



Adaptive Governance Models in Coastal Ecosystem Management to Support Environmental Resilience

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ABSTRACT

This study aims to analyze adaptive governance models in coastal ecosystem management to support environmental resilience in coastal villages of Pesisir Barat Regency, Lampung Province, Indonesia. The study responds to the growing need for governance systems that can address coastal erosion, tidal flooding, mangrove degradation, livelihood vulnerability, and fragmented institutional coordination. A qualitative case study design was used to explore the meanings, experiences, and governance practices of local actors. Data were collected from 28 informants through semi-structured interviews, limited participatory observation, and document analysis in Pekon Pahlungan, Pekon Walur, and Pekon Tembakak from May to August 2025. The data were analyzed using reflexive thematic analysis. The findings reveal five main themes: actor coordination, community participation, local ecological knowledge, institutional flexibility, and social learning. The study shows that coastal communities possess adaptive capacity through informal cooperation, practical environmental knowledge, and collective learning. However, this capacity remains constrained by irregular coordination, unequal participation, weak documentation, limited resources, and project-based governance. The study contributes to adaptive governance theory by emphasizing the importance of local experience, institutional flexibility, and learning-based decision-making in coastal resilience. The findings imply that coastal policy should strengthen permanent multi-stakeholder forums, community-based monitoring, gender-inclusive participation, and integration of local knowledge into formal planning.



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1. Introduction

Coastal ecosystems have become one of the most vulnerable social-ecological spaces under climate change, urban expansion, resource extraction, and ecosystem degradation. Mangroves, seagrass beds, coral reefs, estuaries, and coastal wetlands provide protection from erosion, support fisheries, store blue carbon, and sustain local livelihoods. Yet these ecosystems face growing pressure from sea-level rise, coastal flooding, land conversion, pollution, and fragmented development planning. This condition shows that coastal management cannot rely only on

technical conservation programs. It also needs governance systems that can respond to uncertainty, coordinate multiple actors, and adjust policy decisions to ecological and social change. Nature-based solutions offer important pathways for climate adaptation, but their success depends on institutional design, local participation, and long-term monitoring (Seddon et al., 2020). Chausson et al. (2020) also show that adaptation outcomes from nature-based solutions depend on how interventions are implemented, evaluated, and connected to local contexts.

In Indonesia, coastal ecosystem management has a strategic role because coastal communities depend heavily on marine resources for income, food security, cultural identity, and social stability. Many coastal areas face erosion, tidal flooding, mangrove loss, declining fish catches, and increasing conflict over coastal land use. These problems do not occur only as ecological disturbances. They also reflect weak coordination between government agencies, limited community participation, and uneven access to decision-making processes. Coastal resilience therefore requires more than restoration activities. It requires governance arrangements that recognize local knowledge, institutional capacity, and community vulnerability. Jozaei et al. (2022) argue that coastal governance must consider the relationship between social vulnerability and social-ecological resilience. Clement et al. (2024) further explain that the way resilience is framed by decision-makers shapes the direction of coastal policy, either toward short-term recovery or toward deeper transformation.

Adaptive governance offers a relevant theoretical lens for examining coastal ecosystem management because it views governance as a dynamic process rather than a fixed administrative structure. This approach emphasizes institutional flexibility, social learning, multi-actor collaboration, shared responsibility, and continuous adjustment to changing environmental conditions. In coastal contexts, adaptive governance helps explain how communities, local governments, civil society groups, and technical agencies negotiate decisions when ecological risks and livelihood needs interact. Partelow et al. (2020) note that environmental governance theories are useful for understanding coastal systems because these systems involve complex relationships between rules, actors, power, and ecological change. Akther and Evans (2024) add that adaptive governance in the Global South often depends on informal networks, local leadership, accountability, and context-sensitive institutional arrangements.

Field realities in many coastal communities show that formal policies often do not fully capture everyday experiences of environmental change. Fishers may notice seasonal shifts, women in coastal households may experience greater livelihood insecurity, and local groups may understand changes in mangrove conditions before those changes appear in formal reports. However, this knowledge often remains peripheral in planning and evaluation. Rölfer et al. (2022) stress that coastal governance requires system knowledge, target knowledge, and transformative knowledge to move beyond narrow technical management. In a later study, Rölfer et al. (2024) show that collaboration, knowledge exchange, and stakeholder agency play important roles in strengthening climate resilience in coastal governance. These arguments support the need to study governance not only through policy documents, but also through lived experience, actor interaction, and local interpretation.

