

## From Grassroots to Green Deen: Women's Roles with Climate Change Adaptation in the Coastal Area

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**Abstract:** Climate change has become a significant threat to the coastal communities of Pekalongan, where environmental degradation, tidal flooding, and land subsidence are increasingly disrupting daily life. This study aims to examine how coastal women respond to these challenges by utilising a community-based religious framework, known as Green Deen, to enhance ecological awareness and foster collective resilience. It explores how women reinterpret Islamic teachings to guide practical adaptation strategies and mobilise their communities in environmentally responsible behaviour. This research adopts a qualitative approach using a Participatory Action Research (PAR) framework, involving approximately 15 coastal women, along with community leaders and local climate-action groups. The PAR design positions these women not merely as informants but as co-researchers who actively shape adaptation initiatives. Data were collected through in-depth interviews, participatory observation, and documentation of community practices. This process enabled participants to articulate their experiences, assess environmental risks, and collaboratively design adaptation strategies rooted in both religious values and local ecological knowledge. The findings show that coastal women move beyond traditional domestic responsibilities and act as agents of ecological transformation. They contribute to climate adaptation through environmental conservation, household-based water and waste management, urban farming, and the revitalisation of cultural practices such as Nyadran. Their spiritual practices—prayer, patience, and theological reflection—serve as coping mechanisms that strengthen emotional resilience and reinforce ecological responsibility. These results demonstrate that faith-based ecological ethics significantly enhance community capacity to address climate risks. This study contributes to the discourse on religion, gender, and ecology by showing how Green Deen operates as both an ethical framework and a practical guide for climate adaptation. It underscores the importance of integrating Islamic values, local ecological knowledge, and participatory approaches into climate adaptation policies, offering a culturally grounded model of resilience for coastal communities.

**Keywords:** adaptation; climate change; coastal women; green deen.

**Abstrak:** Perubahan iklim telah menjadi ancaman serius bagi komunitas pesisir di Pekalongan, di mana degradasi lingkungan, banjir pasang surut, dan penurunan tanah semakin mengganggu kehidupan sehari-hari. Studi ini bertujuan untuk mengkaji bagaimana perempuan pesisir merespons tantangan-tantangan tersebut dengan memanfaatkan kerangka kerja keagamaan berbasis komunitas yang dikenal sebagai *Green Deen*, guna meningkatkan kesadaran ekologi dan memperkuat ketahanan kolektif. Penelitian ini mengeksplorasi bagaimana perempuan menafsirkan ulang ajaran Islam untuk mengarahkan strategi adaptasi praktis dan menggerakkan komunitas mereka dalam perilaku yang bertanggung jawab terhadap lingkungan. Penelitian ini menggunakan pendekatan kualitatif dengan kerangka kerja Penelitian Aksi Partisipatif (PAR), melibatkan sekitar 15 perempuan pesisir, bersama dengan pemimpin komunitas dan kelompok aksi iklim lokal. Desain PAR menempatkan perempuan-perempuan ini bukan hanya sebagai narasumber, tetapi sebagai peneliti bersama yang secara aktif membentuk inisiatif adaptasi. Data dikumpulkan melalui wawancara mendalam, pengamatan partisipatif, dan dokumentasi praktik komunitas. Proses ini memungkinkan peserta untuk mengartikulasikan pengalaman mereka, menilai risiko lingkungan, dan secara kolaboratif merancang strategi adaptasi yang berakar pada nilai-nilai agama dan pengetahuan ekologi lokal. Temuan menunjukkan bahwa perempuan pesisir melampaui tanggung jawab domestik tradisional dan bertindak sebagai agen transformasi ekologi. Mereka berkontribusi pada adaptasi iklim melalui konservasi lingkungan, pengelolaan air dan limbah berbasis rumah tangga, pertanian perkotaan, serta revitalisasi praktik budaya seperti Nyadran. Praktik spiritual mereka—doa, kesabaran, dan refleksi teologis—berfungsi sebagai mekanisme penyesuaian yang memperkuat ketahanan emosional dan memperkuat tanggung jawab ekologi. Hasil ini menunjukkan bahwa etika ekologi berbasis agama secara signifikan meningkatkan kapasitas komunitas dalam menghadapi risiko iklim. Studi ini berkontribusi pada diskursus tentang agama, gender, dan ekologi dengan menunjukkan bagaimana *Green Deen* beroperasi sebagai kerangka etika dan panduan praktis untuk adaptasi iklim. Studi ini menekankan pentingnya mengintegrasikan nilai-nilai Islam, pengetahuan ekologi lokal, dan pendekatan partisipatif ke dalam kebijakan adaptasi iklim, menawarkan model ketahanan yang berakar pada budaya untuk komunitas pesisir.

