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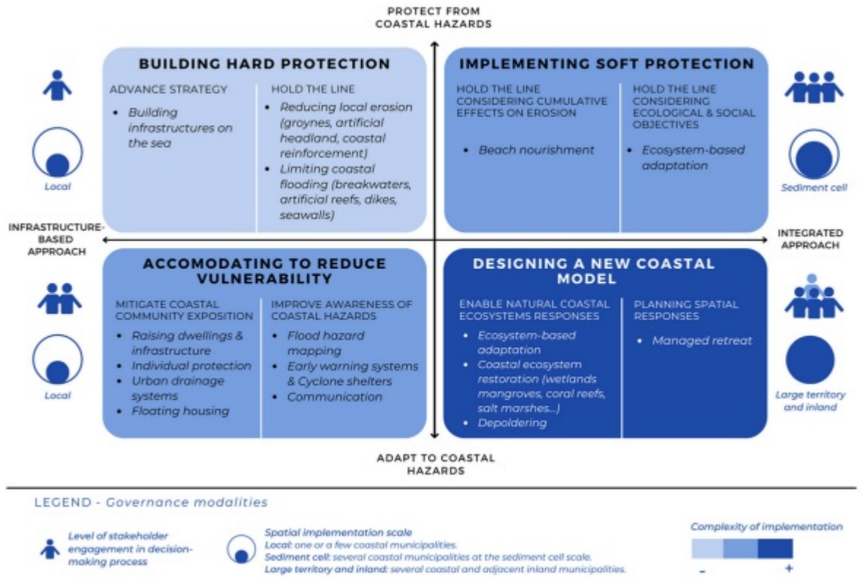
Indonesia Disaster Knowledge Update - September 2023

Disaster-related Research Publication based on Priority Locations for Climate Resilience in Marine and Coastal Sectors in Indonesia

Introduction

To commemorate National Maritime Day and World Maritime Day, CARI! reviews the landscape of scientific publications on Priority Locations for Climate Resilience in the Maritime and Coastal Sector in Indonesia Disaster Knowledge Update (IDKU) September 2023 edition. This review analyzes various studies based on the priority locations for climate actions in coastal sector stipulated in Climate Resilience Development Policy 2020-2024 (Bappenas, 2020). There are 3 location categories : Super Priority, Top Priority, and Priority. The determination of priority locations is based on potential hazards in the area and regional vulnerability criteria or the Indonesia Disaster Risk Index in the area. There are 61 cities/districts categorized as Super Priority, 110 regions in the Top Priority category, and 39 regions in the Priority category.

The Super Priority, Top Priority and Priority Location categories are determined based on the following criteria:	**1. Super Priority** Regions that have a high potential for hazard and have one of the Regional Vulnerability criteria or high IRBI risk index	**2. Top Priority** Regions that have a high potential for hazard and have one of the Regional Vulnerability criteria or high IRBI risk index	**3. Priority** Regions that have a high potential for hazard