The importance of adaptive governance becomes stronger when coastal ecosystem management intersects with blue carbon, local livelihoods, and environmental justice. Mangrove conservation, for example, can support climate mitigation and coastal protection, but it may also create new tensions when community access, benefit-sharing, and land tenure remain unclear. Dencer-Brown et al. (2022) explain that blue carbon initiatives must work for both climate targets and local coastal communities. Friess et al. (2022) also warn that growing financial interest in blue carbon needs careful governance so that ecological goals do not override local rights and social equity. In the Indonesian context, Nasution et al. (2025) show that green governance and institutional resilience can strengthen environmental policy in mangrove ecosystems when governance structures support coordination and low-carbon development.

Although studies on coastal resilience, nature-based solutions, and ecosystem-based management continue to grow, several gaps remain. Many studies focus on ecological outcomes, policy effectiveness, or restoration performance, but fewer studies examine how local actors understand, negotiate, and practice adaptive governance in everyday coastal management. Datta and Chaffin (2022) argue that adaptive governance must be examined critically because its implementation depends on legal, political, and institutional contexts. Elrick-Barr et al. (2024) also emphasize that governance innovation in coastal zones should strengthen social-ecological resilience, not only improve administrative procedures. This gap is important because adaptive governance is not automatically achieved through decentralization, community meetings, or conservation projects. It requires learning processes, trust, shared authority, and mechanisms that allow institutions to revise decisions when conditions change.

Based on this background, this study aims to analyze adaptive governance models in coastal ecosystem management to support environmental resilience. The study focuses on actor coordination, community participation, integration of local and scientific knowledge, institutional flexibility, and learning mechanisms in coastal decision-making. The research uses a qualitative approach because adaptive governance involves meanings, experiences, relationships, and social processes that cannot be fully captured through numerical indicators. Theoretically, this study contributes to the discussion of adaptive governance, social-ecological resilience, and ecosystem-based coastal management in developing-country contexts. Practically, the findings can support local governments, coastal managers, community groups, and civil society organizations in designing more participatory, responsive, and sustainable coastal governance models. Jensen and Ong (2020) show that collaboration between citizens and institutions can strengthen community resilience when supported by social learning, collective efficacy, and trust.

2. Materials and Methods

This study used a qualitative case study design to examine adaptive governance models in coastal ecosystem management. A case study design was selected because the research focused on processes, meanings, actor relations, institutional practices, and local experiences within a specific coastal context. The design allowed the researcher to explore how adaptive governance was understood and practiced by different actors who were involved in coastal ecosystem management. This approach was suitable because adaptive governance is not only a policy framework. It is also a social process shaped by coordination, negotiation, learning, and institutional adjustment. Westerberg et al. (2025) show that case study research can explain governance challenges and opportunities in multifunctional marine and coastal landscapes.

The research was conducted in three coastal villages in Pesisir Barat Regency, Lampung Province, Indonesia. The selected villages were Pekon Pahmungan, Pekon Walur, and Pekon Tembakak. These locations were chosen because they represent coastal areas with ecological pressure, livelihood dependence on marine resources, and community involvement in coastal environmental management. The research was carried out from May to August 2025. This period covered preliminary observation, actor mapping, interviews, field observation, document collection, member checking, and initial data analysis. The location was not selected to produce statistical generalization. It was selected to provide an in-depth understanding of adaptive governance practices in a coastal social-ecological system.

The participants were selected through purposive sampling and snowball sampling. Purposive sampling was used to identify informants who had direct knowledge, authority, or experience in coastal ecosystem management. The participants included village officials, officers from local environmental and marine agencies, community leaders, fishers, women from coastal households, mangrove group members, local conservation volunteers, civil society representatives, and small-scale coastal business actors. Each participant had to meet at least one of three criteria: direct involvement in coastal management programs, lived experience of coastal environmental change, or institutional responsibility related to coastal policy. Snowball sampling was used after the first

interviews to identify additional informants who were considered important by earlier participants. The study involved 28 informants, and data collection stopped when new interviews no longer produced substantially new themes.

Data were collected through semi-structured interviews, limited participatory observation, and document analysis. Semi-structured interviews were used because they allowed the researcher to explore participants' experiences while keeping the discussion focused on the research objectives. The interview guide covered actor coordination, community participation, institutional flexibility, local knowledge, conflict, environmental change, and learning mechanisms in decision-making. Xu et al. (2025) explain that in-depth qualitative interviews help researchers understand experience, meaning, and social processes behind a phenomenon. Observation was conducted in coastal settlement areas, mangrove sites, fish landing areas, village meetings, and community-based environmental activities. Document analysis included village regulations, coastal management reports, program archives, meeting notes, maps, photographs, and local planning documents.