**Kata kunci:** adaptasi; perubahan iklim; perempuan pesisir; *green deen*.

## 1. Introduction

Climate change poses a global crisis that directly impacts daily life, particularly in Indonesia's northern coastal region. Pekalongan stands among the most vulnerable areas, where communities repeatedly confront ecological disturbances such as floods and tidal surges (Saptiyono, 2025). Rising sea levels intensify these threats each year, and tidal flooding continues to expand into inland districts (Robby, 2024). Land subsidence further worsens the situation. Pekalongan experiences one of the highest subsidence rates on the north coast, sinking by 5–19.5 cm annually (Firmansyah & Rahayua, 2024). This condition erodes livelihoods, reduces arable land, restricts access to clean water, and heightens the socio-economic vulnerability of coastal households.

Government actors often respond with infrastructural solutions, such as seawalls and water pump stations. Authorities built sea walls in Pasir Kencana, Degayu, and Krapyak, and installed pump houses in flood-prone zones (Publikasi, 2022). Pekalongan now depends heavily on these pumps for its daily survival. Yet, behind the imposing sea walls and the constant sound of machine engines, the voices and experiences of coastal women remain largely unheard. These women possess vital ecological knowledge that stems from their lived experiences, cultural agency, and spiritual practices. They stand at the front line of climate adaptation, drawing strength from local wisdom and religious values (OECD, 2021). In many households, women manage resources, organise community responses, and weave ecological practices into religious rituals. However, policy frameworks and academic discourse still marginalise women's contributions to climate adaptation (Adawiah, 2023; Datta & Kairy, 2024).

Scholars have explored the intersection of women and climate change through various lenses. The first group of studies examines gender justice in natural resource management (Bangun, 2020; Bezerra Guimarães, 2023; Ketlhoilwe, 2013; Prasetyo, 2024). These scholars highlight ecofeminist and legal perspectives, demonstrating how women often face double forms of inequality—both socially and in their access to environmental resources. Ecofeminism also positions women as agents who demand justice and equal protection before the law, particularly in environmental governance. A second group of studies investigates women's contributions to sustainable environmental stewardship (Ahmad, 2020; Oktarina & Yulianti, 2022; Ramadhani & Hubeis, 2020; Shodieva, Vakhitova, & Abbazova, 2014). Women, especially in urban areas, design climate adaptation strategies that combine local wisdom, technological innovation, and faith-based ethics. This role aligns with global frameworks such as the UNFCCC and the Paris Agreement, which recognise women as central actors in sustainable development. A third group focuses on indigenous communities and portrays indigenous women as guardians of ecological harmony (Adawiah, 2023; Jasmine, Saharuddin, Murdianto, & Abdulkadir, 2023; Nurlidiawati & Ramadayanti, 2021; Orsatti & Dinale, 2024). These women embed nature within cultural identity and treat environmental protection as a sacred responsibility.

This study fills a gap in the existing literature by examining how coastal women in Pekalongan develop community-based resilience from the grassroots level. It positions them not only as vulnerable actors but as initiators of ecological practices shaped by religious values. In this context, Green Deen serves as both cultural and spiritual capital. It frames Islam as a source of ecological ethics, offering a lens to understand how women reinterpret religious teachings in their daily lives as a form of environmental stewardship (Matin, 2012). Indigenous women embody this ethos because their spiritual identity evolves together with their relationship to the natural world. Their worldview integrates nature into communal survival, making them essential actors in culture-based conservation.

This research argues that climate change is not solely an ecological crisis; it also involves ethical considerations, spiritual perspectives, and human responsibility. Islamic teachings portray humans as *khalifah fil ardh*—a role that conveys ecological guardianship rather than domination. This mandate urges believers to protect creation as part of *tawhid* and *amal salih*, affirming the spiritual link between God, humanity, and the natural environment (Khalid, 2002). As Nasarudin emphasises, worship does not end with ritual acts but requires concrete efforts to safeguard the universe for the common good (Kiky, 2025).

The study uses the Green Deen framework to actualise Islamic ecological ethics through environmental care and collective action. This concept positions nature as a medium of spiritual reflection and ethical responsibility, offering a faith-rooted alternative to secular ecological approaches (Matin, 2012). Within this framework, women act not only as technical implementers but as moral agents who negotiate between community-based adaptation and spiritual consciousness. The study also draws on the theory of community resilience, which explains how communities survive, adapt, and recover from environmental shocks (Adger, 2000). Social cohesion and local solidarity form the core of this resilience, especially in coastal areas exposed to recurrent tidal flooding.

By integrating Green Deen with the concept of community resilience, this research contributes a new theoretical perspective. It demonstrates how faith-based ecological ethics reinforce a community's adaptive capacity and enrich discussions on religion, climate change, and women's agency in Muslim coastal societies. The study, therefore, aims to explore how coastal women in Pekalongan adapt to climate change through practices rooted in Green Deen.

