# Community-based conservation and restoration in coastal wetlands: A review

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**Abstract**

Research has shown that conservation and restoration efforts that engage local communities are more successful at meeting stated goals than those that are externally controlled. Such participatory management approaches have been increasingly applied in coastal wetland ecosystems, yet our collective understanding of the scope of methods applied and outcomes observed in these efforts is limited. In order to address this gap, we present a review of the literature on community-based conservation and restoration in coastal wetlands. We summarize the current state of coastal wetland participatory management and provide suggestions for future conservation and restoration efforts, namely: expanding the ecosystem and geographic focus, incorporating additional approaches and outcome metrics, and increasing the post-conservation or restoration monitoring period. It is our hope that this work will encourage further implementation of community-based approaches to coastal wetland management for the collective benefit of both people and nature.

**Keywords:** Participatory conservation; Community-led restoration; Land management; Coastal wetlands; Mangroves; Salt marshes; Seagrass

## Introduction

Research over the last 20 years has shown that conservation and restoration efforts that include local communities in the decision-making and management process are more sustainable and successful at meeting stated goals than those that are primarily externally controlled (Folke et al. 2004). For instance, in their systematic review and synthesis on the role of Indigenous peoples and local communities in conservation, Dawson et al. (2021) found that more than half of locally-

controlled case studies reported positive social and ecological outcomes while only 15% of externally-controlled interventions produced the same results. Further, more than a third of externally-controlled efforts produced negative social and ecological outcomes, which was more than 10 times the negative results reported for locally-controlled efforts (Dawson et al., 2021). Such outcomes may be due to many factors, including participants differing in their understandings of human-nature relations, inequitable negotiation practices, or when legacies of harm make conservation or restoration practices appear threatening (Redpath et al., 2013). These findings highlight the importance of integrating local participation into conservation and restoration initiatives.

As one of the most important and threatened ecosystems globally, coastal wetlands such as mangrove forests, salt marshes, and seagrass meadows have been a key target of conservation and restoration efforts over the last 50 years (Zhang et al., 2018). Historically, management schemes have relied heavily on top-down approaches driven by government institutions and conservation organizations with limited local community participation. However, community engagement has become increasingly central as recognition of the influence of socioeconomic and cultural factors on conservation and restoration outcomes has improved (Sterling et al., 2017, Gavin et al., 2018). The Mangrove Action Project, for example, is a non-profit that emphasizes working with and training local community members in identifying causes of mangrove loss and reasons why natural regeneration hasn't occurred, understanding the social factors that might influence mangrove recovery, and developing a strategy that addresses these social and ecological aspects (Mangrove Action Project). As a result, the Mangrove Action Project has facilitated the successful recovery of mangrove habitats throughout Southeast Asia, coastal Africa, and Central and South America. Similarly, management of the Gwaii Haanas National Park Reserve, National Marine Conservation

Area Reserve, and Haida Heritage Site in British Columbia, Canada embodies a community-based approach to conservation (Stephenson et al., 2014; Gavin et al., 2018). The reserve encompasses more than 500 $km^2$ of land and ocean and is co-managed by the Haida Nation and the Federal Government of Canada through shared responsibilities and consensus building as the foundation for decision-making (Nesbitt, 2016). Management follows the Haida concept of "respect for all living things", with the goal of protecting the area's native species and habitats while meeting the Haidas' needs for food, health, and well-being (Gavin et al., 2018).

As community-based conservation and restoration efforts (hereafter, 'CBCR') in coastal wetlands have increased, there is an attendant need to better understand the scope of approaches applied and outcomes observed in these efforts. To date, a comprehensive evaluation of CBCR in coastal wetlands has not been completed even though this represents a critical step towards assessing the relative effectiveness of these methods. Therefore, here we present a review of the literature and narrative synthesis on CBCR in coastal wetlands with an emphasis on participant involvement, approaches used, and reported outcomes. This work aims to highlight the current state of community-based practices in coastal wetland ecosystems and provide key suggestions for implementing and evaluating outcomes in future CBCR efforts.

## Materials and Methods

*Literature search and review*

A systematic literature search was conducted to compile a comprehensive list of publications on community-based conservation and restoration in coastal wetlands. We searched ISI Web of Science in May 2022 and February 2023 using the following query: TS = (salt marsh* OR mangrove* OR seagrass* OR seagrass bed* OR coastal wetland* OR coastal marsh*) AND

TS = (conservation* OR restoration* OR rehabilitation* OR remediation*) AND TS = (community-based* OR community-led* OR community-involv* OR participatory OR collaborat*). This resulted in 734 papers, excluding conference proceedings and editorials.

