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MORALITY BEFORE KNOWLEDGE

Community-integrated carbon trading: A pathway to environmental conservation and economic sustainability

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ABSTRACT

Background: Severe climate change demands urgent global action, emphasizing the need for innovative strategies to mitigate climate change and reduce carbon emissions. Central to these efforts is the reduction of emissions from deforestation and forest degradation. Engaging local communities in carbon trading initiatives plays a pivotal role in achieving sustainability, empowering them to contribute to climate change mitigation and promoting the adoption of renewable energy. **Method:** This study adopts the PSALSAR framework, which integrates PRISMA and SALSA, to conduct a systematic literature reflection on local community empowerment through carbon trading initiatives. The process includes six main stages: Protocol, Search, Appraisal, Synthesis, Analysis, and Report. The study refers to sources from the Verra Registry, focusing on the AFOLU (Agriculture, Forestry and Other Land Use) project category, and uses the PICOC framework to ensure research relevance. **Findings:** Carbon trading initiatives, such as the Blue Carbon Project in Colombia, the Kuamut Rainforest Conservation Project in Malaysia, and the Plum Project in Indonesia, focus on reducing emissions while empowering local communities. These initiatives promote sustainable practices and economic opportunities, aligning with broader sustainable development goals. The study reveals that integrating community empowerment with environmental conservation can lead to emission reductions, economic growth, and biodiversity preservation. Successful implementation requires collaborative partnerships and effective policy integration. **Conclusion:** Empowering local communities through carbon trading initiatives brings positive impacts across economic, cultural, environmental, and social domains. These initiatives highlight the importance of community involvement and collaboration among stakeholders for achieving sustainability. The study calls for further exploration of challenges and future research directions, emphasizing the transformative potential of community empowerment in carbon trading for a more sustainable future. **Novelty/Originality of this article:** It emphasizes the integration of environmental conservation with community-driven economic opportunities, demonstrating the transformative potential of such initiatives for sustainable development.

KEYWORDS: climate change; carbon emission; local communities; carbon trading initiatives; REDD+.

1. Introduction

Severe climate change has emerged as a critical global issue, with its profound effects on the economy and society prompting urgent action. The dire consequences necessitate a collective effort from all nations and regions to develop innovative strategies for mitigating climate change and cutting carbon dioxide emissions (Shi et al., 2022). The active involvement of countries in climate governance is evident through significant events such as the signing of the Kyoto Protocol in 1997, the Copenhagen Accord in 2009, and the Paris Climate Change Conference in 2015. These milestones underscore the global commitment to addressing and mitigating climate change, with a core component of the Paris Agreement

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being the reduction of emissions from deforestation and forest degradation (REDD+) (Miles, 2021; Shi et al., 2022). Achieving carbon neutrality is essential for humanity to live harmoniously with nature and move towards a sustainable future. Reaching neutrality would reduce the occurrence of catastrophic disasters, directly helping to maintain the current social order, and indirectly fostering the evolution of human society (Chen et al., 2022). Evidence from the Intergovernmental Panel on Climate Change (IPCC) indicates that global warming is mainly driven by carbon dioxide emissions. These emissions largely result from the energy consumption associated with the rapid economic growth since the industrial revolution. Research has demonstrated a strong correlation between the interplay of economic growth and carbon emissions and its impact on climate change (Qin et al., 2024). Various studies aim to develop regulations and strategies for the carbon market, such as carbon pricing and emissions trading systems. These measures incentivize producers to lower their carbon emissions, striving to balance emissions reduction with economic growth (Li et al., 2021; Wen & Jia, 2023). The carbon trading market serves as a crucial mechanism for cutting carbon emissions (Li et al., 2024; Shi et al., 2022).

The Carbon Emissions Trading Scheme (CETS) is one of emission trading type that externality cost of carbon emission can be internalized through emission trading schemes (ETSs), which contribute to carbon emission reduction (Li et al., 2021). The main objective is to regulate market participants in managing and controlling CO_2 emissions through pricing. Economic development, resource consumption (including energy), and greenhouse gas emissions (such as CO_2) have strained the ecological environment's carrying capacity and driven climate change (Chen & Lin, 2021). Acheiving the energy and carbon intensity targets, the carbon constraint and Emission Trading Scheme (ETS) policy are employed to promote energy saving and CO_2 emission reduction. Carbon trading, a market-based tool for addressing climate change, involves the exchange of emissions for six primary greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) (Sovacool et al., 2021). The government needs to develop the domestic carbon market further, improve energy efficiency and optimize industrial structure to promote synergistic emission reduction (Li et al., 2021). The European Union already has the world's largest carbon market and has been reducing greenhouse gas emissions through the carbon market mechanism by setting emission thresholds (Rachmaniar et al., 2021). Carbon sequestration through forest carbon offset projects, carbon trading is one of the instruments to mitigate the undesirable impacts of climate change (Shinbrot et al., 2022). In order to achieve increased carbon sequestration, the most important thing is to modify the regulatory framework to provide incentives for communities in community forest management plans (Delma et al., 2024). Based on previous research, carbon trading has a major impact on the public and private sectors through the contribution of local revenue between 7.5%-26.1% of the total revenue of the Public Service Agency from 2011 to 2019 (Irama, 2020).