This research employs a qualitative approach using Participatory Action Research (PAR) (Afandi, 2020; Afandi et al., 2022; Anggraeni, 2021). The PAR method empowers coastal women to participate as co-researchers, engaging in collective reflection and designing adaptation strategies that address complex ecological challenges. The fieldwork took place in North Pekalongan, specifically in the villages of Kandang Panjang, Panjang Wetan, and Krapyak. The study involved women's communities, local leaders, climate change working groups, community organisations, and policy actors. Purposive sampling selected around 15 women based on their active involvement in climate adaptation activities.

The study gathered data through in-depth interviews, participatory observation, and document analysis. The interviews captured women's experiences, challenges, and strategies in facing ecological change. Participatory observation allowed the researcher to witness adaptation practices directly, including mangrove planting and community-driven mitigation efforts. Document analysis included working-group reports, local government policy documents, and previous studies on climate change in coastal Pekalongan.

Data analysis followed the PAR cycle, which involved planning actions with coastal women, implementing and monitoring adaptation initiatives, evaluating their outcomes, and conducting collective reflection sessions (Cornish et al., 2023). These stages produced a narrative that reveals women's ecological agency in both technical and spiritual dimensions.

## **2. Results Climate Change Impacts: Social, Economic, and Ecological Conditions of Pekalongan Coastal Communities**

The North Coast (Pantura) of Java, stretching from Merak to Surabaya, is home to dense populations and vibrant economic activities, particularly in trade, fisheries, agriculture, and industry. Despite its strategic position, the Pantura region remains one of the most vulnerable areas to climate change (Hartatik, 2018). Rising sea levels, recurrent tidal flooding, coastal abrasion, and deteriorating sanitation continue to disrupt ecological balance and weaken socio-economic structures. The Pekalongan district and city exemplify how the climate crisis is reshaping the environmental, economic, and social landscapes of coastal communities.

Pekalongan lies in a lowland zone along Java's northern coastline, with elevations between 0 and 6 metres above sea level. North Pekalongan borders the Java Sea directly, which exposes it to frequent tidal floods (rob) (Perkim, 2021). Coastal abrasion has erased entire settlements; Simonet Hamlet in Semut Village, spanning 21 hectares, has disappeared completely beneath the rising sea (Wishnu, 2023). The seven urban villages in North Pekalongan—Panjang Wetan, Panjang Baru, Kandang Panjang, Krapyak, Bandengan, Degayu, and Padukuhan Kraton—face high flood threats across 3,895.449 ha, with 94.103% of the area categorised as at risk (Wijayanti, Wijaya, & Rahmawaty, 2024).

Land subsidence intensifies these hazards each year. Geological Agency data indicate that Pekalongan subsided by 27 cm between March 2020 and March 2025, averaging 5.4 cm per year (Widiyaningrum, 2025). Damage in upstream areas, sea-level rise, and excessive underground water extraction aggravate the situation and affect local livelihoods (Panji, 2022).

Climate change has reshaped migration patterns. Many working-age residents have left in search of better living conditions. One informant explained: "Pesona Residence, Panjang Wetan, used to be an elite area with many residents. Around 150 families lived here, but now only 30 remain. Those who had savings moved to safer districts." (Fauzan, personal communication, March 4, 2025). This rapid decline reflects residents' frustration with chronic flooding, economic disruption, damaged homes, water scarcity, and growing health risks.

Many households have lost their primary livelihoods. Farmers who once depended on fertile fields can no longer cultivate them because saltwater inundation has rendered the land unproductive. An informant recalled: "Six or seven years ago, one hectare produced two tons. After the repeated tidal floods, even 10 kilograms is impossible. Everything is submerged. Replanting costs too much." (Arofah, personal communication, February 28, 2025). Fishermen have faced similar difficulties: "Tidal floods destroyed shrimp and fish ponds. Agricultural land turned into swamps. Even the fish catch at sea isn't like before." (M. Latiful Maruf, personal communication, March 6, 2025).

Environmental degradation appears visibly along the coastline. Seawater inundation causes sedimentation, pollution, and disruption of marine microorganisms, weakening the coastal food chain and reducing fish populations. Abrasion in Panjang Wetan has swept away sandbanks and mangrove trees, removing natural buffers against waves and eliminating important carbon sinks. Abandoned houses, worsening sanitation, and the loss of green spaces now illustrate Pekalongan's ecological decline.

The Pekalongan City Government has attempted to reduce risks by constructing embankments and installing water pumps. Residents of Degayu acknowledged these improvements: “Degayu used to look like the sea because of the constant floods. Thanks to the Susukan River embankment and pump house, the land is now visible again.” (Aini, personal communication, February 29, 2025). A resident of Krapyak shared similar sentiments: “Before the embankment on the Loji River, this area never dried. It stayed flooded day and night. Now, when it rains, the water recedes more quickly.” (Fakhruddin, personal communication, March 15, 2025).

However, climate change presents a complex challenge that infrastructure alone cannot resolve. Physical mitigation measures address only part of the problem. Coastal communities face long-term social, cultural, and environmental pressures that necessitate more comprehensive interventions. Sustainable adaptation requires strengthening community capacity, promoting ecological awareness, and rooting resilience in spiritual and religious values that guide everyday life.