A filtering process was then applied to each study wherein the abstracts and body were reviewed and those that met the following criteria were retained: (1) the study focused on community-based conservation or restoration where "community-based" was defined as efforts that incorporate local community participation in decision-making; (2) conservation or restoration efforts were conducted in mangroves, salt marshes, or seagrass meadows; and (3) the study provided details on CBCR approaches taken and the outcomes observed. Following this filtering process, 55 publications were retained (see Supplementary Materials).

*Data collection and analysis*

For each study, we extracted bibliographic information along with data on the country or geographic region of focus, habitat type, participants involved (e.g., local communities, policy-makers, etc.), CBCR approaches taken, and reported outcomes. Details on participants, approaches, and outcomes were initially categorized by the terms and phrases used in each study and were then further grouped using the terms and definitions listed in Table 1 in order to make comparisons across studies.

We used descriptive statistics to summarize the number of studies detailing CBCR efforts in coastal ecosystems, the geographic focus, the participants involved in the efforts, the conservation or restoration approaches used, and the conservation or restoration outcomes reported. All quantitative analyses were completed using RStudio version 2023.03.0+386.

## Results

*Publication details*

The 55 studies included in this review were published between 2000 and 2022, with the largest number of publications per year occurring between 2016 and 2022. Of these studies, 52 evaluated conservation and restoration efforts in mangroves, two focused on seagrass meadows, and one focused on salt marshes. Finally, 37 studies were qualitative (i.e., relied primarily on surveys and focus group interviews of participants), 15 presented quantitative results, and three were narrative literature reviews.

*Geographic distribution*

A total of 20 countries were identified across 9 geographic regions (Table S1). The region with the greatest representation was Asia, with 34 publications, followed by Africa with 10, and the Americas with eight. Because these large geographic regions are not homogenous sociopolitical landscapes with shared environmental management approaches, it is important to also note the within-region distribution of publications. Namely, 22 studies were published on Southeast Asia, 12 on South Asia, six on East Africa, four each on West Africa and North America, three on South America, two on the Pacific Islands, and one each on the Caribbean and Australia. Finally, of the 55 publications, all but two featured a country-specific geographic focus. The first exception detailed a collaborative restoration effort between the United States and Mexico (Zaldívar-Jiménez et al., 2017), and the second assessed conservation and restoration initiatives in India, the Philippines, and Thailand (Datta et al., 2012).

*CBCR participants, approaches, and outcomes*

As a requirement for inclusion in this synthesis, local communities were involved in conservation or restoration efforts in each study considered here and additional participants were included in all but six cases. Policy-makers or government officials were involved in 71% of studies, private-sector businesses and NGOs in 55% of studies, and researchers or scientists in just under 10% of studies (Table 1).

Conservation and restoration approaches were grouped into four categories: community-based land-use, joint land management, planting, and hydrological restoration, with nearly 65% of studies incorporating community-based land-use or planting practices (Table 1). The distribution of approaches varied considerably by ecosystem type – planting and hydrological restoration occurred in salt marshes, planting and community-based land-use was applied in seagrass meadows, and all of the identified approaches were used in mangrove ecosystems (Figure 1A).

CBCR outcomes were placed into five thematic categories based on the descriptions provided in each study: economic outcomes (reported in 42% of studies), ecosystem functions and services (reported in 18% of studies), ecosystem health (reported in 75% of studies), social (reported in 18% of studies), and sustainability outcomes (reported in 27% of studies). While these outcomes included positive, negative, and neutral observations, the overwhelming majority of studies reported positive outcomes such as increased area of the target ecosystem, increased ecosystem health, and increased income for local community participants. Approximately 16% of studies observed negative outcomes such as increased conflict, exacerbated unsustainable activity, and diminished coastal resilience. These observed outcomes varied considerably by ecosystem type (Figure 1B). Notably, studies on salt marshes and seagrass meadows only reported an increase in area of the target ecosystem and improved ecosystem health while all other outcomes were reported for mangroves.

## Discussion and Conclusions

*CBCR in coastal wetlands: Participants, approaches, and outcomes*

Across the 55 studies evaluated here, the majority of CBCR efforts were collaboratively implemented, particularly with partnerships between local communities, policy-makers, and the private sector. For example, two local communities inhabiting Pantanos de Centla Biosphere Reserve (PCBR) in Tabasco, Mexico worked with PCBR officials and researchers to reforest 160 ha of mangrove area and cleaned 4,942 m of natural channels to reestablish water flow across 34.7 ha. (Gómez-Ruiz et al., 2022). Similarly, efforts to reduce nutrient-loading and facilitate improved water quality and seagrass meadow recovery in Tampa Bay, Florida, USA relied heavily on strategies defined by the local community in partnership with state and local governments as well as private businesses (Greening et al., 2014). These examples highlight the value of leveraging diverse knowledge systems and resources across participant groups in order to build capacity and implement meaningful action.