Carbon trading has contributed to the preservation of the Amazon forest in Brazil through the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), which requires that a portion of greenhouse gas emissions from international flights be offset by the purchase of carbon credits (Gonçalves, 2022). Based on data from 30 provincial administrative regions in China from 2001 to 2018, China's carbon trading system policy shows that the implementation of the carbon trading system promotes the level of green development and economic growth in pilot cities (Nie et al., 2022). Previous research shows that there is a positive correlation between the percentage of conserved area and the percentage of greenhouse gas emission reduction (Wahyudi et al., 2022). Research on Buthan community forests covering 107,866 hectares produced 19 million Mg of carbon, the existence of community forest management groups with better management will double carbon stocks to reach 40 million mg of carbon (Delma et al., 2024). Community forests have the potential and important role in climate change mitigation as well as an effective forest management system to overcome deforestation and forest degradation (Delma et al., 2024). Based on biomass comparison research between natural forests and plantations, the carbon loss is higher in natural forests, so for climate change mitigation efforts it is more

appropriate to maintain natural forests than to convert natural forests into plantations (Islam et al., 2024; Nero & Opoku, 2022).

The keys to the sustainability of carbon trading projects include the balance of forest ecosystems through biodiversity protection compensation mechanisms, guaranteed benefits for local communities, participation of local communities, carbon offset systems and institutional design that covers various social needs (Abadie et al., 2024; Xu, 2024). Compared to developing countries, developed countries have recognized the carbon offset factor as a challenge for social carbon market implementation (Abadie et al., 2024; Xu, 2024). Another challenge to carbon trading projects from the private organization side is that the carbon market is still not responsive, lacks accountability and is not regulated, so transparency as an important evidence of carbon market quality is not accommodated (Cullenward et al., 2023). On the other hand, there are factors that hinder the participation of local communities, including land use rights arrangements, geographical and biophysical factors between carbon forests and local community forests (Wei et al., 2021). Carbon market challenges require a lot of time and large financial resources, which will reduce the profitability of the carbon project itself (Herr et al., 2019; Huang et al., 2022).

Empowering local communities through carbon trading initiatives globally is a crucial aspect of sustainable development and climate change mitigation efforts. Research in this area emphasizes the importance of community engagement, capacity building, and local ownership in carbon trading schemes to ensure meaningful participation and positive outcomes. Studies have highlighted the role of participatory planning in guiding local sustainability priorities and achieving broader sustainability goals, emphasizing the dual benefits of local empowerment and global impact (Szetey et al., 2021). Additionally, research has explored the potential of co-creating local socioeconomic pathways to advance sustainable development goals, empowering communities to drive their sustainability agendas autonomously (Szetey et al., 2021). Through engaging local communities, carbon trading programs can achieve social and economic sustainability by incentivizing community involvement in climate change mitigation efforts, promoting the adoption of renewable energy to decrease carbon emissions, and boosting the economic prosperity of local residents through the sale of carbon credits from community energy initiatives. This fosters environmental awareness, aids in climate change mitigation, and offers further encouragement for participation in renewable energy projects (Meitern, 2024).

Engaging local communities in community energy projects has a beneficial and impactful effect on carbon emission reduction. This is facilitated by the active involvement of motivated community members who feel a sense of ownership over the project, the promotion of renewable energy use to decrease carbon emissions, heightened environmental awareness leading to changes in energy consumption behavior, and substantial contributions to broader climate change mitigation endeavors (Meitern, 2024). The aim of empowering local communities through carbon trading initiatives is to foster collaboration, build capacity, and promote sustainable practices. By integrating community empowerment strategies into carbon trading schemes, it is possible to achieve environmental goals while also supporting local development and resilience. This paper aims to highlight a comprehensive overview of benefit local communities involvement, implementation of the sustainable development goals and impact on climate change.

2. Methods

The research employs the SALSA framework for literature search and analysis, aiming to minimize subjectivity while ensuring a detailed examination of the literature (Saraji & Streimikiene, 2023; Siksnelyte-Butkiene et al., 2021). This methodology, known for Search, Appraisal, Synthesis, and Analysis, is recognized in scientific literature for its effectiveness in identifying, evaluating, and systematizing scientific and practical studies, thereby guaranteeing methodological accuracy and completeness (Saraji & Streimikiene, 2023; Siksnelyte-Butkiene et al., 2021). Using the SALSA technique enables a comprehensive literature review while reducing the potential for subjective bias, as acknowledged in

previous scholarly works (Saraji & Streimikiene, 2023; Siksnelyte-Butkiene et al., 2021). Furthermore, for ensuring consistency and comprehensiveness in the research, the use of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement is advocated (Quinton & Nesbitt, 2024; Saraji & Streimikiene, 2023; Siksnelyte-Butkiene et al., 2021). However, a new approach proposed by Mengist et al. (2020) integrates PRISMA and SALSA methodologies, resulting in the PSALSAR framework, which comprises six main steps: Protocol, Search, Appraisal, Synthesis, Analysis, and Report. This integrated technique has been applied in a systematic literature review examining the existing knowledge and research gaps in ecosystem services in mountainous regions (Mengist et al., 2020; Saraji & Streimikiene, 2023). Table 1 outlines the method utilized to systematically search the literature for identifying program related to the empowering local communities through carbon trading initiatives.

Table 1. Systematic literature search and review framework

No	Steps	Main task
1.	Protocol	Dentifying the program related to the empowering local communities through carbon trading initiatives using The PICOC framework.
2.	Search	Searching for publications related to the research goals in Verra Registry using specific keywords.
3.	Appraisal	Studies selection.
4.	Synthesis	nvolves preparing a template for data extraction, categorizing the data for further analysis, and extracting information on classification from the articles included in the study.
5.	Analysis	Analyzing classified information, proposing a new challenge framework, organizing data, comparing results, and deriving conclusions with recommendations.
6.	Report	ummarizing the outcomes of the analyses within an article format.