### 3. Coastal Women’s Adaptation Strategy to Climate Change

The ecological knowledge that coastal women possess serves as a source of strength, shaping their identity and strategies for adapting to climate change. Coastal women have long relied on the marine ecosystem to meet their needs, gaining a deep understanding of tidal cycles, fishing seasons, changes in pond salinity, and climate-appropriate vegetation through direct experience (Nunn et al., 2024). This knowledge embodies both social and ecological capital, enabling coastal communities to respond to the impacts of climate change in practical and culturally meaningful ways.

Adaptation efforts initiated by coastal women often arise from their everyday needs. These efforts then develop into forms of collective social strength, especially when women face shared conditions that threaten the security of their families and livelihoods. Women, therefore, work together to identify practical solutions while maintaining the social fabric of their communities. Table 1 illustrates the various strategies coastal women employ to adapt to climate change.

**Table 1.** Coastal Women’s Adaptation Strategy to Climate Change

Coastal Women’s Adaptation Efforts	Forms of Coastal Women’s Adaptation
Modification of Building Infrastructure	Construction of Sea Walls Raising the House Stilt House Model
Environmental Preservation	Water Tanks Waste Management Mangrove Planting
Land Utilisation and Food Security	Urban Farming Green Yard Tilapia Fish Farming

#### *Modification of Building Infrastructure*

Coastal communities that face frequent flooding and tidal surges respond by modifying their building infrastructure. Women encourage their families to raise the foundations of their homes, redesign structures, or adopt stilt-house models so the water does not submerge their living spaces. They carry out this work independently and treat it as a necessary form of mitigation against recurring floods and rob (Sari et al., 2025). Their initiative reflects a conscious response to climate threats that increase sea levels each year.

This response extends beyond residential buildings. Schools in the Krapyak area frequently experience tidal flooding, which impacts the learning process. Women, teachers, and community figures collaborated to design alternative, flood-resistant learning spaces constructed on stilt structures. This strategy not only maintains educational continuity but also symbolises the community's resilience, creativity, and commitment to safeguarding children's learning rights during climate disruptions.

Coastal communities also face serious challenges in accessing clean water and sanitation due to seawater intrusion into household wells. Women, in collaboration with the village government, addressed this problem by initiating the construction of a public toilet equipped with a clean-water tank. The community manages this facility collectively, with each household contributing Rp5,000 per month towards maintenance. This model demonstrates community-based governance and active female participation in managing essential public services.

The adaptation strategies used by Pekalongan's coastal communities demonstrate that technical measures alone do not define climate resilience. Women strengthen adaptation practices through social capital, local innovation, and community collaboration. Their ability to construct stilt houses, maintain sanitation facilities, and organise neighbourhood cooperation reflects a form of structural and social resilience that grows organically from within the community (Purifyningtyas & Wijaya, 2016).

### *Environmental Conservation*

Environmental conservation has become an urgent necessity that coastal women address through a blend of local wisdom, spiritual values, and practical environmental management. They respond directly to the degradation of their surroundings by developing ecological practices rooted in everyday experience and communal responsibility. Through these actions, coastal women position themselves not only as caretakers of their households but also as key actors in sustaining the environmental stability of their communities.

Groups of coastal women frequently organise mangrove planting activities. They engage in every stage of the process—from preparing nurseries to planting and caring for mangroves. They conduct these activities through *gotong royong*, involving various groups within the community. Mangrove planting does more than restore coastlines. It reflects a cultural commitment to protect land, improve marine habitats, and shield settlements from abrasion (Publikasi, 2025a).

Mangrove planting occurs in several locations in North Pekalongan, including Panjang Baru, Panjang Wetan, Kandang Panjang, Bandengan, Degayu, and Krapyak. The Head of the Pekalongan Environmental Agency, Sri Budi Santoso, stated that during World Environment Day, the agency planted 5,000 mangrove and *firiapi* seedlings in North Pekalongan (Publikasi, 2025a). Women actively join these efforts, ensuring that mangrove planting becomes a sustained environmental movement rather than an annual ceremony.



**Figure 2.** Mangrove Nurseries and Planters

Sources: Researcher Documentation

Women also take responsibility for water and sanitation at the household level. In situations where clean water is scarce, they create simple reservoirs from large buckets or plastic drums and place them

in their yards to collect rainwater. They use the harvested water for washing household items, watering plants, and flushing toilets. They also collect greywater from laundry activities, filter it simply, and reuse it for watering plants or cleaning their yards. These creative practices demonstrate women's ability to adapt daily routines to the realities of climate change.