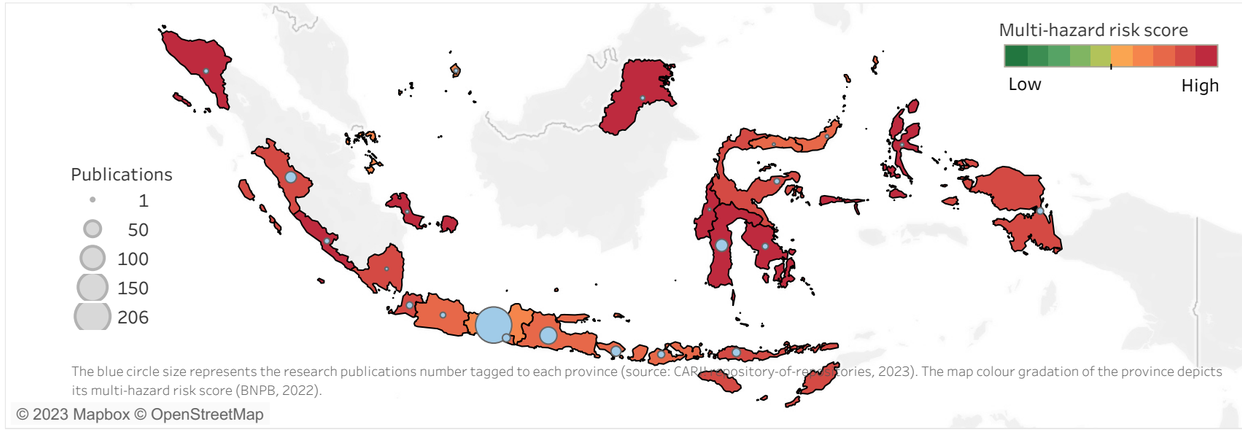


For a more in-depth analysis related to climate resilience in the coastal and marine sectors, we use the Adaptation Strategies framework proposed by Bongarts et al., 2021. This framework divides adaptation strategies into 4 quadrants which are based on the main function of the strategy carried out, namely protect from coastal hazards or adapt to coastal hazards, then the scale of governance, namely infrastructure-based approach or integrated approach. Apart from that, this framework also considers the spatial scale of implementation, the level of stakeholder engagement in decision-making processes, and the complexity of the implementation itself. 1) Building Hard Protection, is an adaptation strategy related to building infrastructure to protect coastal hazards, such as sea walls, embankments, etc. 2) Implementing Soft Protection, an adaptation strategy related to the implementation of ecosystem-based adaptation such as planting wave-blocking vegetation and mangroves in a local scale context. 3) Accommodating to Reduce Vulnerability, is an adaptation strategy related to mitigating coastal community exposure and also increasing awareness of coastal hazards. 4) Designing a New Coastal Model is an adaptation strategy related to large-scale coastal ecosystem restoration, such as changing a land cover to a mangrove forest area, or managed relocation for coastal residents.

Reference:
1) Designing Coastal Adaptation Strategies to Tackle Sea Level Rise
2) Daftar Lokasi & Aksi Ketahanan Iklim

The number of studies is concentrated in Java Region, specifically Central Java regions

Research article distribution map



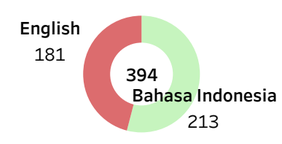
Volume of publication by municipality/regency

This map shows that the number of studies tends to revolve around the locations that have experienced frequent coastal floods and coastal erosion disasters on the island of Java. Notably, Central Java and East Java provinces have a sizeable number of studies compared to other regions. Moreover, Central Java province occupies the region with the most publications (206 publications), this is related to the phenomena of coastal erosion, abrasion, and tidal floods which are frequent all the time in the north coastal area of Central Java. The word cloud shows that many cities/regencies have become research locus related to adaptation strategies on priority locations for climate resilience. The pattern shows that more publications were found in cities/regencies in the north coastal area of Central Java Province which regularly experiences coastal flooding and coastal erosion, such as Pekalongan, Tegal, Semarang City, Demak, and Kendal. Meanwhile, in other cities/regencies, there are still few publications found, especially in municipalities/regencies that are classified as super priority.

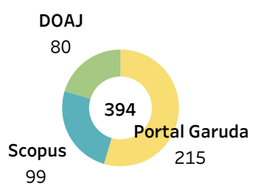
Research Articles Statistics

394 Publications | 290 Publishers | 378 Authors

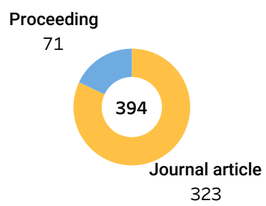
Publications by language



Publications by repository/indexing



Publications by type



For analytical purposes, we examined research articles related to adaptation strategies in priority locations for climate resilience in the marine and coastal sectors. The scientific articles were obtained from CARI! Knowledge Engine sourced from Scopus, DOAJ, and Portal Garuda repositories. All journal articles and proceedings were included in this analysis. Also, only articles written in English and Bahasa Indonesia were included. In total, we selected **394 publications** to be reviewed in the subsequent analysis.