2.1 Research protocol

This step involves formulating and implementing a search strategy. The primary goal at this stage is to delineate the scope of the current research. Research questions can be developed, and the most relevant strategies for achieving the research objectives can be chosen. In this study, the PICOC framework was employed as an effective tool to define the research scope. This framework provides a structured approach that facilitates the examination of research questions based on their constituent ideas, thereby clarifying the study's purpose (Saraji & Streimikiene, 2023; Siksnelyte-Butkiene et al., 2021).

2.2 Searching

This step includes creating and executing a search strategy, with an emphasis on selecting the appropriate database to ensure the literature gathered is of high quality and covers most available papers. The search terms and information from the publications are refined using the PICOC framework (Quinton & Nesbitt, 2024; Siksnelyte-Butkiene et al., 2021). Additionally, specific keywords are used to search for publications related to the research goals in the Verra Registry using search engine ini scope area of focus - agriculture, forestry, and other land use (AFOLU). The Categories of AFOLU projects are Afforestation, Reforestation and Revegetation (ARR), Agricultural Land Management (ALM), Improved Forest Management (IFM), Reduced Emissions from Deforestation and Degradation (REDD), Avoided Conversion of Grasslands and Shrublands (ACoGS) and Wetlands Restoration and Conservation (WRC).

2.3 Appraisal

The report selection process adheres closely to the defined research objectives, focusing on the specific criteria outlined for inclusion. From the extensive array of reports

available in the Verra Registry, only three sample reports were chosen to undergo thorough assessment. These reports were carefully evaluated based on key parameters such as Project Name, Location Name, Community involvement, Project Type, Program Type aligned with Sustainable Development Goals, Project Area coverage, and Project Benefits. This meticulous selection process ensures that the chosen reports effectively contribute to fulfilling the research objectives by providing relevant and comprehensive insights into empowering local communities through carbon trading initiatives.

2.4 Synthesis

The study employs a structured approach to categorize the extracted information into both general and specific categories, ensuring a comprehensive analysis. General categories encompass essential aspects such as publication year, journal sources, case study locations, and future directions, offering a broad overview of the research landscape. Meanwhile, specific categories delve deeper into the intricacies of the research, addressing critical elements such as research gaps, aims, results, and methodologies. These specific categories aim to tackle the multifaceted challenges pertinent to the research questions, classifying them into distinct dimensions including social, economic, environmental, technical, and institutional aspects.

To streamline the process, a template for data extraction is meticulously prepared, facilitating the systematic organization of information. This template serves as a structured framework for categorizing data, enabling efficient analysis and synthesis of findings. By extracting classification information from the included articles, the study ensures a methodical approach to data interpretation, thereby enhancing the reliability and validity of the research outcomes. Through this comprehensive categorization process, the study aims to uncover nuanced insights into empowering local communities through carbon trading initiatives, addressing diverse challenges and paving the way for informed decision-making and future research endeavors.

2.5 Analysis

During the Analysis stage, the focus lies on addressing fundamental research inquiries by meticulously examining categorized data to meet research criteria, with outcomes delineated in section 3. This involves a thorough exploration of the data, proposing a novel framework for challenges, and organizing the findings to contrast results effectively. Data sets are scrutinized based on identified criteria, including socio-economic factors, environmental impacts, technological constraints, and institutional barriers. By presenting different sets of indicators according to their primary purpose, researchers aim to uncover nuanced insights into empowering local communities through carbon trading initiatives. Moreover, the Analysis stage entails the formulation of conclusions with actionable recommendations, drawing upon the synthesized findings and the proposed framework for challenges. These recommendations are designed to inform policymakers, practitioners, and stakeholders, guiding efforts towards maximizing the positive impacts of community empowerment in mitigating climate change and promoting sustainability.

2.6 Report

This step format serves as a structured platform, facilitating the concise yet comprehensive summarization of the outcomes derived from the analyses conducted. By offering an organized framework, it enables the presentation of key findings, insights, and implications gleaned from the research in a systematic manner. Through this format, the results of the analyses are effectively communicated to a broader audience, enhancing understanding and interpretation of the study's outcomes. This structured approach not only aids in distilling complex information into digestible segments but also ensures that the essence of the research is effectively conveyed. Ultimately, summarizing the outcomes

of the analyses within an article format provides a comprehensive and accessible means of disseminating the research findings to both academic and non-academic audiences, thereby maximizing the impact and relevance of the study.

3. Result and Discussion

In the context of carbon trading, empowering local communities involves equipping them with the necessary knowledge, resources, and tools to participate effectively in carbon markets, thereby reducing emissions and fostering sustainable practices. This aligns with broader objectives of promoting community engagement and empowerment across sectors like energy markets and biodiversity conservation (Gatiso et al., 2022). Verra, formerly known as VCS, is a non-profit organization that oversees standards and certification initiatives for reducing greenhouse gas emissions and fostering sustainability within carbon markets. Through the Verified Carbon Standard (VCS), Verra validates projects that reduce emissions or improve carbon storage, advocating for environmental sustainability and encouraging businesses and governments to address climate change (Indrajaya et al., 2024). Furthermore, the REDD program aims to reduce greenhouse gas emissions from deforestation and forest degradation in developing countries by accepting projects that promote sustainable forest management and decrease carbon emissions in the forestry sector. This provides financial incentives for developing countries to preserve forests and aligns with global efforts to address climate change and promote natural resource conservation (Indrajaya et al., 2024).