Tidal waves, abrasion, and clean water scarcity are not the only problems coastal women face. Waste—especially plastic—poses an increasingly complex challenge (Publikasi, 2025b). Women must manage waste from their households while also dealing with piles of rubbish that river currents push onto the shore. This pollution disrupts marine ecosystems and interferes with livelihoods such as fishing and aquaculture. Fishermen often complain that plastic waste entangles their nets, reducing their catches.

Women in Panjang Wetan, supported by Kemitraan.id, established a community-based waste management centre. They sort waste into organic and inorganic materials, turning organic waste into compost and sending recyclable waste to a waste bank or using it to create handicrafts. These activities expand beyond household waste collection to include cleaning river mouths and shoreline areas. These efforts reduce pollution while generating economic value for local women's groups (PKK) (Ahmad, 2020).

Environmental conservation for coastal women is not merely a technical task. It emerges from life experiences, faith, and social responsibility. Women are often seen as drivers of change at the community level (Leal & Carreño, 2024). They strengthen the environmental movement through simple but meaningful everyday actions—harvesting rainwater, managing waste, nurturing mangroves, and teaching children to love nature. These initiatives reinforce ecological resilience at the local level while contributing to broader global climate adaptation and mitigation efforts (Leal & Carreño, 2024).

#### *Land Use by Coastal Women for Food Security*

Climate change creates significant challenges for land use in coastal areas. Increased tidal flooding and permanent inundation continue to transform formerly productive agricultural land into unusable wetlands, reducing the community's ability to rely on traditional farming systems. Despite these constraints, coastal women show remarkable ingenuity by converting swampy and waterlogged spaces into productive green areas that support household food security and community resilience.

Urban farming has become an important practice among coastal women who have limited access to agricultural land (Fitriyani & Anggraeni, 2024). Women utilise narrow yards and flood-prone spaces to cultivate vegetables using polybags, vertical planting racks, and small-scale hydroponics. They grow daily kitchen staples such as kangkong, spinach, aubergine, and chilli. Women's community farming groups, such as Kencana Jaya KWT, Pesona Swadaya Hijau, and the Kandang Panjang Community, collectively manage these activities.

Communities also convert permanently flooded wetlands into areas for tilapia farming. With support from Kemitraan.id and simple net-pond technology, women diversify household food sources and income. One informant explained:

"The stocking of tilapia seedlings in 2024 amounted to 3,450 fish. Until early January 2025, we harvested three times: the first harvest yielded 13 kg on October 27, 2024; the second harvest yielded 14 kg on November 17, 2024; and the third harvest yielded 50 kg on January 10, 2025. We sell these to middlemen, TP-PKK orders, and other buyers. Each harvest averages 5–10 kg, with a price of Rp20,000–23,000 per kilogram." (Ipuk, personal communication, March 15, 2025)

Women further increase value by selling cleaned and seasoned fish ready for cooking, which commands a higher price. These activities show that coastal women can convert environmental limitations into sustainable opportunities through local knowledge and collective initiative. More importantly, coastal women increasingly recognise climate change as a challenge deeply embedded in their everyday lives. Through lived experience, they design adaptation strategies that remain efficient, contextual, and sustainable.



**Figure 4.** Utilization of Swamp into Productive Land

Sources: Researcher Documentation

#### 4. Spiritual-Cultural Dimension in Adaptation

##### *Traditional Practices (Nyadran)*

The Nyadran or sea-alms tradition, preserved by coastal communities in Pekalongan, reflects a form of ecological spirituality—religious practice intertwined with environmental stewardship. Nyadran expresses gratitude for the sustenance fishermen obtain from the sea and includes prayers for continuous abundance and protection while working at sea. Fishermen believe that when they show kindness and respect to the spiritual guardians of the sea, the sea will, in turn, treat them kindly by offering safety and sufficient harvests (Afriansyah & Sukmayadi, 2022).

In Pasir Kencana, the Nyadran ritual begins with communal recitation on the evening before the offering is taken to the sea. The recitation includes tahlil and the communal sharing of tumpeng. Women play a central role by preparing the tumpengan and various foods that will later be delivered to the sea in the main Nyadran procession. This tradition reflects the spiritual worldview of Pekalongan's coastal communities, who see the sea as a locus of divine blessing and livelihood, and who express their gratitude to God through ceremonial offerings (Anggraeni, Hadiyanto, & Hakam, 2023). At the same time, Nyadran embodies cultural values that families must preserve and pass on to future generations, ensuring they continue to protect the environment, maintain marine ecosystems, and nurture communal harmony.

Coastal women interpret these spiritual practices as integral components of climate change adaptation. Prayer, moral values, and tradition form the psychological and social foundations that help them withstand ecological crises. Ecological spirituality fosters an awareness that nature is a divine trust (*amanah*) that must be cared for responsibly.