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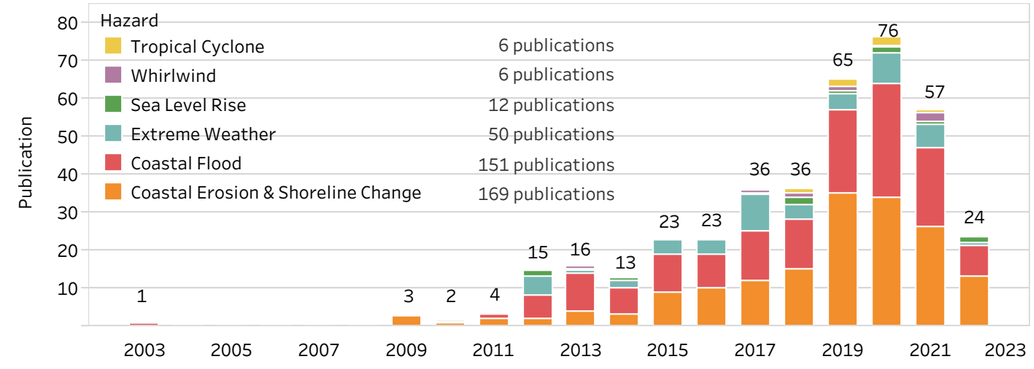
Research Growth & Descriptive Analysis

The growth of coastal hazard research shows a positive trend, specifically coastal erosion and coastal flo..

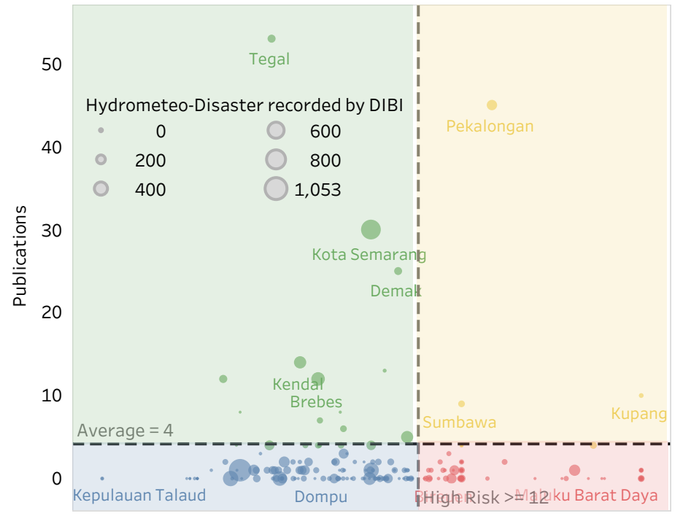
Research publication trend by year



The growth of disaster research in the priority locations for climate resilience continues to increase. Substantial growth in publications was observed after 2018. In 2019 and 2020, there were 65 and 76 research publications, respectively. The increasingly widely discussed issue of climate change and climate resilience has prompted many publications to discuss the impact of climate change on coastal hazards in the region. In addition, many studies raised the topic of coastal flood and coastal erosion & shoreline change. In the last two years, research in these locations has decreased, and attention to the topic of coastal hazards needs to be increased in the future.

Many studies are found in Central Java regions regardless of their risk level

Quadrant plot of number of publications vs extreme weather risk score



Category
- Less publications, higher risk
- More publications, higher risk
- Less publications, lower risk
- More publications, lower risk

We divided provinces into four groups based on the average number of publications and the extreme weather risk score. The cut-off risk score for the high-risk category is set at >= 12, and hence the quadrant plot. The plot shows four categories, namely more publications & higher risk (yellow), more publications & lower risk (green), fewer publications & higher risk (red), and fewer publications & lower risk (blue). Additionally, we used hydrometeo-disaster event data based on administrative areas (the circle size).