3.1 Blue carbon project gulf of morrosquillo "vida manglar"

The Blue Carbon Project in the Gulf of Morrosquillo is Colombia's inaugural REDD initiative focusing on mangroves. Covering all mangrove forests in the Gulf, including protected areas, the project addresses threats posed by human activities to these vital ecosystems. Mangroves play a crucial role in carbon sequestration and provide habitat for vulnerable species, but are endangered by unsustainable practices. The project's objectives include reducing greenhouse gas emissions, promoting sustainable mangrove management, fostering alternative livelihoods, and enhancing governance. Over its 30-year lifespan, it aims to decrease emissions by 939,296 CO_2 through activities like governance improvement, alternative livelihood projects, mangrove rehabilitation, and monitoring. By tackling financial and institutional obstacles to mangrove conservation, the project benefits local communities through better governance, sustainable practices, economic opportunities, and job creation. Conservation efforts will safeguard biodiversity, particularly endangered species such as the manatee, needle caiman, and otter, by preserving habitat connectivity and ecosystem functions.

Table 2 offers a comprehensive overview of Blue Carbon Project Gulf of Morrosquillo "Vida Manglar", which is a pivotal component of the Reducing Emissions from Deforestation and Forest Degradation (REDD) program. This program is strategically designed to mitigate the emission of greenhouse gases stemming from deforestation and forest degradation in developing nations. It operates by approving projects that advocate for sustainable forest management practices while concurrently curbing carbon emissions within the forestry sector. The project serves as a catalyst for achieving various sustainable development objectives, notably goal 8, which pertains to fostering decent work opportunities and stimulating economic growth. This is achieved through active engagement with local communities, thus empowering them economically. Furthermore, the project aligns with goal 11, emphasizing the importance of building sustainable cities and communities, by prioritizing the development and empowerment of local community structures. Moreover, the initiative resonates strongly with goal 13, focusing on climate action, by dedicating efforts towards the conservation and effective management of mangrove ecosystems. Similarly, it contributes to goal 14, centered around life below water, through its commitment to enhancing governance frameworks and management strategies for coastal

areas. Additionally, in line with goal 15, which underscores the significance of life on land, the project aims to restore mangrove ecosystems adversely impacted by human activities. Table 2 demonstrating its effectiveness, the initiative has generated measurable positive outcomes in diverse aspects—social, economic, and environmental—within the community.

Table 2. Empowering local communities through carbon trading initiatives in Colombia

No	Description	Colombia, Latin America
1.	Project name	Blue Carbon Project Gulf of Morrosquillo "Vida Manglar"
2.	Location name	Coastal area southwest of the Caribbean region of Colombia (Gulf of Morrosquillo)
3.	Community	The Integrated Management District (DMI) of Cispatá Bay and its surrounding regions such as mangrove harvesters, fishermen, aquaculturists, ranchers, farmers, and tourism providers
4.	Project type	Reducing Emissions from Deforestation and Forest Degradation (REDD)
5.	Program type based on Sustainable Development Goals	Decent work and economic growth, sustainable cities and communities, climate action, life below water, and life on land
6.	Project area	This area encompasses approximately 9,064 hectares of mangrove forests in 2015, of which 4,163 hectares have been designated for sustainable use under the Integrated Management Plan (PMI)
7.	Project benefits	Conservation and sustainable management of mangrove ecosystems: Significant reduction in mangrove deforestation: 85% within the project area and 32% in the larger region. Preservation of 511 hectares of mangrove forests within the project area and an additional 117 hectares in the broader region. Prevention of 69,027 metric tons of CO_2 equivalent emissions, contributing to ecosystem preservation. Strengthening local governance and management of protected marine-coastal areas: Advancement in technical knowledge for mangrove ecosystem maintenance. Conducted theoretical-practical workshops and awareness campaigns for local stakeholders.

(Cardona, 2021)

The Blue Carbon Project Gulf of Morrosquillo, known as "Vida Manglar," endeavors to foster various community benefits within the Gulf of Morrosquillo region. Through a participatory approach, the project engages community associations, such as mangrove harvesters, in decision-making processes, ensuring that the project activities align with the community's needs and concerns. Additionally, the establishment of the "Vida Manglar" Financial Sustainability Fund aims to provide long-term technical and financial support for mangrove management, fostering conservation efforts with a participatory approach. Community organizations have voluntarily entered agreements to participate in the REDD+ Project, committing to execute activities related to the Integrated Management Plan of the protected area and the Subsystem of Marine Protected Areas. By emphasizing proper mangrove management and sustainable development, the project contributes to the conservation of biodiversity and community conservation values. These community benefits not only aim to enhance the economic welfare of local residents but also strive towards the sustainable management of natural resources and the preservation of the Gulf of Morrosquillo ecosystem.

3.2 Kuamut rainforest conservation

The Kuamut Rainforest Conservation Project in Sabah, Malaysia aims to protect and restore 83,381 hectares of tropical forest within the Tongod and Kinabatangan Districts. It operates under a 99-year lease agreement between Yayasan Sabah and the Sabah Forestry

Department, with the goal of preventing commercial logging over 84,000 hectares for 30 years. This intervention will prevent the release of approximately 16 million tonnes of carbon dioxide equivalent (CO_2) into the atmosphere. Additionally, the project safeguards a biodiverse habitat known for its high populations of elephants, banteng, orangutans, and endangered bird species.