##### *Prayer and Patience as Coping Mechanisms*

The coastal communities of Pekalongan cultivate an awareness that every event unfolds within God's decree. This spirituality becomes a rational foundation that strengthens their ability to endure difficulties. They live out this awareness in daily routines. When tidal conditions threaten their fishing activities, fishermen still go to sea because they believe that God has arranged their lifespan and sustenance; their responsibility is to make an effort, while women pray for the safety of their husbands at sea. Women understand ecological disasters as tests that demand patience and steadfastness. As one informant explained:

“Everything that happens in this universe relates to what humans plant. The current condition comes from God, who is testing His servants; therefore, we must remain patient and steadfast. Our duty is to pray to God and continue to strive. (Utari, personal communication, March 5, 2025).

This awareness strengthens their emotional resilience and prevents them from directing blame outward. Instead, it anchors them in hope and persistence amidst recurring hardships (Nunn et al., 2024). Prayer becomes more than ritual—it functions as a daily ecological ethic. Before fishermen go to

sea, they recite prayers for protection, which deepens their awareness of the sea as God's creation. Through this synthesis of faith and practice, women develop a spiritual coping strategy that reinforces both psychological endurance and environmental responsibility.

## 5. Green Deen Framework in Practice

### *Application of The Green Deen in Everyday Life*

Global climate change demands approaches that emphasise spiritual depth and religious values to cultivate sustained ecological awareness. One ecological consciousness deeply rooted among coastal women in Pekalongan derives from the concept of Green Deen. This Islamic eco-spiritual ethos highlights the obligation to protect the earth as a divine mandate. Green Deen frames environmental care as part of religious commitment and spiritual responsibility, positioning humans as *khalifah* (stewards) who must maintain the earth with trust and integrity (Matin, 2012).

Through their domestic and social roles, women deal directly with nature (Nurlidiawati & Ramadayanti, 2021). They manage water, food, and household waste, while also teaching environmental ethics to children and the community. Their ecological actions do not arise merely from technical considerations, but from a moral consciousness rooted in obedience to God. Qur'anic commands—to avoid causing earth damage (QS. Al-A'raf: 56), maintain balance (QS. Ar-Rahman: 7–9), and cultivate the earth in trust (QS. Hud: 61)—serve as ethical foundations for their environmental efforts. Women cite these verses as motivation for practicing urban farming, managing organic waste, and preserving local traditions, such as Nyadran, which are rooted in spiritual and ecological values.

Green Deen empowers women to strengthen their identity as guardians of life and natural ecosystems. It shapes a collective awareness that protecting the environment is not only a social duty but also a form of worship and an expression of piety (Rahman, 2020). (With this ethical grounding, coastal women take active roles in grassroots climate adaptation and build resilience within their communities. They use Green Deen to guide daily decisions, mobilise neighbours, and pass down ecotheological values to younger generations through religious gatherings, storytelling, and practical demonstrations.

Pekalongan's coastal women articulate an ecological consciousness that develops organically from their faith. They interpret climate change and environmental degradation as divine reminders prompted by human negligence in fulfilling their role as *khalifah fil ardh*. Green Deen becomes a moral identity that shapes their daily interactions with the environment. Table 2 shows how coastal women apply these principles in practice.

**Table 2.** The Application of Green Deen Principles

Prinsip Green Deen	Practice in Daily Life
Tawhid, Understanding the Oneness of God and the Greatness of His Words	Coastal women love and protect nature as part of worship to God; treat the sea, plants, and animals as God's creation that must be respected.
Ayat, seeing the signs of God's Essence	Observing weather changes, the rise and fall of sea tides, and plant cycles as a form of contemplation of the greatness and orderliness of His creation.
Caliph, being a guardian who prospers the earth	Coastal women conserve the environment by planting mangroves to prevent abrasion, cultivating yards into family food land (urban farming), and managing household waste independently.

Amanah, keeping the trust given by God	Avoiding waste disposal into rivers and seas is a form of moral and spiritual responsibility.
Adl, fighting for justice for all inhabitants of the earth	Initiating a community of women who care about the environment, fighting for ecological justice by rejecting industrial practices that damage the ecosystem
Mizan, maintaining balance in life between humans and nature	Planting and maintaining trees to maintain the balance of the ecosystem, and not overexploiting the sea, so that the balance of nature is maintained.

Coastal communities treat these six principles as a practical ethic guiding everyday behaviour. These values help them understand environmental challenges not simply as natural disasters but as spiritual tests that demand ethical and ecological responsibility. Religion thus provides moral strength that motivates coastal women to protect the environment (Nur Aulia, M. Jasin, Anggraeni, Mardhiah, & Hadiyanto, 2020). Their awareness continues to evolve as they reflect on their experiences and develop new ways to adapt to ecological change. These practices show that Islamic teachings can harmonise with ecological consciousness, forming a grassroots model of women's environmental stewardship.

#### *Integration of Faith and Environmental Action*

Women in coastal Pekalongan demonstrate strong ecological agency by integrating faith with environmental practice. They organise mangrove planting as a form of "tree alms" (*sedekah pohon*), treating each tree as continuous charity (*amal jariyah*) that benefits future generations by restoring biodiversity and protecting coastlines. Their beach clean-up activities serve not only civic needs but also spiritual aspirations, ensuring communal well-being and ecological balance. Religious study groups and women's circles integrate Islamic learning with environmental education, cultivating a grassroots movement of sustainable, faith-based activism.