The plot depicts that municipalities/regencies in Central Java Province have more publications, such as Semarang, Tegal, Pekalongan, and Demak. There are 19 administrative areas categorized as green category which means the administrative areas have more publications and less risk. There are 6 administrative areas categorized as yellow category which means the regions have more publications and high risk. There are 109 administrative areas categorized as the blue category which means the regions have fewer publications and less risk. However, there are still many administrative areas that fall into the red category (76 areas), which means there is still a lack of knowledge base for the adaptation strategies as part of climate resilience in these regions, even though the number of disasters that have occurred is rel..

Top Research Article

Top 3 publications based on citation count

Mangrove forest decline: consequences for livelihoods and environment in South Sulawesi
Malik A. | Regional Environmental Change |
Published on January 1, 2017 | Cited by 51 article(s)

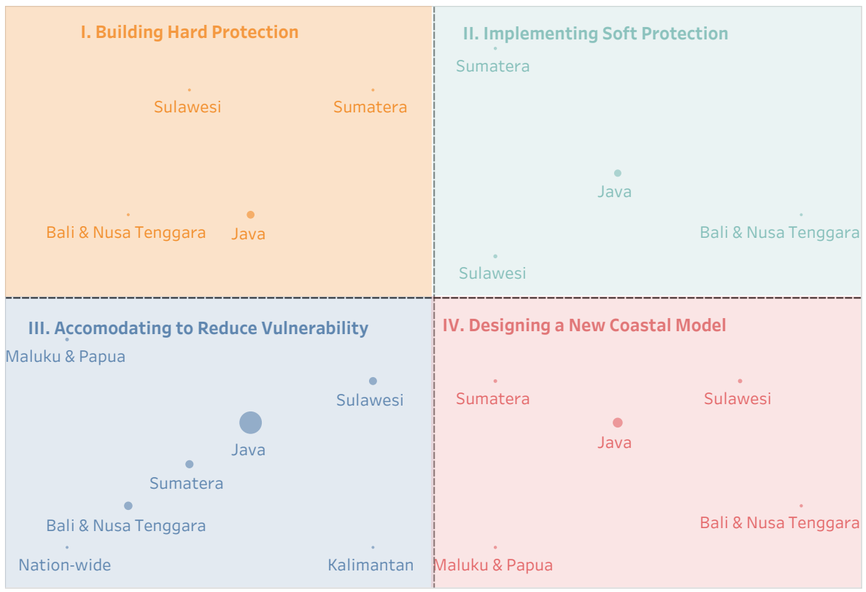
Participatory ecosystem service mapping to enhance community-based mangrove rehabilitation and management in Demak, Indonesia
Damastuti E. | Regional Environmental Change |
Published on January 31, 2019 | Cited by 30 article(s)

Shoreline and mangrove analysis along semarang-demak, Indonesia for sustainable environmental management
Irsadi A. | Jurnal Pendidikan IPA Indonesia |
Published on March 1, 2019 | Cited by 18 article(s)

The list above is each of the top three publications on the topic of adaptation strategies in priority cities/districts for climate resilience, ranked by citation number recorded by Scopus in September 2023. The three top studies above discuss mangrove conservation and rehabilitation as part of adaptation strategies. The first publication discusses the decline of mangrove forests and the consequent impact on livelihoods and the environment in South Sulawesi. The second publication discusses participatory mapping of community-based mangrove rehabilitation and management in Demak. The third publication discusses changes in coastlines and mangroves on the coast of the Semarang-Demak area.

