

Enhancing capacities of
local stakeholders in
Coral Triangle in
managing Blue Carbon
Ecosystems for climate
mitigation and
adaptation



CBA2020-05SY-Kohsaka

2023



東京大学
THE UNIVERSITY OF TOKYO



東京工業大学
Tokyo Institute of Technology



神戸大学



BRIN
BADAN RISET
DAN INOVASI NASIONAL

Project Reference Number: CBA2020-05SY-Kohsaka

Project Duration: 1 April 2021 to 30 September 2023

Funding Awarded: USD 40,000

Grant DOI: <https://doi.org/10.30852/p.14061>

Date of Publication: 26 October 2023

Project Leader and Contact Details: Prof. Ryo Kohsaka, The University of Tokyo, Japan
(rkohsaka@g.ecc.u-tokyo.ac.jp)

Collaborators and Contact Details:

- Dr. Yuta Uchiyama, Kobe University, Japan
(yuta.uchiyama@landscape.kobe-u.ac.jp)
- Prof. Kazuo Nadaoka, Tokyo Institute of Technology, Japan
(nadaoka.k.aa@m.titech.ac.jp)
- Dr. Jay Mar D. Quevedo, The University of Tokyo, Japan
(quevedojaymar@gmail.com) (started September 2022)
- Prof. Miguel D. Fortes, University of the Philippines, Philippines
(miguelfortes@gmail.com)
- Assoc. Prof. Josephine Dionisio, University of the Philippines, Philippines
(jcdionisio@up.edu.ph)
- Dr. Ellyn Kathalina Damayanti, Bogor Agricultural University, Indonesia
(ellynk.damayanti@gmail.com)
- Prof. Martha Fani Cahyandito, Universitas Padjadjaran, Indonesia
(cahyandito@yahoo.com)
- Dr. Novi Susetyo Adi, Ministry of Marine Affairs and Fisheries, Indonesia
(novi_marineoptics@yahoo.com)
- Dr. Kevin Muhamad Lukman, National Research and Innovation Agency, Indonesia
(kevin.muhamad.lukman@gmail.com) (started September 2022)
- Dr. Yuki Sofue, The University of Tokyo, Japan
(ysofue@g.ecc.u-tokyo.ac.jp) (started October 2023)

Recommended Citation:

Kohsaka, R., Quevedo, J.M.D., Uchiyama, Y., Nadaoka, K., Fortes, M.D., Lukman, K.M., Damayanti, E.K., Cahyandito, M.F. & Adi, N.S. (2023). *Enhancing capacities of local stakeholders in Coral Triangle in managing Blue Carbon Ecosystems for climate mitigation and adaptation*. Project Final Report. Asia-Pacific Network for Global Change Research.



Asia-Pacific Network for Global Change Research (APN)

© 2023 The authors. Published by the Asia-Pacific Network for Global Change Research (APN) under the Creative Commons Attribution-NonCommercial 4.0 International (CC-BY-NC 4.0) licence.

All opinions, findings, conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of APN. While the information and advice in this publication are believed to be true and accurate at the date of publication, neither the editors nor APN accepts any legal responsibility for any errors or omissions that may be made. APN and its member countries make no warranty, expressed or implied, with respect to the material contained herein.

The use of geographic names, boundaries and related data on maps, and in lists and tables within this publication are not warranted to be error-free, nor do they imply any endorsement by APN

9. Appendices

Appendix 1: Introductory Project Meeting on “Enhancing capacities of local stakeholders in Coral Triangle in managing Blue Carbon Ecosystems for climate mitigation and adaptation”, 10 June 2021

The first collaborative meeting was held online to formally meet the project collaborators and present the project objectives and deliverables. The attendees included Prof. Ryo Kohsaka, the Project Leader, Dr. Yuta Uchiyama, and Prof. Kazuo Nadaoka (collaborators from Japan), Prof. Miguel Fortes and Assoc. Prof. Josephine Dionisio (collaborators from the Philippines), Dr. Novi Susetyo Adi, Dr. Ellyn Kathalina Damayanti, and Prof. Martha Fani Cahyandito (collaborators from Indonesia), and Mr. Jay Mar D. Quevedo (PhD Student/Project Coordinator).