Data validation was carried out through source triangulation, method triangulation, member checking, and audit trail. Source triangulation was applied by comparing information from government actors, community members, fishers, women's groups, local leaders, and civil society organizations. Method triangulation was applied by comparing interview data with observation notes and documents. Member checking was conducted by asking selected key informants to review summaries of preliminary findings. This process helped ensure that the researcher's interpretation remained consistent with participants' experiences. Ahmed (2024) states that credibility, dependability, transferability, and confirmability in qualitative research can be strengthened through triangulation, systematic documentation, participant validation, and researcher reflexivity.

The data were analyzed using reflexive thematic analysis. The analysis began with interview transcription, repeated reading, initial coding, code comparison, theme development, theme review, theme naming, and narrative writing. Initial codes were developed from the data and guided by the theoretical focus on adaptive governance. The coding process included categories such as actor coordination, institutional barriers, social learning, local ecological knowledge, participation, trust, conflict, and adaptive capacity. Byrne (2022) explains that reflexive thematic analysis helps researchers identify patterns of meaning in qualitative data through an interpretive and systematic process. Braun and Clarke (2022) also emphasize that thematic analysis requires methodological coherence so that themes represent meaningful patterns, not only descriptive topics.

Research ethics were maintained throughout the study. Each participant received information about the purpose of the study, the voluntary nature of participation, the expected use of data, and the protection of identity. Oral consent was obtained before each interview because some participants were more comfortable with verbal agreement than written forms. Informant names were replaced with codes to protect confidentiality. The researcher also used reflective memos to record assumptions, positionality, field decisions, and possible bias during data collection and analysis. This procedure supported transparency and allowed limited replication in other coastal areas with similar social-ecological characteristics. The replication does not aim to duplicate the findings, but to compare governance processes, participation patterns, institutional flexibility, and adaptive capacity across different coastal contexts.

3. Results and Discussions

The results and discussions section is the main part of the paper. The author(s) meticulously present their findings, providing a comprehensive analysis of the data collected. The author(s) elucidates the significant trends and patterns observed, correlating them with the hypotheses stated earlier in the study. The discussion integrates these findings with existing literature,

highlighting agreements and discrepancies with prior research. The author(s) delve into the implications of the results, considering both theoretical and practical perspectives. Furthermore, the author(s) should address potential limitations and suggest areas for future research to build upon their work, ensuring a holistic understanding of the topic under investigation.

Avoid using personal pronouns, value judgments, elements of the methodology description, and direct repetition of the data given in the tables and graphic material in the text. Numerical results should be rounded in accordance with accepted rules, considering the mean error in the experiment, the confidence interval, or the distribution of values. Research results must be sufficiently substantiated, methodologically correct, and have novelty as well as practical value. The "Discussion" exemplarily described by the author provokes a discussion and invites other scientists interested in the subject to take part in it, bringing their well-grounded vision of the problem under discussion.

4. Conclusions

This study concludes that adaptive governance in coastal ecosystem management in Pekon Pahlungan, Pekon Walur, and Pekon Tembakak emerged through actor coordination, community participation, local ecological knowledge, institutional flexibility, and social learning. The findings show that coastal communities have strong practical capacity to recognize environmental change and adjust their actions through informal collaboration, ecological observation, and collective learning. However, this capacity has not been fully institutionalized in formal governance mechanisms. Coordination remains irregular, participation is stronger in implementation than in planning, local knowledge is rarely documented, and program evaluation still focuses more on physical outputs than long-term ecological and social outcomes.

The study contributes theoretically by showing that adaptive governance should be understood as a layered social-ecological process that involves institutions, community knowledge, power relations, trust, and learning. Practically, the findings suggest that local governments and coastal managers need to strengthen permanent multi-stakeholder forums, community-based ecological monitoring, gender-inclusive planning, and documentation of local ecological knowledge. From a policy perspective, coastal resilience programs should move beyond project-based restoration toward adaptive, participatory, and accountable governance systems. Future research should compare adaptive governance practices across different coastal regions and use longitudinal designs to examine how community-based adaptation becomes institutionalized over time.