Table 3. Empowering local communities through carbon trading initiatives in Malaysia

No	Description	Sabah, Malaysia
1.	Project name	Kuamut Rainforest Conservation Project
2.	Location name	Tongod and Kinabatangan Districts of Sabah, Malaysia
3.	Community	Karamuak cluster, consisting of four communities to the north-west of the project area, Kuamut cluster, comprising four communities to the north-east
4.	Project type	Improved Forest Management (IFM)
5.	Program type based on Sustainable Development Goals	No poverty, good health and well being, decent work and economic growth, climate action, and life on land
6.	Project area	The Kuamut Rainforest Conservation Project aims to protect and restore 83,381 hectares of tropical forest in Sabah, Malaysia. The project area is located in the Tongod and Kinabatangan Districts of Sabah and is part of a larger approximately 1-million-hectare concession granted to Yayasan Sabah on a 99-year lease arrangement with the Sabah Forestry Department
7.	Project benefits	Protection and Conservation of Forest Area: The project has successfully protected and conserved 83,381 hectares of forest area by legal conversion into a Class 1 Forest reserve, establishing it as a protected conservation area. This protection has been implemented through guard posts, regular patrolling, and security measures. Conservation of Critical Biodiversity Corridor : The improved protection status of the project area has led to the avoidance of logging and other activities, contributing to the conservation of a critical biodiversity corridor between protected areas. Community Empowerment and Support : Provision of clean, piped water to communities in the Kuamut Cluster, benefiting 98 families . Agricultural advice and support, including training on environmentally friendly farming and socioeconomic livelihood activities . Direct community engagement through training on food processing and entrepreneurship . Support for women through training activities, employment opportunities, food aid, and access to education. Benefit Sharing Mechanisms : The project has established a Benefit Sharing Mechanism framework to distribute gains from emission reduction initiatives among the local community. This includes investments in health, education, infrastructure, and direct household support. Additionally, proceeds from carbon credit sales will finance programs like microfinance, eco-tourism initiatives, agricultural advancements, and food security projects

(Permian Global, 2023)

Table 3 offers a comprehensive overview of Kuamut Rainforest Conservation Project, which is a pivotal component of Improved Forest Management (IFM) program. This program is strategically designed to enhance the management of forest resources in a more efficient and sustainable manner, with a focus on preserving biodiversity, improving air and water quality, and providing economic benefits to local communities and relevant stakeholders. This project plays a crucial role in advancing several key Sustainable Development Goals (SDGs). Firstly, it directly supports SDG 1 (No poverty) and SDG 3 (Good health and well being) by providing agricultural advice and support to local communities. This includes training on environmentally friendly farming practices and socioeconomic

livelihood activities, empowering individuals to improve their agricultural productivity and economic well-being. Moreover, the project contributes significantly to SDG 8 (Decent work and economic growth) through the establishment of a Benefit Sharing Mechanism framework. This framework ensures that the gains from emission reduction initiatives, such as carbon credit sales, are distributed equitably among the local community. These gains are invested in various sectors including health, education, infrastructure, and direct household support. Additionally, funds from carbon credit sales are allocated to finance programs such as microfinance, eco-tourism initiatives, agricultural advancements, and food security projects, fostering economic growth and sustainable development. Furthermore, the project aligns with SDG 13 (Climate action) by effectively protecting and conserving vast forest areas. Through legal conversion into a Class 1 Forest reserve, approximately 83,381 hectares of forest have been safeguarded, establishing them as protected conservation areas. This proactive approach not only mitigates carbon emissions but also preserves crucial ecosystems and biodiversity, contributing to global climate resilience efforts. Lastly, the project contributes significantly to SDG 15 (Life on land) by enhancing the protection status of the project area. By preventing logging and other harmful activities, the project safeguards critical biodiversity corridors between protected areas. This conservation effort helps maintain ecological balance and preserve invaluable habitats for various plant and animal species. Table 3 demonstrating its effectiveness, the initiative has generated measurable positive outcomes in diverse aspects—social, economic, and environmental—within the community.

The Kuamut Rainforest Conservation Project aims to bring about a myriad of benefits to the communities involved through its diverse range of activities. These encompass economic empowerment, livelihood enhancement, healthcare improvements, education support, sustainable agriculture promotion, biodiversity conservation, community livelihood improvement, healthcare and sanitation enhancement, education support, and sustainable agriculture promotion. Economic empowerment initiatives include supporting small to medium-sized businesses through microfinance programs, with a focus on empowering women and fostering entrepreneurship. Livelihood improvement efforts strive to deliver lasting benefits to the communities, whether through economic gains, developmental support, or the preservation of traditional knowledge and cultural practices. Collaboration with local authorities enhances healthcare access and sanitation practices, ensuring clean drinking water and adequate waste treatment facilities. Educational support initiatives aim to improve the quality of basic education, increase enrollment, and facilitate higher education pursuits through scholarships and capacity-building workshops. Promotion of sustainable agriculture practices, including palm oil cultivation and smart techniques, aims to bolster agricultural productivity and livelihoods. Biodiversity conservation efforts prioritize protecting and enhancing the region's rich ecological diversity. These comprehensive community benefits underscore the holistic approach of the Kuamut Rainforest Conservation Project, integrating conservation efforts with community development initiatives for a sustainable and mutually beneficial conservation endeavor.

3.3 Plum peat, mangrove conservation and restoration project (plum project)

The PLUM Project focuses on conserving and restoring peat and mangrove forests in Central Kalimantan Province, Indonesia, covering a 23,665-hectare forest concession. Previously slated for oil palm plantations, the project aims to protect the remaining forest, restore ecosystem function, and safeguard biodiversity. It also aims to enhance community resilience to climate change. Through activities like forest patrols, fire prevention, and canal blocking to rewet peat ecosystems, the project seeks to prevent forest loss and restore degraded land. Additionally, it plans to rehabilitate 15,088 hectares of degraded land. The project aims to benefit local communities by improving livelihoods, health, education, and overall well-being. Notably, the project area is habitat to 31 globally threatened species, and the project activities aim to conserve these species and restore degraded habitats to improve biodiversity and habitat quality.