Prof. Ryo Kohsaka, opened the meeting and provided the project details. This was followed by a presentation by Dr. Yuta Uchiyama on the projects’ objectives and expected results. Afterwards, each collaborator introduced themselves, their expertise, and how they can contribute to meeting the project’s objectives. This was followed by group discussion on ways to efficiently and effectively collaborate.

The preparation for the first capacity development workshop for the Philippines was also discussed during the meeting. A few of the topics raised included: workshop date and duration, participants, and activities and how to conduct those activities. The meeting was concluded with Prof Kohsaka setting up for next meeting.



Participants of the introductory project meeting held online on 10th of June 2021.

Appendix 2: [Philippines] First Capacity Development Workshop on “Enhancing capacities of local stakeholders in Coral Triangle in managing Blue Carbon Ecosystems for climate mitigation and adaptation”, 2 July 2021

The 1st capacity development workshop on “Enhancing capacities of local stakeholders in Coral Triangle in managing Blue Carbon Ecosystems (BCEs) for climate mitigation and adaptation” for Eastern Samar stakeholders in the Philippines was held online on 2 July 2021. Participants of the workshop were composed of ten scientists, ten municipal-level policymakers, and three provincial-level project implementers. The Eastern Samar province was selected as the priority site for capacity development since previous research activities have shown that BCEs are highly perceived by communities for their benefits (e.g., food and livelihood source, coastal protection benefits).^{1,2} Yet, initiatives to protect, conserve, and sustainably manage these resources are lacking due to limited institutional capacities (e.g., technical, financial). With the increasing effect of climate change, the frequency of severe weather patterns is most likely to become more prominent in the present years, which in turn could damage the BCEs and consequentially affecting the local stakeholders. Thus, there is a need to capacitate them on sustainable management of BCEs, which are essential in community resilience and climate mitigation and adaptation.



Participants of the 1st Capacity Development Seminar Workshop held on 2 July 2021. The group consisted of scientists from different disciplines, provincial-level project implementers, and local policymakers from four municipalities of Eastern Samar province, Philippines.

¹ Quevedo, J. M. D., Uchiyama, Y., & Kohsaka, R. (2020). Perceptions of local communities on Mangrove forests, their services and management: implications for eco-DRR and blue carbon management for Eastern Samar, Philippines. *Journal of Forest Research*, 25 (1), 1-11. doi:10.1080/13416979.2019.1696441

² Quevedo, J. M. D., Uchiyama, Y., & Kohsaka, R. (2020). Perceptions of the seagrass ecosystems for the local communities of Eastern Samar, Philippines: preliminary results and prospects of blue carbon services. *Ocean and Coastal Management*, 191, 105181. doi:10.1016/j.ocecoaman.2020.105181

As a summary of the workshop program, the project leader, Prof. Ryo Kohsaka opened the event and introduce the collaborators/members of the project. This was followed by a message from the APN Secretariat (Ms. Christmas Uchiyama). Overview of the project and the goal of the workshop was presented by the project leader, followed by the presentation of Prof. Kazuo Nadaoka on their research activities in Eastern Samar province. The other presentation was done by Dr. Yuta Uchiyama showing community perceptions of BCE services.

There were two activities conducted during the workshop, namely SWOT (Strength-Weakness-Opportunity-Threats) and DPSIR (Driver-Pressure-State-Impact-Response) analyses. The former was used to identify the existing capacities and capabilities of local policymakers while the latter was utilized to understand the cause-effect linkages of threats to BCEs and their corresponding management solutions. The first activity showed that despite key policymakers implementing various local ordinances, their capacity to implement these are sometimes limited due to a lack of technical capabilities and financial constraints, coupled with overlapping government regulations and mandates. They perceived that there is an opportunity to efficiently communicate amongst themselves and effectively implement their mandated tasks.