Women see environmental protection as a religious expression rather than a technical task. Their love for the sea and coastal ecosystems stems from their belief that these are divine creations they must safeguard. It echoes Prianto et al. (2021), who explain that Islam frames the human–nature relationship through tawhid, whereby excessive exploitation is considered a spiritual wrongdoing. Coastal women read signs of nature—tides, weather, planting cycles—not only for practical decisions but as contemplation of God's orderly creation. It aligns with Koehrsen's idea that religion functions as a cognitive tool through which communities interpret ecological phenomena, encouraging innovation in adaptation (Koehrsen, 2018)

As chaliphs, women actively plant mangroves, cultivate home yards, and practise small-scale urban farming to secure food supplies. These actions demonstrate their role as ecological agents in faith-based movements (Carroll, 2022). They embody the principle of adl (justice) by opposing industrial pollution and demanding ecological fairness, framing environmental degradation as a justice crisis requiring moral transformation (Haris, Widodo, Tantri, & Sarah, 2024).

### *Women as Moral-Ecological Leaders*

Green Deen evolves from theological doctrine into a communal ethos that unites faith, action, and environmental care. This framework empowers women to serve as ecological leaders within their communities (Diemberger, 2025). Through *majelis taklim*, recitation forums, and women's organisations, they transmit Qur'anic and Hadith-based ecological ethics that emphasise stewardship, balance, and responsibility. They contextualise these teachings into concrete strategies for climate adaptation at the grassroots level.

This integration of religious discourse with environmental activism positions women as moral-ecological agents who influence community norms and inspire intergenerational awareness. These dynamics strengthen social cohesion and resilience in climate-vulnerable settings. Research by Tiwari and Sunny (2024) affirms that religiously driven environmental movements—especially those led by women—significantly enhance community resilience and embed ecological ethics into local culture. Thus, the coastal women of Pekalongan demonstrate how grassroots religiosity can foster transformative ecological practice, offering a replicable model for regions facing climate challenges. Religion, therefore, functions not only as normative guidance but also as a form of cultural capital that drives grassroots environmental movements.

## **6. Discussion: Green Deen, Gender, and Community Resilience in Coastal Pekalongan**

The findings show that coastal women in Pekalongan contribute significantly to climate adaptation through technical, social, and spiritual strategies that respond directly to environmental degradation. They modify housing structures, manage water and waste, cultivate urban farming systems, and engage in community projects such as mangrove planting. At the same time, they rely on spiritual and cultural practices—including Nyadran, prayer, and ecological interpretations of Islamic teachings—to strengthen emotional resilience and collective identity. These results reveal a multidimensional form of adaptation that combines ecological knowledge, domestic responsibility, and religious consciousness.

When compared with previous studies, the findings align with broader global patterns of gendered climate adaptation. Research in Indonesia, Bangladesh, and the Indian Sundarbans shows that women manage household resources, sustain food security, develop innovations under pressure, and utilise Traditional Ecological Knowledge (TEK) to respond to environmental shifts (Abikoye & Abikoye, 2025; Danugroho, Rustinsyah, Adib, & Idris, 2025; Khalil, Jacobs, McKenna, & Kuruppu, 2020; Raha, Sen, & Biswas, 2025; Setiawan et al., 2025; Swarnokar, Mou, Sharmi, Iftikhar, & Jesmin, 2025; Velmurugan, Swarnam, Subramani, Meena, & Kaledhonkar, 2020). Studies on gendered vulnerability also confirm that women face higher risks due to caregiving roles and limited access to decision-making processes (Anjum & Aziz, 2025; Riviwanto & Basuki, 2019). However, this study adds a distinctive dimension by demonstrating how Islamic ecological ethics—articulated through Green Deen (Matin, 2012)—offer spiritual motivation that strengthens women's adaptive capacity. This contribution expands the literature on ecofeminism, religion, and climate resilience by showing how faith-based frameworks operate at the grassroots level in Muslim coastal communities.

Reflecting on the findings, the women's strategies signify more than technical adaptation; they symbolise a deeper shift in how communities understand climate change. Women interpret coastal degradation as both ecological disruption and spiritual warning. This belief strengthens moral responsibility and situates environmental stewardship as an expression of worship, in line with Qur'anic ethics on avoiding destruction (QS. Al-A'raf: 56), maintaining balance (QS. Ar-Rahman: 7–9), and fulfilling the amanah of khalifah fil ardh (QS. Hud: 61). Their actions echo the view that spirituality shapes meaning-making and behavioural transformation in times of crisis (Nunn et al., 2024), which aligns with Green Deen's principle that ecological responsibility flows directly from the oneness of God, moral accountability, and justice (Matin, 2012; Rahman, 2020). This framing transforms daily environmental practices—such as urban farming, waste sorting, mangrove planting, and water conservation—into acts of piety and ethical consciousness.