Table 4 offers a comprehensive overview of Plum Peat And Mangrove Conservation And Restoration Project, which is a pivotal component of the Reducing Emissions from Deforestation and Forest Degradation (REDD) program and Afforestation, Reforestation and Revegetation (ARR). The primary goal of the Reducing Emissions from Deforestation and Forest Degradation (REDD) program is to mitigate climate change by reducing greenhouse gas emissions associated with deforestation and forest degradation in developing countries. This is achieved through various mechanisms such as financial incentives, capacity building, and policy support to encourage sustainable forest management practices and conservation efforts. On the other hand, the objective of the Afforestation, Reforestation, and Revegetation (ARR) program is to increase forest cover and restore degraded ecosystems through the planting of trees, reforestation of deforested areas, and revegetation of degraded lands. By doing so, the ARR program aims to enhance biodiversity, improve soil and water quality, mitigate climate change by sequestering carbon, and provide socio-economic benefits to local communities. In essence, while the REDD program focuses on reducing emissions from existing forests, the ARR program emphasizes the expansion and restoration of forested areas to achieve environmental sustainability and climate resilience. Both programs are vital components of global efforts to address climate change and promote sustainable forest management practices.

Table 4. Plum peat, mangrove conservation and restoration project

No	Description	Kalimantan Tengah, Indonesia
1.	Project name	Plum Peat and Mangrove Conservation And Restoration Project (Plum Project)
2.	Location name	Katingan Kuala District in Katingan Regency and Pulau Hanaut District in East Kotawaringin Regency
3.	Community	The project targets vulnerable communities within the project area
4.	Project type	Reducing Emissions from Deforestation and Forest Degradation (REDD) Afforestation, Reforestation and Revegetation (ARR)
5.	Program type based on Sustainable Development Goals	No poverty, good health and wellbeing, decent work and economic growth, climate action, and life on land
6.	Project area	The project area covers a total area of 23,631.51 hectares, excluding 477.76 hectares of paddy fields that were excluded from the project area after consultation with local stakeholders.
7.	Project benefits	The project aims to provide tangible benefits to the local community by improving livelihoods, health, education, and overall well-being. For example, it will assist local coffee farmers and forest honey producers in enhancing harvesting, processing, and market access. Additionally, the project will support the formation of women's groups in target villages to increase economic opportunities for women and implement interventions to improve health and sanitation in the 13 target villages.

(PT Pagatan Usaha Makmur, 2024)

This project aligns with several Sustainable Development Goals (SDGs). Firstly, it contributes to SDG 1 (No poverty) by addressing the root causes of low incomes and poverty, such as low agricultural land productivity. By implementing a Sustainable Agriculture Program for farmers, the project aims to increase productivity, combat land degradation, and enhance resilience to climate change, thereby improving livelihoods in the project area. Additionally, the project supports SDG 3 (Good Health and Wellbeing) by improving access to health services and providing fair employment opportunities. Through initiatives aimed at enhancing healthcare access and promoting equitable employment practices, the project seeks to foster healthier communities and contribute to overall well-being. Furthermore, the project is aligned with SDG 13 (Climate action) by aiming to achieve net emissions reductions and removals of 69,999,940 CO_2 over a 60-year crediting period. By implementing measures to mitigate climate change impacts, such as sustainable land

management practices, the project actively contributes to global efforts to combat climate change and its adverse effects. Lastly, the project supports SDG 15 (Life on land) by focusing on preserving and restoring the integrity of the Peat Swamp and Mangrove Forest landscape, as well as protecting the rich biodiversity found in the area. By conserving these critical ecosystems, the project safeguards valuable habitats and promotes biodiversity conservation, thus contributing to sustainable land management and ecosystem preservation. Table 4 demonstrating its effectiveness, the initiative has generated measurable positive outcomes in diverse aspects—social, economic, and environmental—within the community.

The PLUM (Peatland Rewetting and Conservation Project) program yields a spectrum of benefits for local communities, spanning both short and long-term durations. In the short term, community members experience enhanced access to vital services such as healthcare through village health service improvements, and increased opportunities for higher education facilitated by scholarship programs and university collaborations. Moreover, initiatives like educational assistance programs within villages and village water supply schemes contribute to the immediate well-being of residents. Additionally, the project generates employment prospects for locals through corporate recruitment efforts and enhances hydrological systems to mitigate the risk of fires and floods in plantation and settlement areas. For the long term, the program's impact extends to the protection of air and water quality. By restoring degraded wetlands and safeguarding forests, the project acts as a natural filter, sustaining the water cycle and curbing the incidence of forest and land fires, thereby minimizing the adverse health effects of smoke and fire on local communities. Furthermore, the project fosters lasting improvements in the quality of life and community resilience through empowerment initiatives in education, health, and economics.

3.4 Local communities involvement

Local community involvement in the Blue Carbon Project Gulf of Morrosquillo "Vida Manglar" in Colombia yields significant benefits. Their participation not only enhances the sustainable management capacity of natural resources but also empowers the local economy by creating new job opportunities within the project area. Moreover, active engagement fosters transparency in project management and enhances territorial governance capabilities. However, it's essential to acknowledge potential risks related to the distribution of project benefits and political interest domination. For instance, unequal distribution among involved communities may lead to internal conflicts, while specific political interests might hinder achieving the project's primary objectives. Therefore, ensuring the success and sustainability of this program requires active monitoring and management of both positive and negative impacts throughout its implementation. Consequently, local community involvement can be more effectively executed, providing long-term benefits for all stakeholders.