Accommodating to Reduce Vulnerability is the most studied strategy in Java region, so does in other regions

Quadrant plot of number of publications by region & adaptation strategy



Publication
- 1
- 50
- 100
- 150
- 191

The graph depicts the distribution of research publications based on the adaptation strategies quadrant. The graph clearly shows that many publications fall into the adaptation strategy III: Accommodating to Reduce Vulnerability, while in other quadrants it is still very minimal. The highest number of publications was found in the Java region with adaptation strategy III of 191 publications. This was also found in other quadrants that the Java Region was the main focus of researchers in the adaptation strategies aspect as with previous findings. Unfortunately, many regions still lack a knowledge base in all quadrants, particularly Maluku & Papua with the least number of publications with 4 publications. Therefore, there needs to be encouragement for research in other areas with a focus on the four adaptation strategies quadrants.

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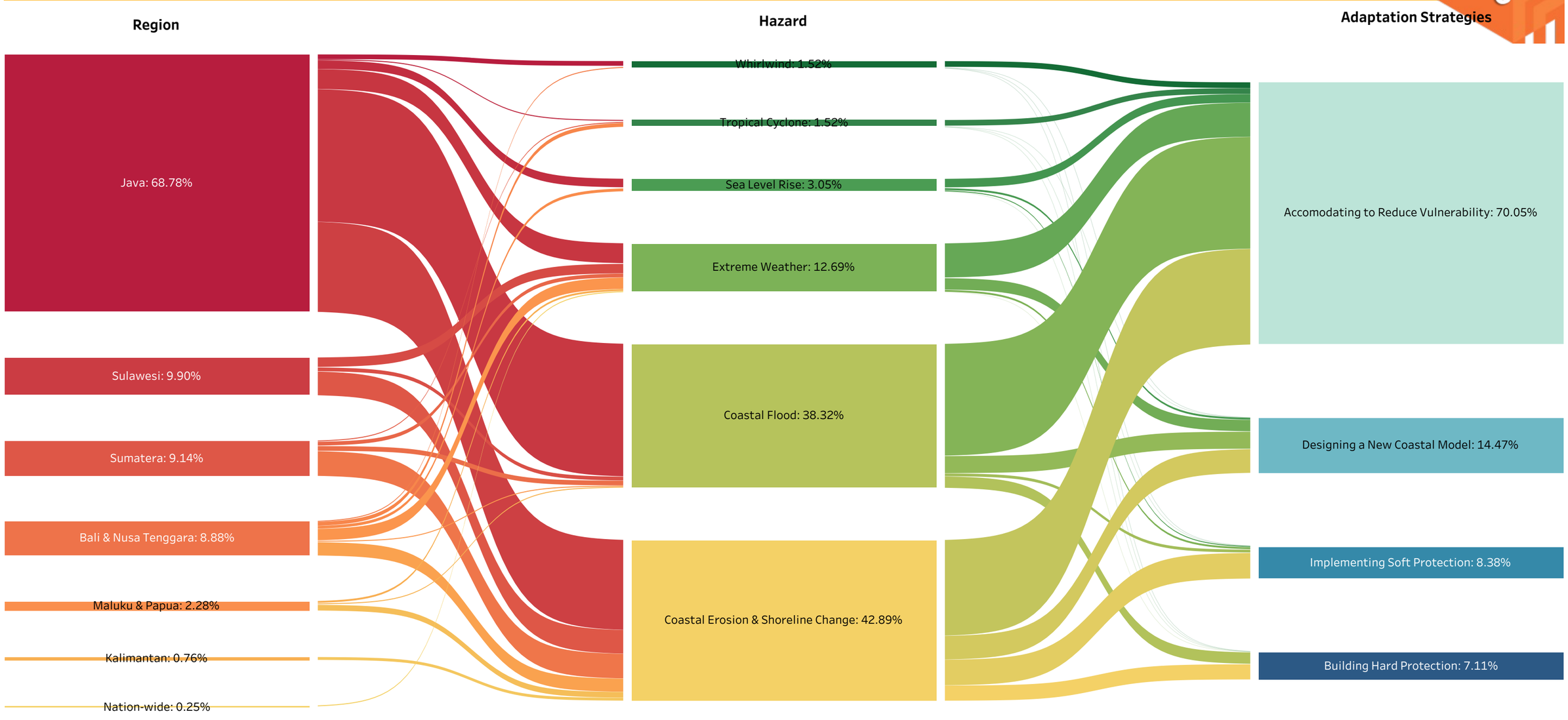
Sankey Diagram of Publications: Research Location to Hazard to Adaptation Strategies