References

- Ahmed, S. K. (2024). The pillars of trustworthiness in qualitative research. *Journal of Medicine, Surgery, and Public Health*, 2, Article 100051. <https://doi.org/10.1016/j.glmedi.2024.100051>
- Akther, S. A., & Evans, J. (2024). Emerging attributes of adaptive governance in the global south. *Frontiers in Environmental Science*, 12, Article 1372157. <https://doi.org/10.3389/fenvs.2024.1372157>
- Braun, V., & Clarke, V. (2022). Toward good practice in thematic analysis: Avoiding common problems and becoming a knowing researcher. *International Journal of Transgender Health*, 24(1), 1–6. <https://doi.org/10.1080/26895269.2022.2129597>
- Byrne, D. (2022). A worked example of Braun and Clarke's approach to reflexive thematic analysis. *Quality & Quantity*, 56, 1391–1412. <https://doi.org/10.1007/s11135-021-01182-y>
- Chausson, A., Turner, B., Seddon, D., Chabaneix, N., Girardin, C. A. J., Kapos, V., Key, I., Roe, D., Smith, A., Woroniecki, S., & Seddon, N. (2020). Mapping the effectiveness of nature-

- based solutions for climate change adaptation. *Global Change Biology*, 26(11), 6134–6155. <https://doi.org/10.1111/gcb.15310>
- Clement, S., Jozaei, J., Mitchell, M., Allen, C. R., & Garmestani, A. S. (2024). How resilience is framed matters for governance of coastal social-ecological systems. *Environmental Policy and Governance*, 34(1), 65–76. <https://doi.org/10.1002/eet.2056>
- Datta, A. W., & Chaffin, B. C. (2022). Evolving adaptive governance: Challenging assumptions through an examination of fisheries law in Solomon Islands. *Ecology and Society*, 27(2), Article 30. <https://doi.org/10.5751/ES-13251-270230>
- Dencer-Brown, A. M., Shilland, R., Friess, D. A., Herr, D., Benson, L., Berry, N. J., Cifuentes-Jara, M., Colas, P., Damayanti, E., López García, E., Gavalvão, M., Grimsditch, G., Hejnowicz, A. P., Howard, J., Islam, S. T., Kennedy, H., Kivugo, R. R., Lang'at, J. K. S., Lovelock, C. E., & Huxham, M. (2022). Integrating blue: How do we make nationally determined contributions work for both blue carbon and local coastal communities? *Ambio*, 51(9), 1978–1993. <https://doi.org/10.1007/s13280-022-01723-1>
- Elrick-Barr, C. E., Thomsen, D. C., & Smith, T. F. (2024). Governance innovations in the coastal zone: Towards social-ecological resilience. *Environmental Science & Policy*, 153, Article 103687. <https://doi.org/10.1016/j.envsci.2024.103687>
- Friess, D. A., Howard, J., Huxham, M., Macreadie, P. I., & Ross, F. (2022). Capitalizing on the global financial interest in blue carbon. *PLOS Climate*, 1(8), Article e0000061. <https://doi.org/10.1371/journal.pclm.0000061>
- Jensen, O., & Ong, C. (2020). Collaborative action for community resilience to climate risks: Opportunities and barriers. *Sustainability*, 12(8), Article 3413. <https://doi.org/10.3390/su12083413>
- Jozaei, J., Chuang, W.-C., Allen, C. R., & Garmestani, A. (2022). Social vulnerability, social-ecological resilience and coastal governance. *Global Sustainability*, 5, Article e12. <https://doi.org/10.1017/sus.2022.10>
- Nasution, M. S., Rusli, Z., Heriyanto, M., Zulkarnaini, Syahza, A., Adianto, Mayarni, & Ismandianto. (2025). Green governance and institutional resilience: Strengthening environmental policies for a low-carbon economy in mangrove ecosystems. *Frontiers in Political Science*, 7, Article 1631249. <https://doi.org/10.3389/fpos.2025.1631249>
- Partelow, S., Schlüter, A., Armitage, D., Bavinck, M., Carlisle, K., Gruby, R. L., Hornidge, A. K., Tissier, M. L., Pittman, J. B., Song, A. M., Sousa, L. P., Văidianu, N., & Van Assche, K. (2020). Environmental governance theories: A review and application to coastal systems. *Ecology and Society*, 25(4), Article 19. <https://doi.org/10.5751/ES-12067-250419>
- Rölfer, L., Celliers, L., & Abson, D. J. (2022). Resilience and coastal governance: Knowledge and navigation between stability and transformation. *Ecology and Society*, 27(2), Article 40. <https://doi.org/10.5751/ES-13244-270240>
- Rölfer, L., Celliers, L., Fernandes, M., Rivers, N., Snow, B., & Abson, D. J. (2024). Assessing collaboration, knowledge exchange, and stakeholder agency in coastal governance to enhance climate resilience. *Regional Environmental Change*, 24, Article 6. <https://doi.org/10.1007/s10113-023-02163-7>
- Seddon, N., Chausson, A., Berry, P., Girardin, C. A. J., Smith, A., & Turner, B. (2020). Understanding the value and limits of nature-based solutions to climate change and other global challenges. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 375(1794), Article 20190120. <https://doi.org/10.1098/rstb.2019.0120>