The local community's engagement in the Kuamut Rainforest Conservation Project in Malaysia offers significant advantages. Through ecotourism development, handicrafts, and sustainable agriculture programs, this initiative empowers locals by enhancing their skills and income while strengthening the local economy. Furthermore, the project generates employment opportunities for the local population, with at least 50% of recruited workers coming from the community. By identifying market access and providing training in various fields such as financial management, the project also boosts sales of local products and community skills. Nonetheless, potential negative impacts, such as changes in local lifestyle and gender inequality in access and benefits, need to be addressed. Additionally, economic dependence on the project poses risks, which could have adverse effects if the project ends or faces financial constraints. Hence, stakeholders must monitor and manage these negative impacts to ensure the project's sustainability and long-term benefits for the local community.

The local community's involvement in the Plum Peat And Mangrove Conservation And Restoration Project (PLUM PROJECT) in Indonesia brings significant benefits. This includes improved access to healthcare through enhanced village health services, higher education opportunities through scholarships, and quality education through village education assistance programs. Additionally, the project enhances access to clean water through village water supply and provides job opportunities through corporate recruitment programs. Moreover, the project focuses on improving hydrological systems to prevent forest fires and floods in plantations and settlement areas. Positive impacts of the program encompass air and water quality protection, improved quality of life, and community resilience through empowerment in education, health, and economy, as well as sustainable natural resource enhancement. However, it's crucial to note potential negative impacts, such as financial inequality among villagers, increased immigration and competition with migrants, low-quality education services, and limited access to healthcare. Furthermore, environmental degradation like forest fires, illegal logging, and coastal abrasion poses risks. Thus, stakeholders must address and manage these negative impacts to ensure the program's sustainability and prevent adverse effects on local livelihoods.

The community involvement in conservation projects across three locations—Colombia, Malaysia, and Indonesia—yields significant benefits, including enhanced capacity for sustainable natural resource management and economic empowerment through job creation and skill development. In other research conducted by Markantoni & Aitken (2016), Participation of the community in Community Benefits initiatives offers a variety of benefits. Engaging communities in decision-making processes improves democratic participation and governance. It also builds their capacity to manage benefits from renewable energy programs, enhancing their understanding of environmental preservation and climate change mitigation. These programs ultimately improve the communities' quality of life, economically and environmentally (Markantoni & Aitken, 2016). According to research conducted by Meitern (2024) Community involvement in energy projects offers various advantages, such as raising awareness, creating local job opportunities, reducing energy costs, promoting inclusivity among community members, and delivering socio-economic benefits to local stakeholders. This involvement not only leads to positive environmental outcomes but also generates substantial social and economic impacts within the community.

However, challenges such as unequal distribution of benefits, political interests, changes in local lifestyles, and environmental degradation must be addressed to ensure the long-term sustainability and success of these initiatives. Engaging the local community can present various, potential disputes and conflicts among community members, apprehensions about inequitable distribution of benefits, and restricted community involvement. In order to rectify these deficiencies, it is crucial to enhance transparency, equity, and decision-making procedures in order to optimize the efficacy of Community Benefits programs and bolster sustainable development objectives (Markantoni & Aitken, 2016). Active monitoring and management of both positive and negative impacts are crucial for maximizing the benefits and minimizing the risks associated with community engagement in conservation efforts. Engaging communities in projects presents a multitude of advantages, although it also entails certain disadvantages, like the intricacy of decision-making, constraints on resources, conflicting interests, differing levels of involvement, and difficulties in communication (Meitern, 2024). To overcome these limitations, it is necessary to address the obstacles in order to ensure that the participation of the community in energy projects results in the maximum advantages for all parties involved (Meitern, 2024).

3.5 Implementation of the sustainable development goals

The implementation of sustainable development initiatives across three distinct projects—Blue Carbon Project Gulf of Morrosquillo "Vida Manglar" in Colombia, Kuamut Rainforest Conservation Project in Malaysia, and the PLUM Peat and Mangrove Conservation and Restoration Project (PLUM Project) in Indonesia—offers valuable

insights into the complexities and challenges of such endeavors. In Colombia, the Vida Manglar project demonstrates the potential for raising environmental awareness and fostering economic empowerment among local communities, particularly through mangrove conservation efforts. By actively involving communities in the preservation of mangroves, the project not only enhances ecosystem resilience but also provides alternative livelihood opportunities, thereby reducing dependency on unsustainable practices like deforestation and illegal fishing.

However, challenges such as benefit distribution conflicts and unforeseen environmental impacts highlight the need for careful management and sustained stakeholder commitment. Similarly, in Malaysia, the Kuamut Rainforest Conservation Project showcases the positive impacts of preserving tropical rainforests and empowering communities through ecotourism and sustainable agriculture. Through initiatives like eco-tours and organic farming cooperatives, the project not only conserves biodiversity but also creates sustainable income sources for local residents. Yet, issues like social and cultural changes within communities and economic dependency on the project underscore the importance of addressing inequalities and promoting fair benefit distribution. Meanwhile, the PLUM Project's comprehensive approach to sustainable development encompasses forest conservation, ecosystem restoration, and community well-being enhancement in Indonesia. By restoring degraded peatlands and mangrove habitats, the project aims to mitigate climate change, protect biodiversity, and improve the livelihoods of local communities.