The second activity engaged local participants in discussing the threats and management issues of BCEs. Using the DPSIR framework, they were able to identify emerging issues that hinder their management actions, influence the public's behaviour, and affect BCEs. For instance, they shared that limited institutional capacities cause pressures such as lack of technical knowledge, limited funds, and weak law enforcement. These pressures, which influence the institution's morale, led to limited conservation projects, unclear management protocols, non-compliance of residents to ordinances, and, eventually, degradation of BCEs. In response, policymakers perceived to strengthen their implementation of programmes, create suitable BCE management plans, involve communities in coastal management, and increase environmental awareness campaigns.

Both activities allowed open discussions between the local decision-makers and scientists. Involving them to blue carbon and climate discourse warrants a more inclusive approach since they are the ones who experienced first-hand the effect of climate change, such as the frequency of more intensified typhoons and benefiting from BCEs. Despite time constraints and limited activities, the project gathered preliminary information that is vital in selecting priority areas for capacity development. Understanding how policymakers function, their motivation and challenges, and existing capabilities and capacities is a necessary step in order to effectively enhance or develop new management strategies in line with BCEs and climate mitigation and adaptation.

Note: The content of this write-up is published and available online. For details, please check <https://www.apn-qcr.org/perspective/engaging-local-policymakers-in-blue-carbon-and-climate-dialogues/#ref4>

Appendix 3: [Indonesia] Online training on socio-ecological applications on “Enhancing capacities of local stakeholders in Coral Triangle in managing Blue Carbon Ecosystems for climate mitigation and adaptation”, 2 November 2021

The project had an opportunity to introduce the socio-ecological applications for mangrove management to young researchers and regional partners in Indonesia as part of their capacity development goals. The training workshop was held online and was part of the Mangrove Monitoring International Training – Regional Training and Research Center on Marine Biodiversity and Ecosystem Health (RTRC-MarBEST). The event was held from October 29 to November 6, 2021, and organized by the Research Centre for Oceanography of the National Research and Innovation Agency (BRIN). The project shared their research results and exposed regional partners to various socio-ecological applications that can support GIS-derived data in mangrove monitoring and to a few trends on global change researches (previous and future studies). The participants of the workshop training were composed of 38 different stakeholders from government agencies (18 persons) (e.g., Ministry of Marine Affairs and Fisheries, Ministry of Environment and Forestry, National Research and Innovation Agency, Karimunjawa National Park), professors and students from universities (14 people) (e.g., Diponegoro University, IPB University), and members of non-government organizations (6 persons) (e.g., Blue Forests Foundation, Titian Lestari Foundation). The main activity delivered by the project was the DPSIR activity which enabled the participants to assess the mangroves in their area based on their observations and/or perceptions. The activity allowed them to develop a causal link of environmental issues from the driving forces of mangrove cover changes to existing management responses. The results of this activity were used as indicators to review and assess the globally important mangrove ecosystems of Indonesia which is critical towards evidence-based policymaking approaches.³



Left panel: The project members (top left-bottom right) – Dr. Novi Susetyo Adi, Prof. Ryo Kohsaka, Dr. Jay Mar D. Quevedo, Dr. Yuta Uchiyama, and Dr. Kevin Muhamad Lukman. Right panel: Dr. Jay Mar D. Quevedo giving an overview of the DPSIR activity.