Conservation and restoration approaches are often uniquely tailored to the local environmental context and the specific goals of the effort; therefore, approaches can vary widely from one initiative to another. That said, nearly every study included in this review emphasized community-based land-use as a conservation strategy and planting vegetation as a restoration method. This reflects the broader shared objectives across studies to implement management approaches that integrate local needs and repair lost or degraded coastal habitat. In an effort that incorporated both approaches, Katon et al. (2000) found that co-management between community members, the local government, a private firm, and an international NGO resulted in the rehabilitation of 110 ha of mangrove areas, planting of 109 ha, and assisted natural regeneration

of 20 ha. Additionally, community survey results indicate that participants perceived improvements in conflict resolution, knowledge of mangroves, information exchange, control over resources, and influence over resource management due to the co-management approach. This case study therefore underscores the particular value of taking a mixed-methods approach in CBCR initiatives.

The majority of outcomes reported across studies indicate positive impacts on environmental, economic, and social variables. In particular, an increase in ecosystem area and health, as well as an increase in income for community members were the most commonly reported outcomes associated with CBCR activities. These results suggest that CBCR approaches can improve ecosystem conditions and simultaneously address community needs. However, several CBCR efforts produced negative outcomes, including increased conflict between participants and an exacerbation of unsustainable practices. For instance, DasGupta et al. (2017) found that participatory management of mangroves in the Indian Sundarbans resulted in conflict between mangrove users and forest management officials due to restricted access to economically exploitable mangrove products, reduced financial gains when conducting business with the local forest office, and lack of trust and conflicting interests between the officials and the communities. Though negative outcomes represent a small portion of the studies included here, such results highlight the importance of *equitably* engaging participant groups in the decision-making and management process.

*Knowledge gaps and next steps*

The CBCR efforts summarized here were almost exclusively applied in South and Southeast Asia mangrove ecosystems. While this provides important insights into the structure and

efficacy of these approaches in a geographic region experiencing a high rate of habitat loss, other geographic regions and coastal systems would benefit from CBCR approaches. Approximately 36% of the world's wetlands are legally protected, but the effectiveness of these conservation approaches is still debated (Friess et al. 2019; Cadier et al. 2020). Further, the success of restoration has been estimated to range between 38% in seagrass meadows and 65% in salt marsh ecosystems (Bayraktarov et al. 2016; Cadier et al. 2020). These data suggest that there is considerable room for improvement in salt marsh and seagrass meadow conservation and restoration, and community-based approaches may help facilitate increased conservation and restoration success.

Across the studies evaluated here, the CBCR approaches that were overwhelmingly used were community-based land-use and planting vegetation. Although these approaches primarily resulted in positive outcomes, future efforts may benefit from incorporating a more comprehensive ecological approach that integrates conserving or restoring non-target species. Positive species interactions, such as mutualism and facilitation, and trophic cascades have the potential to improve environmental conditions or survival rates of target species and therefore may play an important role in conservation and restoration initiatives (Renzi et al., 2019, Sievers et al., 2022). None of the studies included in this review explicitly considered these broader ecological features; this therefore represents an important area for future CBCR in coastal wetlands efforts to explore.

Finally, future CBCR efforts and studies assessing their efficacy should aim to standardize and incorporate additional outcome metrics that provide comparable and holistic assessments. This includes incorporating other measures of ecosystem functions and services (e.g., soil nutrient availability, cultural ecosystem services, etc.), health and well-being aspects (e.g., mental and physical health, social connection, etc.), and monitoring outcomes over longer periods of time. Such metrics and monitoring practices will allow for a comprehensive assessment of CBCR efforts

that integrates critical attributes of complex social and ecological systems. Taken together, it is our hope that this work and the aforementioned suggestions will encourage further implementation of community-based approaches to coastal wetland management for the collective benefit of both people and nature.

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## Table Legends

Table 1. Category groupings and definitions for CBCR participant types, approaches, and outcomes. Values in parentheses indicate the number of studies that incorporated these aspects.