The Sankey diagram is proportionally visualizing the number of publications. The larger size of the box and the wider lines indicate a greater number of publications accounted for them. The diagram illustrates the distribution of research articles and their relations across studied locations, hazard types, and adaptation strategies.

The Sankey diagram is used to determine the co-analysis relationship among the research location, the hazard type, and adaptation strategies investigated in each research article. The majority of research is distributed in the Java region which accounts for 68.78% or 271 articles, followed by the Sulawesi region with 9.90% or 39 articles, the Sumatra Region with 9.14% or 36 articles, and the Bali & Nusa Tenggara region with 8.88 % or 35 articles. As in previous findings, the distribution is concentrated on the island of Java due to the phenomena of coastal floods and coastal erosion which are common in the northern coastal area of Central Java. This is also shown by the number of publications that have the topic of the dangers of coastal erosion & shoreline change amounting to 42.89% or 169 articles and the dangers of coastal floods amounting to 38.32% or 151 articles. Moreover, regarding the impact of climate change, there are 12.69% or 50 articles discussing extreme weather, 3.05% or 12 articles discussing sea level rise, 1.52% or 6 articles discussing tropical cyclones, and 1.52% or 6 articles discussing whirlwinds.

Most types of hazard research are related to Accommodating to Reduce Vulnerability as an adaptation strategy with 70.05% (276 articles) of the total publications. Followed by Designing a New Coastal Model with 14.47% (57 articles) of the total publications, Implementing Soft Protection with 8.38% (33 articles) of the total publications, and Building Hard Protection with 7.11% (28 articles) of the total publications. This shows a gap in knowledge regarding adaptation strategies, especially the many publications that discuss the Accommodating to Reduce Vulnerability, compared to other adaptation strategies which are still minimal in number. This is because many publications discuss the assessment of potential dangers, vulnerabilities, and coastal hazard risks related to the Accommodating to Reduce Strategy. Therefore, there is a need for encouragement for broader research in adaptation strategies, particularly by considering the distribution of locations, and type of hazards.