³ Quevedo, J. M. D., Lukman, K. M., Ulumuddin, Y. I., Uchiyama, Y., & Kohsaka, R. (2023). Applying the DPSIR framework to qualitatively assess the globally important mangrove ecosystems of Indonesia: A review towards evidence-based policymaking approaches. *Marine Policy*, 147, 105354. <https://doi.org/10.1016/j.marpol.2022.105354>

Appendix 4: Community perceptions as a monitoring tool

Monitoring mangrove cover changes and drivers using **community perceptions**

PHILIPPINES EASTERN SAMAR CASE

Municipalities of Lawaan, Balangiga & Balangkayan

The advancement in remote-sensing applications allows rapid mapping and detection of mangrove cover changes, however, identification of drivers is often not included. These drivers can be identified and monitored using community perceptions. The following case study utilizes a simple questionnaire and maps to ascertain the drivers of mangrove cover changes in selected municipalities in Eastern Samar Province, Philippines. The methodology followed is outlined below.

1 Developing the questionnaire

- Socio-demographic characteristics (e.g., age, education, occupation)
- Oral histories or observed changes in mangrove areas (e.g., using maps)
- Direct and indirect drivers of mangrove cover changes (e.g., illegal logging, population growth)

2 Applying the questionnaire

- Respondents provide their details
- Respondents can share their experiences, observations, the year they observed the changes, how they happened, and what were the causes
- Respondents ranked the pre-determined drivers (from previous studies) from least to most important



▲ Dr. Quevedo and the three local enumerators conducting community perception surveys.

3 Processing the filled questionnaire

- Identify all the marked changes in the questionnaire maps and make a new map combining all the changes observed/perceived.



- ▲ Respondents identified the massive mangrove cover loss after Typhoon Haiyan in 2013

- Tabulate the drivers in order of the most important driver to identify which one is the most frequented answer by respondents. A ranking index can also be used to be more accurate in ranking the drivers.

Pre-determined drivers	Frequency [Rank]
Natural threats	71/96 [1]
Coastal development	30/96 [2]

- ▲ Interviewer can easily check which among the drivers is ranked first. In the above example, 71 out of 96 respondents ranked natural threats as the number 1 driver of mangrove cover changes in their municipalities.

Source: Quevedo, J.M.D., Uchiyama, Y. & Kohsaka, R. Community perceptions of long-term mangrove cover changes and its drivers from a typhoon-prone province in the Philippines. *Ambio* 51, 972–989 (2022). <https://doi.org/10.1007/s13280-021-01608-9>

Appendix 5: Participatory mapping tool

Monitoring drivers of land use changes using participatory mapping

INDONESIA
MUARA GEMBONG CASE
Bekasi Regency, West Java

Participatory mapping is another way to gather community perceptions, particularly on socio-economic factors influencing the health of BCEs. Here, we present a case study using community perceptions through participatory mapping to identify the land cover changes and their drivers in Derawan Island located in Berau Regency, East Kalimantan, Indonesia. The steps are enumerated below and can be modified depending on the objective of the researcher or the scope of information needed in BCE management.

1 Pre-fieldwork preparation

- Discussion with research team members and related collaborators
- Identify the target sites and sample size needed
- Setting landscape images (Google Earth images) to be used in the questionnaire



2 Developing the questionnaire

- Socio-demographic characteristics (e.g., age, education, occupation)
- Oral histories or observed changes in coastal areas using printed Google Earth maps

3 Applying the questionnaire

- Respondents provide their details
- Respondents mark the changes observed and provide the drivers/threats



4 Analyzing the data collected

- Tabulate and summarize the socio-demographic characteristics
- Identify the marked changes and group together similar perceptions
- Encode the marked changes and reflect them in a new map



▲ Participatory mapping conducted in Muara Gembong

◀ Perception map of land-use change drivers in Derawan Island (left: distribution of perceived drivers by frequency)

Source: Lukman, K.M., Uchiyama, Y., Quevedo, J.M.D., et al. Land use changes assessment using a triangulated framework: Perception interviews, land-use/land cover observation, and spatial planning analysis in Tanjung Batu and Derawan Island, Indonesia. *Human Ecology* 49, 551–564 (2021). <https://doi.org/10.1007/s10745-021-00253-w>