Despite facing challenges such as social and economic disparities and environmental risks, the project holds promise in fostering strong partnerships and delivering lasting benefits to local communities. Overall, these initiatives emphasize the importance of balancing environmental conservation with community empowerment and highlight the need for collaborative efforts to achieve long-term sustainability and resilience in diverse socio-ecological contexts. According to research conducted by Liu et al. (2023) Emphasizing the significance of the connection between shared prosperity and carbon reduction in China, underscoring the necessity of simultaneously considering economic development and environmental conservation. Collaborating with local communities is crucial for tackling environmental concerns and advancing sustainable development. Engaging communities in carbon reduction programs, enhancing environmental consciousness, and empowering local stakeholders can contribute to environmental conservation objectives while enhancing community resilience. This cooperative approach guarantees that sustainability initiatives are adaptable to local requirements and capable of generating a lasting good influence on the environment and society. Within local communities, ecosystem carbon absorption services (ECSS) have a significant impact on advancing the Sustainable Development Goals (SDGs) and offering immediate advantages to communities. The implementation of ECSS can contribute to the establishment of a favorable socio-ecological setting, leading to enhanced educational standards and facilitating the attainment of diverse sustainable development objectives within the local community (Yin et al., 2023). By leveraging the interconnections with other ecosystems services, ECSS also plays a role in advancing the collective development of social, economic, and ecological Sustainable Development Goals (SDGs) within the community context.

3.6 Climate change

In regions spanning from Colombia to the Kuamut Rainforest and the PLUM Project sites, diverse initiatives such as the Blue Carbon Project Gulf of Morrosquillo "Vida Manglar," the Kuamut Rainforest Conservation Project, and the PLUM Peat and Mangrove Conservation and Restoration Project have been implemented to tackle the impacts of climate change. These projects play pivotal roles in both mitigating and adapting to the effects of climate change. For example, the Blue Carbon Project in Colombia is specifically designed to focus on sustainable mangrove management, thereby reducing greenhouse gas emissions and bolstering the resilience of coastal ecosystems. Similarly, the Kuamut

Rainforest Conservation Project seeks to curb carbon emissions while simultaneously fortifying community resilience and modeling potential climate change impacts within the region. Additionally, the PLUM Project strives to combat climate change through sustainable forest management practices and restoration efforts, all while enhancing community-driven adaptation strategies.

The ecosystem carbon absorption service (ECSS) is essential for climate change mitigation as it absorbs carbon dioxide from the atmosphere. Improving vegetation and soil quality at the local community level can help reduce the accumulation of carbon dioxide, thereby enhancing the ECSS. In addition to does this help maintain the balance of carbon in the atmosphere, but it also provides immediate benefits in reducing the impacts of climate change. By facilitating the interconnections of ECSS (Environmental, Social, and Economic Systems), climate change, and local communities, it is possible to develop a more sustainable and resilient ecosystem (Yin et al., 2023). According to research conducted by Senadheera et al. (2019) Forest reforestation initiatives, like the Hiniduma Bio-link Project in Sri Lanka, play a vital role in combating climate change by capturing carbon dioxide through the planting of trees. Comprehensive public education regarding environmental awareness is crucial for comprehending the consequences of climate change and the significance of forests in mitigating them. The Hiniduma Bio-link Project is in line with Goal Thirteen of the Sustainable Development Goals (SDGs) as it centers on climate action and empowering local people. This provides as an illustration of how reforesting forests might be a nature-centric strategy for mitigating climate change.

However, despite the positive aims of these projects, several challenges persist. Unforeseen climate risks, limited resources, and the necessity for effective stakeholder coordination remain significant hurdles across all initiatives. Overcoming these challenges demands the development and implementation of sustainable, resilient adaptation strategies, as well as robust community engagement and cohesive collaboration among stakeholders. Despite the complexities involved, the combined efforts of these projects offer promising avenues to address climate change effectively, ensuring the longevity and sustainability of ecosystems and communities on a global scale.

4. Conclusions

In conclusion, the case studies examined present a comprehensive overview of the benefits of local community involvement, the implementation of sustainable development goals, and the impact on climate change. Across the Blue Carbon Project in Colombia, the Kuamut Rainforest Conservation Project in Malaysia, and the PLUM Project in Indonesia, local community engagement has yielded significant benefits, including enhanced natural resource management capacity and economic empowerment through job creation and skill development. However, challenges such as unequal benefit distribution, political interests, changes in local lifestyles, and environmental degradation must be addressed to ensure the long-term sustainability and success of these initiatives. Moreover, the implementation of sustainable development goals across these projects offers valuable insights into the complexities and challenges of such endeavors. While these projects demonstrate positive impacts such as environmental awareness raising and economic empowerment, challenges like benefit distribution conflicts and unforeseen environmental impacts highlight the need for careful management and sustained stakeholder commitment. Additionally, initiatives play crucial roles in both mitigating and adapting to the effects of climate change. Despite facing challenges such as unforeseen climate risks and limited resources, the combined efforts of these projects offer promising avenues to address climate change effectively, ensuring the longevity and sustainability of ecosystems and communities on a global scale.

The suggestions for future research are indeed insightful and pertinent. These studies have shed light on various aspects of local community involvement, sustainable development implementation, and climate change impacts. However, there is still much to explore and understand in these areas. Future research could delve deeper into the mechanisms of community engagement and empowerment within conservation projects,

examining how different approaches influence outcomes and sustainability. Additionally, further investigation into the implementation of sustainable development goals across diverse socio-ecological contexts could provide valuable insights into effective strategies and best practices. Moreover, given the urgent need to address climate change, continued research into adaptation and mitigation measures, as well as their effectiveness and scalability, is essential. By addressing these research gaps, we can enhance our understanding and improve the efficacy of conservation and sustainable development efforts worldwide.

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