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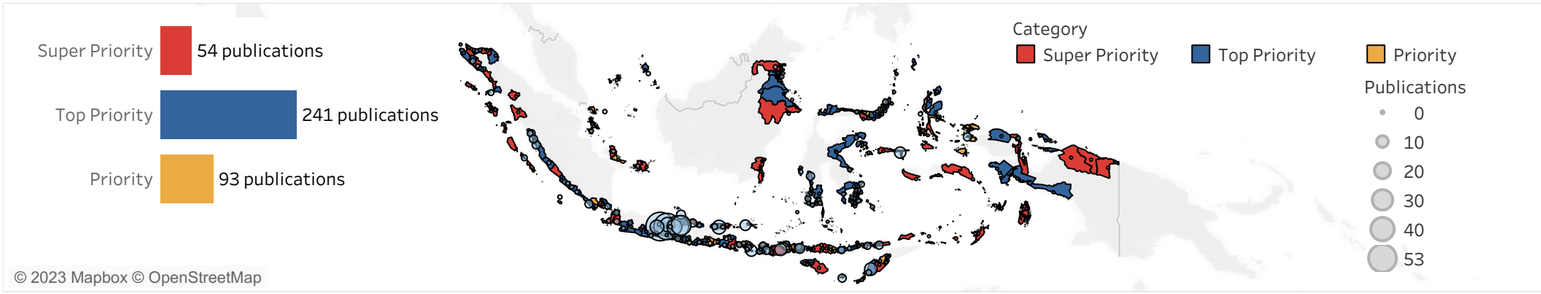
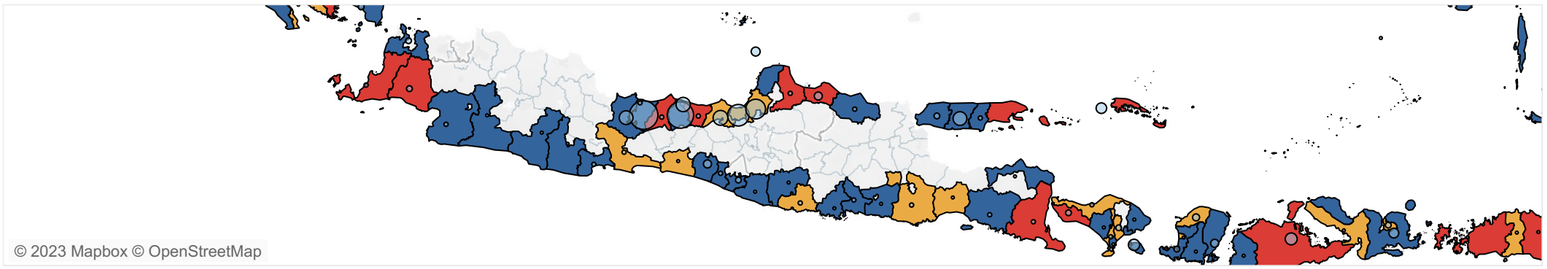
In-depth Analysis of Priority Locations for Climate Resilience in the Marine and Coastal Sectors in Indonesia

Knowledge base gaps in locations outside Java

Research distribution map by priority locations for climate resilience in the marine and coastal sectors in Indonesia

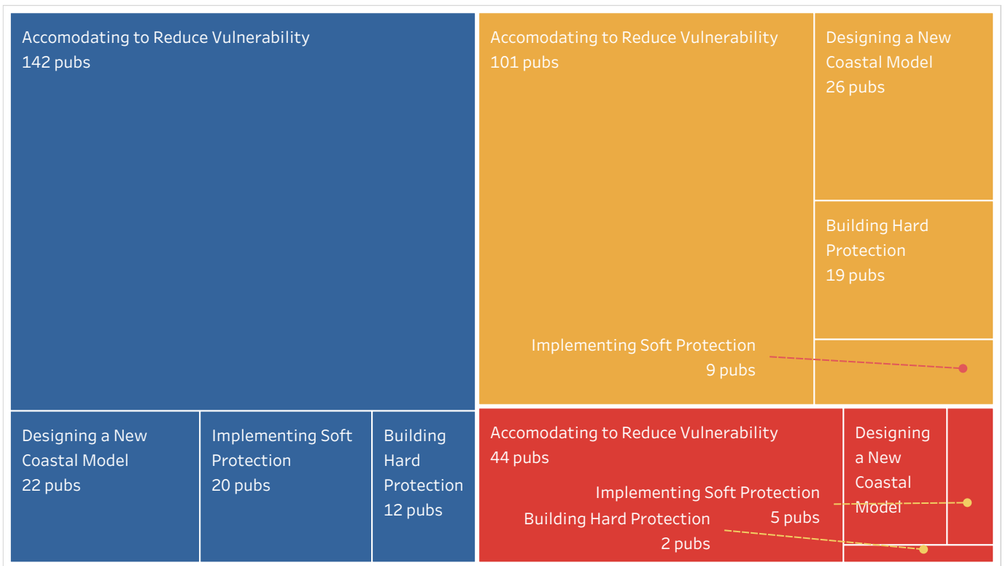


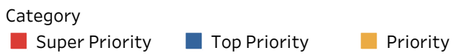
Research distribution map in Central Java and its surrounding areas