Appendix 6: Published Journal Articles

1. Linking blue carbon ecosystems with sustainable tourism: Dichotomy of urban–rural local perspectives from the Philippines (Published in Elsevier, *Regional Studies in Marine Science*, IF 2.166) <https://doi.org/10.1016/j.rsma.2021.101820>

Abstract

Blue carbon ecosystems (BCEs) are linked to tourism industry either as the main destination site or as additional features. Achieving sustainable tourism in coastal areas warrants the inclusion of long-term BCE management and protection, hence, it is important to understand how tourism impacts these resources to better formulate apt strategies tailored to the individual contexts. In Busuanga Island, Philippines, where tourism industry depends highly on its coastal and marine resources, there is a gap in understanding the impacts of tourism on BCEs. Thus, this study aims to analyze communities' perceptions of sustainable tourism and BCE services by comparing household survey results between urban (Coron) and rural (Busuanga) communities. Specifically, this work aims to determine residents' perceptions of tourism impacts at the personal and community levels, to examine whether socio-demographic profiles, ecological consciousness, awareness of programs for sustainable tourism, and ecological protection drive these perceptions, and to compare these results in urban and rural settings. Results of this study indicate a distinctive difference between urban and rural perceptions; e.g., residents perceived highly of tourism benefits and impacts in Coron whereas fewer recognitions are observed in Busuanga. Correlations of locals' awareness of BCE services with perceived environmental changes caused by tourism showed positive effects. Environment-related plans received high recognition in promoting sustainable tourism. Overall, locals' perceptions of tourism and blue carbon ecosystems can be bundled together. This linkage could address future planning of sustainable tourism master plan at the municipal level particularly those towns that features coastal resources as their main tourism attractions.

Keywords

Blue carbon ecosystems, Sustainable tourism, Perceptions, Local communities, Urban–rural setting, Philippines

2. Are Municipalities Ready for Integrating Blue Carbon Concepts?: Content Analysis of Coastal Management Plans in the Philippines (Published in Taylor & Francis, *Coastal Management*, IF 3.234) <https://doi.org/10.1080/08920753.2021.1928455>

Abstract

The blue carbon ecosystems are gaining salience in the international arena due to their intrinsic role in climate change mitigation. Reviews on management strategies and plans at the local level are largely overlooked, although they are crucial factors in translating commitments to contextualized actions for sustainable management. The primary goal of this study is to investigate the present coastal management plans for blue carbon ecosystem management strategies using content analysis of the local plans of select municipalities in the Philippines. The analysis generated eight (8) clusters based on keywords focusing on mangrove and

seagrass ecosystems, namely: ecological profile, ecosystem services, carbon sequestration, tourism, natural threats, anthropogenic threats, laws, policies, & ordinances, and management activities. The management activities cluster has the most coverage while the carbon sequestration cluster is the least mentioned. There is also a distinct gap in the inclusion of mangroves compared to seagrasses in the coastal management plans where these ecosystems are present in the localities concerned. Mangrove ecosystems are frequently mentioned, covering all clusters while seagrass ecosystems are discussed to less extent in only five (5) clusters. This study also showed that the “blue carbon” concept is not yet fully incorporated in the current management plans where carbon sequestration cluster is only discussed under mangrove ecosystems in one of the sites while no discussions for seagrasses’ “blue carbon” functions. The results of this study can serve as a benchmark for local policy-makers in updating their present management plans particularly in branching their focus on integrated management of seagrass ecosystems and advancing technical capacity and knowledge on blue carbon ecosystems.

