extent of human-driven degradation in a project's location, with higher scores indicating higher levels of structural ecosystem degradation. The map shows the global distribution of HMI values. Darker colors have values closer to 0 while lighter colors have values closer to the global maximum of 0.99765.





The Species Richness, or number of unique species that could be present in each carbon credit project site, indicates the number of species that a carbon credit project that conserves biodiversity could protect. The map shows the global distribution of Species Richness values. Darker colors have values closer to 0, while lighter colors have values closer to the global maximum of 1,242.

BII assesses ecosystem health in terms of biodiversity by considering species count and abundance, providing a comprehensive measure of how closely species composition and abundance resemble those of a pristine ecosystem. It also evaluates biodiversity health relative to a baseline of minimal human disturbance. The map shows the global distribution of BII values, with darker colors closer to 0 and lighter colors closer to the maximum of 1.38738.

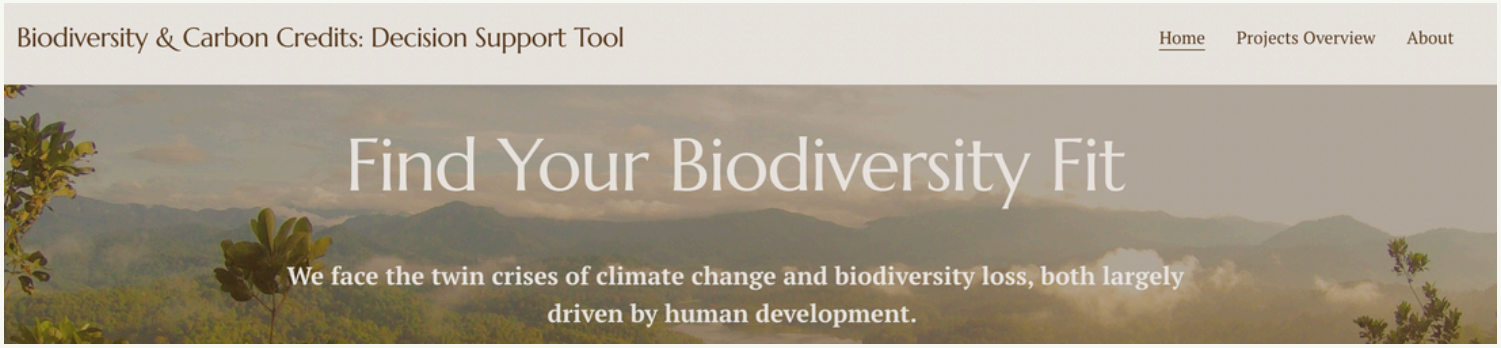


CONCLUSION

This project highlights the connections and tradeoffs between climate mitigation and biodiversity conservation in nature-based carbon credit projects. This analysis lays the groundwork for better-informed decision-making in the carbon credit market by pinpointing project location and design as key factors influencing biodiversity outcomes. The resulting buyer decision-support tool simplifies the evaluation process, enabling buyers to align their investments with both their climate and biodiversity goals. This approach promotes the integration of biodiversity conservation into carbon credit projects, advancing efforts to tackle climate change and biodiversity loss simultaneously.

IMPACT

This analysis provides a structured approach to evaluating the potential of nature-based carbon credit projects to support biodiversity, which directly informed the development of a buyer decision-support tool website. This web tool is designed to help buyers navigate the complexities of biodiversity assessment by offering clear project location and design criteria. By synthesizing analysis of project documentation and external ecological datasets into a standardized evaluation framework, the tool will enable buyers to make more informed purchasing decisions, ensuring that their carbon credit investments align with both their climate and biodiversity goals. Ultimately, this approach seeks to promote the purchase of carbon credits that integrate biodiversity conservation as a core component of carbon sequestration efforts.



Visit conscioustcarbon.org to explore the prototype buyer decision support tool.

UC SANTA BARBARA
Bren School of Environmental Science & Management