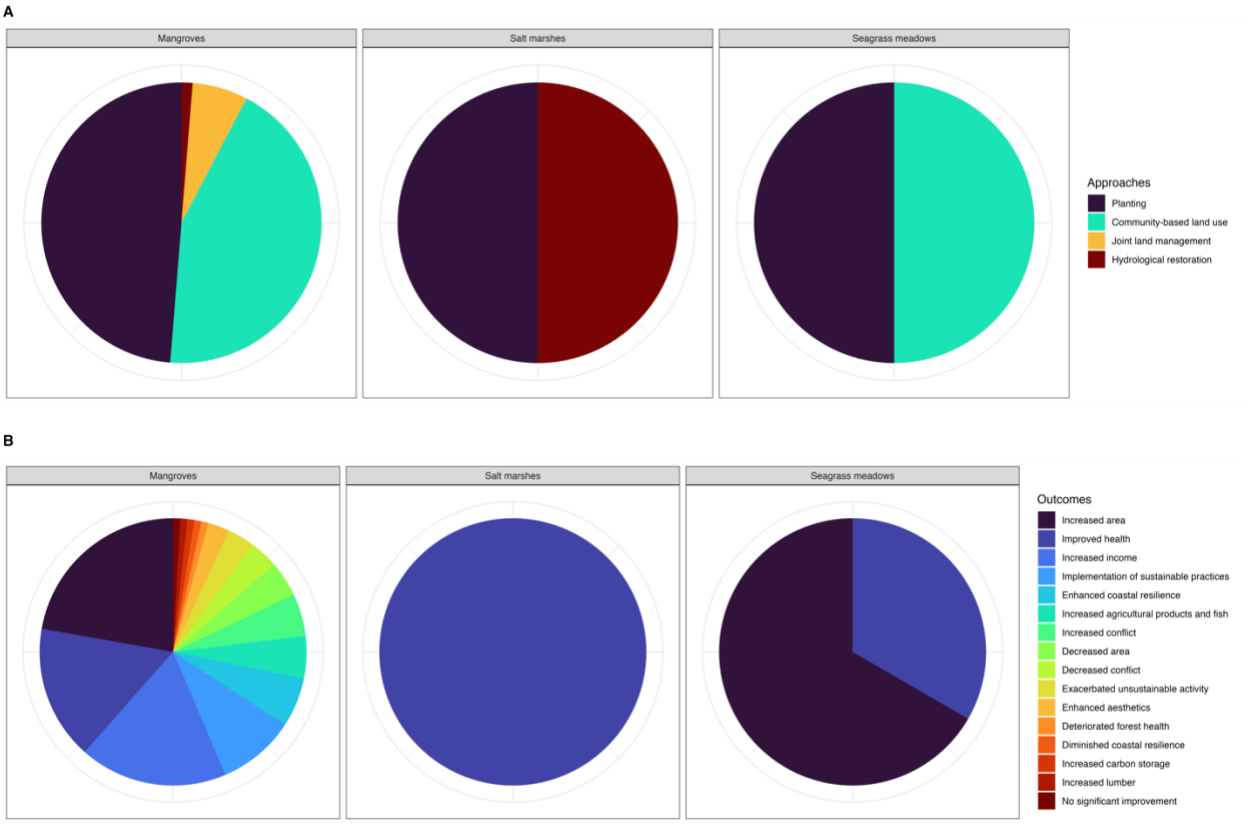
**Table 1**

| **Participant Type** | **Definition** |
|---|---|
| Local Communities (55) | Groups of interacting people living in the same location(s) |
| Policy-Makers (39) | Government or local officials involved in making policy and management decisions. |
| Private Sector (30) | Organizations or institutions that are not under government control, such as industry or NGOs. |
| Researchers (5) | Individuals or groups carrying out academic or scientific research. |
| | |
| **Conservation/Restoration Approach** | |
| Community-based Land Use (35) | Management approach that integrates a diversity of land-uses based on the needs of the local community. |
| Hydrological Restoration (2) | The removal or modification of barriers to improve hydrological connectivity and tidal flow. |
| Joint Land Management (5) | Management approach that involves formal collaboration and decision-making between local communities and other entities, such as the local government. |
| Planting (40) | Seeding or planting vegetation to increase ecosystem area. This includes reforestation and afforestation for forested ecosystems. |
| | |
| **Conservation/Restoration Outcome** | |
| Economic (23) | Outcomes that involve an economic or monetary component, such as increased income or an increase in local tourism. |
| Ecosystem Health (41) | Outcomes that consider aspects of ecosystem health, such as the size of the ecosystem or measures of biodiversity. |
| Ecosystem Functions and Services (10) | Outcomes that involve the functions and services that ecosystems provide, such as carbon storage and coastal protection. |
| Social (10) | Outcomes that include changes in the ways that community members interact with one another, including an increase or decrease in conflict |
| Sustainability (15) | Outcomes that consider changes in behavior towards more or less sustainable activities. |

## Figure Legends

Figure 1. CBCR approaches (A) and outcomes (B) reported by ecosystem type.

**Figure 1**


A
Mangroves
Salt marshes
Seagrass meadows
Approaches
Planting
Community-based land use
Joint land management
Hydrological restoration
B
Mangroves
Salt marshes
Seagrass meadows
Outcomes
Increased area
Improved health
Increased income
Implementation of sustainable practices
Enhanced coastal resilience
Increased agricultural products and fish
Increased conflict
Decreased area
Decreased conflict
Exacerbated unsustainable activity
Enhanced aesthetics
Deteriorated forest health
Diminished coastal resilience
Increased carbon storage
Increased lumber
No significant improvement