Keywords

Blue carbon ecosystems, coastal management plans, content analysis, local level, Philippines

3. Tourism impacts on small island ecosystems: public perceptions from Karimunjawa Island, Indonesia (Published in Springer, Journal of Coastal Conservation, IF 2.098)
<https://doi.org/10.1007/s11852-022-00852-9>

Abstract

In Indonesia, tourism has become a promising major economic sector, particularly because of its contributions toward developing the economy and creating employment opportunities for local communities with rich coastal ecosystems. However, the balance between the environmental, social, and economic realms has come into question, as unsustainable tourism practices continue to be promoted in Indonesia. To address such challenges, it is important to identify tourism impacts and provide sustainable policies and plans. Communities often record tourism impacts through their perceptions and act as important stakeholders in the process of sustainable tourism development. We examined tourism impacts on coastal ecosystems in Karimunjawa from the perspective of local communities. More comprehensively, we investigated their perceptions from three perspectives: socio-cultural, economic, and environmental. The study results revealed that the respondents held positive perceptions about tourism’s impact on socio-cultural and economic sectors and negative perceptions about its impact in the environmental domain. A chi-square test and Spearman’s correlation analysis indicated that the respondents’ educational attainment and tourism involvement influenced their perceptions on these issues. The current study results could be used as a baseline reference for contextualizing sustainable tourism plans regarding small island ecosystems in Indonesia.

Keywords

Coastal ecosystem, Perception, Environmental impacts, Sustainable tourism

4. Understanding rural and urban perceptions of seagrass ecosystem services for their blue carbon conservation strategies in the Philippines (Published in Wiley, Ecological Research, IF 2.056) <https://doi.org/10.1111/1440-1703.12325>

Abstract

Seagrass meadows provide diverse ecosystem services that directly or indirectly benefit the coastal communities. Despite this, they are among the most threatened coastal ecosystems. Though coastal and marine conservation actions have progressed over the years, seagrasses received less attention compared with other more charismatic ecosystems such as coral reefs and mangroves. Among the influencing factors, the lack of societal recognition of what seagrasses are and their importance underlies the global crisis of seagrass conservation. Thus, in this study, we gathered rural and urban perceptions of seagrass ecosystem services, their threats, and management-related activities at the unit of barangay or village in the Philippines. Overall, rural respondents displayed higher awareness of seagrass ecosystem services than urban respondents. Socio-economic status and personal connection or direct experience to these services influenced their perceptions. Local-level threats were also perceived and recognizing these at the early onset can avoid severe habitat degradation. Though the role of seagrass blue carbon in climate change mitigation was barely discussed in local contexts, the impact of climate change-induced stressors on seagrass was perceived by the respondents. Thus, local stakeholders, practitioners, and policymakers have the opportunity to design future seagrass-focused management plans and programs in the era of climate change.

Keywords

Seagrass ecosystems, Rural-urban perceptions, Comparative analysis, Blue carbon, Philippines

5. Community perceptions of long-term mangrove cover changes and its drivers from a typhoon-prone province in the Philippines (Published in Springer, Ambio, IF 6.943) <https://doi.org/10.1007/s13280-021-01608-9>

Abstract

Mangrove forests are among the most productive ecosystems with important services such as food and livelihood provisions, recreations, and regulations (e.g., coastal protection) in local scales. At global scale, they are gaining salience for their carbon sequestration capacities, currently conceptualized as “blue carbon.” However, their essential benefits are reduced or lost when degraded. There is, therefore, a need to explore long-term mangrove cover change (MCC) and its underpinning drivers to develop sustainable management strategies. MCC has been analyzed extensively, including satellite images and field surveys, with drivers of changes frequently embedded in local contexts. Thus, in this study, MCC and the causal factors are evaluated at the local scale by gathering community perceptions in Eastern Samar, a typhoon-prone province in the Philippines, with a timeframe since the 1970s until the present. Results show that mangrove cover loss was observed following the occurrence of Typhoon Agnes in 1984 and Typhoon Haiyan in 2013 while conversion of mangrove areas to residential spaces was identified as a recurring driver of mangrove depletion from the early 1970s to 1990s. Study participants perceived that natural threats and lack of law enforcement were the

leading proximate and underlying drivers of degradation, respectively. Respondents perceived that mangrove cover is increasing mainly due to successive reforestation programs coupled with stricter implementation of local ordinances in the sites. The results indicate the increased role of mangrove forests in disaster risk reduction and climate change mitigation strategies, while the perceptions of drivers change in long terms.