More knowledge base is needed in locations with super priority category

Distribution of research publications by priority category and adaptation strategy





This figure shows the proportion of the knowledge base based on priority categories of climate resilience and type of adaptation strategies. Most of the research was conducted in areas with the Top Priority (the blue) and Priority (the yellow) categories. Unfortunately, it is still much less compared to research conducted in areas in the Super Priority category (the red). Apart from that, in line with previous findings, there are still many publications that focus on aspects of adaptation strategies in the form of Accommodating to Reduce Vulnerability. There are still several other adaptation strategies that little has been discovered. Therefore, there is a need to encourage further research related to other adaptation strategies as an effort to create a knowledge base for developing more comprehensive adaptation strategies in priority areas for climate resilience.

Recommendations

The September edition of IDKU clearly shows the volume of academic and scientific publications available for serving as the basis for climate actions in coastal and marine sectors in the priority locations within Indonesia is limited. This recurring pattern is also evident in many past IDKU editions (see: https://caribencana.id/products/idku); especially, IDKU's themes on coastal disasters, tsunamis, nature-based solutions, and climate change hazards. The gap is also insufficient to become the optimum basis for informing climate resilience actions in the sub-priority locations in the marine and coastal sectors of Indonesia, especially in terms of the match between the supply (available research publications) and demands (locations and action group with the Climate Resilience Policy of Indonesia 2020-2024 (https://lcdi-indonesia.id/wp-content/uploads/2021/11/1_List-of-Priority-Locations-Climate-Resilience-Actions.pdf or the PBI Document). Case in point, some key areas in the main activities of the PBI Document are to enhance the availability of integrated marine safety and multi-hazards warning systems for marine climate, information technologies, and to enhance finances for fishermen; available research publications do not directly could contribute to this necessity in terms of policy and program formulation. Therefore, our main recommendation is for the implementation of the PBI and climate actions policy and programs by the Government of Indonesia and development partners to be conducted in parallel with scientific knowledge production, especially in super-priority and priority locations.

In addition, based on the combined knowledge from relevant IDKUs, below are additional recommendations from CARI! for enhancing knowledge-informed climate actions in marine and coastal sectors.

1. Conduct systematic valuation of ecosystem services in marine and coastal areas, cost-benefits of NbS and grey-green actions in marine areas, as well as impact valuation of relevant investments investment. which could incentivize stakeholders to implement systematically, monitor, evaluate, and upgrade enhancement. And not as a one-off or ceremonial intervention. This should also be tied to income generation and accounted as revenue to the local economies (e.g., as non-tax revenue) without disrupting the existing economic structure of a regency/city.

2. Pioneer a multi-stakeholder body that sets standards and guidelines as key reference guides for grey, green, NbS, and mix green-grey planning, implementation, monitoring, evaluation, and corrective actions. Climate actions in marine and coastal sectors should also bring closer stakeholders working in climate change, disaster management, sea vessel safety, and the wider development and environmental groups.

3. Creation and enhancement of an information platform for monitoring, control, evaluation, and determining corrective actions to track the success and failure of climate actions in marine and coastal sectors. This information platform could also enhance the function of knowledge management. The current PBI/LCDI platform is a good initial modality, which could be enhanced by being more inclusive such as incorporating scientific repository platforms into the PBI/LCDI platform.

4. The Marine and coastal sector is vast with tacit and indigenous knowledge, not only scientific knowledge. Hence, the establishment of living labs in super-priority and priority areas is crucial, as a practical solution to optimize climate actions that balance between local people's livelihood, local wisdom institutionalization, biodiversity preservation, and climate-related science. The existence of local research bodies, local universities, and science-based non-government organizations in the region has the potential to establish such initiatives with their expertise and in-depth understanding of local contexts to co-create open innovation ecosystems that operate in real-life environments and contexts to result in sustainable solutions, business models or products. It is imperative to build capacity as part of policy and programs in all priority and super-priority areas.

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