Keywords

Anthropogenic impacts, Community perceptions, Local drivers, Mangrove cover change, Philippines

6. Potential of seagrass habitat restorations as nature-based solutions: Practical and scientific implications in Indonesia (Published in Springer, *Ambio*, IF 6.943) <https://doi.org/10.1007/s13280-022-01811-2>

Abstract

Seagrasses offer diverse ecosystem services, yet, they are among the most threatened ecosystems. When degraded or destroyed, their services are lost or reduced in the process, affecting, for instance, local communities directly dependent on their livelihood provision. The Intergovernmental Panel on Climate Change (IPCC) reported that climate change is projected to worsen over time; thus, there is an urgent need for mitigation strategies in practice and also in the longer term. This work aims to provide an alternative perspective of seagrass restoration as a nature-based solution (NbS) on a global scale, yet, giving an emphasis on tropical regions such as Indonesia. We focused on seagrass restorations which are not yet well established in comparison with other restoration programs (e.g., mangroves) despite their critical roles. We present in this work how restoring seagrass meadows fits the global standard of NbS published by the International Union for Conservation of Nature (IUCN). The results of this study can serve as a basis for promoting seagrass restorations as NbS against climate change particularly in countries with a wide extent of seagrass coverage.

Keywords

Blue carbon, Climate change mitigation, Ecosystem services, Local stakeholders, Societal challenges

7. Applying the DPSIR framework to qualitatively assess the globally important mangrove ecosystems of Indonesia: A review towards evidence-based policymaking approaches (Published in Elsevier, *Marine Policy*, IF 4.315) <https://doi.org/10.1016/j.marpol.2022.105354>

Abstract

Indonesia has the largest extent of mangroves globally, supporting communities at the local scale while contributing to climate change mitigation at the global scale. Yet, they are highly threatened by multiple anthropogenic and natural stressors. Thus, in this study, we aim to qualitatively assess Indonesia's mangrove ecosystems by conducting a literature review applying the Driver-Pressure-State-Impact-Response (DPSIR) framework. By using the framework, we identified multiple stressors and existing management efforts in 27 provinces of

Indonesia. For instance, we identified aquaculture expansion as the most frequented driver of mangrove loss leading to the conversion of mangroves to shrimp farms in 20 provinces. In terms of responses, mangrove rehabilitation and community-based management have a long history in Indonesia while economic valuation and payment of ecosystem services are yet to be established across the country. The identification of multiple stressors and/or threats is instrumental to addressing the causes of degradation of globally-important mangroves in Indonesia if effectively translated into policies, which remains a future challenge.

Keywords

Mangroves, Literature review, DPSIR, Blue carbon, Indonesia

8. Progress of blue carbon research: 12 years of global trends based on content analysis of peer-reviewed and 'gray literature' documents (Published in Elsevier, *Ocean and Coastal Management*, IF 4.295) <https://doi.org/10.1016/j.ocecoaman.2023.106495>

Abstract

Blue carbon (BC) research has progressed over the years and is continuously evolving. Several existing review papers are available and scrutinized BC research, yet, knowledge gaps and overlaps in science and practice remain a challenge. Thus, we conducted a literature review on 1179 BC-related documents including peer-reviewed articles, technical reports/policy briefs, books/book chapters, conference presentation abstracts, dissertations/theses, and news articles. The work undertaken was guided by three research objectives – (1) to identify the knowledge gaps, trends, and updates in BC literature, (2) to determine the geographic distribution of BC research, and (3) to review the timeline of BC research and elucidate critical issues that potentially drag BC advancement. Key results showed, that, firstly, BC literature favors academic research papers over gray literature (e.g., guidelines, policy briefs). This is critical since research papers are hard to access and process by non-technical persons and practitioners worldwide, thus, promoting gray publications particularly those dedicated to policymakers and coastal managers such as policy briefs and technical manuals are highly encouraged. Secondly, there is an uneven geographic distribution of BC documents, roughly reflecting weak international collaborations among scholars from developing and developed countries. Additionally, this can be attributed to scholar's limited capabilities and international networks. Lastly, BC research remained in favor of natural/physical/applied sciences in comparison to social and policy-oriented papers. Despite this, we noted that the number of social-driven publications in the last two years is increasing, which can change trends in the future. The findings of this review, covering the last 12 years of BC research, can be instrumental to coastal managers and/or practitioners in terms of developing state of the art BC management strategies that are science-based. Moreover, the results can support scholars by complementing their future research agendas to avoid unnecessary overlaps and/or redundancies that can potentially drag the advancement of BC science.

Keywords

Blue carbon, Content analysis, Co-occurrence network, Co-authorship network, Global trends

9. Understanding community awareness of seagrass ecosystem services for their blue carbon conservation in marine protected areas: A case study of Karimunjawa National Park (Published in Wiley, Ecological Research, IF 2.056) <https://doi.org/10.1111/1440-1703.12391>

Abstract

Seagrasses provide diverse ecosystem services that support communities, yet, they are among the most threatened marine habitats. Efforts to conserve and sustainably manage seagrasses are increasing, particularly amidst the era of climate change, in which they play a critical role. However, these activities often received less attention or were slow in gaining momentum partly due to a lack of societal recognition of seagrasses and their importance. Thus, in this study, we collected community perceptions of seagrass ecosystem services and threats from 391 respondents in Karimunjawa National Park (KNP), a nationally declared protected area in Indonesia. We aim to provide insights on people's recognition of seagrasses from a local scale with strict protection measures. Overall, respondents showed varying perceptions of seagrass ecosystem services, with provisioning services more highly perceived than regulating services. The perceived level of threats was inconclusive, though, reclamation along shorelines received higher rates (leaning toward most damaging) than other threats such as natural disasters and illegal fishing activities. Sociodemographic attributes of respondents were found to influence their perceptions, with occupation as the most pronounced driving factor. The variations observed in seagrass perceptions suggest that there is a need to strengthen and/or enhance seagrass awareness and education campaigns, which is in line with the increasing demand that public perceptions matter for the conservation and sustainable management of seagrass ecosystems. We presented here the use and insights of community perceptions for seagrass blue carbon conservation in KNP, and consequently in Indonesia, where seagrass meadows are considered globally important carbon sinks.

Keywords

Blue carbon, Perceptions, Seagrass management, Local scale, Indonesia

Appendix 8: Conference Presentations

Topic	Authors	Conference/Symposium Name	Year
Local perception as a scientific evidence for managing blue carbon ecosystems for climate mitigation and adaptation	R. Kohsaka J.M.D. Quevedo K.M. Lukman Y. Uchiyama	UN Climate Change Conference	2021
Applying DPSIR framework for blue carbon ecosystems assessment: The case of Busuanga Island, Philippines.	J.M.D. Quevedo Y. Uchiyama R. Kohsaka	Japan Geoscience Union (JpGU) Annual Meeting	2021
Analyzing coastal management plans of select municipalities in the Philippines for Blue Carbon concepts	J.M.D. Quevedo Y. Uchiyama K.M. Lukman R. Kohsaka	2 nd National Blue Carbon Symposium (NBCS2)	2022
Comprehensive Assessment of Ecosystem Services – Including People’s Awareness on the Significance of Blue Carbon Ecosystems	K.M. Lukman J.M.D. Quevedo T.E.A. Quiros Y. Uchiyama R. Kohsaka	Blue Carbon Regional Symposium (BCRS)	2023