The implications of these findings are substantial. Coastal adaptation requires more than infrastructural interventions; it depends on communities that sustain ecological care through shared values and moral commitments. Women become moral-ecological leaders whose domestic activities evolve into community environmental stewardship. Their initiatives strengthen social cohesion, collective identity, and intergenerational knowledge, echoing global research that identifies women's leadership as crucial for community resilience (Aipira, Kidd, & Morioka, 2017; Diemberger, 2025; Tiwari & Sunny, 2024). By grounding ecological action in Islamic ethics, Green Deen becomes a practical guide that transforms religious belief into environmental action. This positions women not only as vulnerable groups but as strategic actors capable of driving sustainable adaptation.

Understanding why these results emerge requires attention to the lived realities of Pekalongan's coastal ecology. Women bear the brunt of the consequences of rising tides, land subsidence, contaminated water, and the loss of their livelihoods. Their domestic roles compel them to act quickly and creatively to secure food, water, and safety for their families. Their social and religious responsibilities strengthen their sense of duty, producing psychological resilience rooted in tawakkul, patience, and communal solidarity. Because formal climate policies often exclude women, as noted in climate policy analyses (Aipira et al., 2017; Anjum & Aziz, 2025), women build informal, community-based systems that compensate for institutional gaps. The integration of spirituality, cultural practice, and ecological action, therefore, emerges naturally from the socio-religious fabric of coastal life.

Moving forward, several actionable steps become clear. Policymakers should incorporate gender-responsive and faith-based approaches into coastal adaptation strategies, recognizing women's ecological expertise and their crucial role in maintaining community resilience. Local governments should expand support for women's environmental groups by improving access to resources, climate information, and decision-making platforms. Religious leaders and community educators can strengthen ecological ethics within majelis taklim, Qur'anic study circles, and women's organisations by embedding Green Deen principles in learning materials. NGOs working in resilience-building need to integrate spiritual and cultural perspectives into their programs rather than relying solely on technical interventions. Future research should investigate the long-term effects of faith-based ecological practices on disaster risk reduction to develop a more comprehensive model of community resilience in Muslim coastal regions.

## 7. Conclusions

This study shows that coastal women hold a strategic and significant role in addressing climate change. Through grassroots initiatives and the internalisation of Islamic values, coastal women in Pekalongan emerge as transformative actors who build socially rooted ecosystems oriented towards environmental preservation. They do more than implement adaptive practices; they also serve as agents of social change, nurturing collective ecological consciousness. These findings demonstrate that religion and women are not merely components of critical narratives but also vital sources of sustainable solutions to climate-related challenges.

Using a Participatory Action Research (PAR) approach, the study reveals that women's contributions extend far beyond reactive responses to environmental impacts. They take proactive steps to cultivate shared awareness and practise Green Deen—an ethical and spiritual approach that integrates faith with environmental stewardship. The research confirms that women in the coastal areas of Pekalongan are not passive victims of climate change, but rather key actors in community-based adaptation movements. This shift underscores the reality that women are not secondary figures within their communities; they are essential elements in strengthening socio-ecological resilience. From domestic settings to public spheres, they demonstrate that traditional roles do not need to be abandoned but can evolve into powerful drivers of change.

Academically, this study enriches the discourse on gender, religion, and ecology, particularly within coastal contexts. First, it broadens theoretical understanding by demonstrating that coastal women are not simply a vulnerable group or victims of the climate crisis; they are strategic actors who actively shape the socio-ecological resilience of their communities. Second, the study introduces Green

Deen as an ethical and spiritual framework that integrates Islamic values with ecological concerns. Through this, the research contributes to the broader discussion on religion and ecology by demonstrating how Green Deen serves as both an ethical foundation and a practical guide for climate adaptation.

However, this research carries several limitations. Its geographical focus remains limited to the coastal region of Pekalongan, and it does not yet examine in depth the direct impact of Green Deen practices on disaster risk reduction or on the systematic strengthening of community adaptive capacity. These limitations highlight the need for further studies that investigate the effectiveness of Green Deen in mitigating climate-related risks and enhancing long-term community resilience more comprehensively.

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## References

- Abikoye, O., & Abikoye, A. (2025). Marine policy and community engagement: rethinking the role of vulnerable groups in climate and ocean action on Lagos' Atlantic Coast, Nigeria. *Marine Policy*, 182. <https://doi.org/10.1016/j.marpol.2025.106850>
- Adawiah, R. (2023). Protecting Nature: Religious Ecofeminism in Indigenous Women's Movements. *Wawasan: Jurnal Ilmiah Agama Dan Sosial Budaya*, 8(2), 113–124. <https://doi.org/10.15575/jw.v8i2.26155>
- Adger, W. Neil. (2000). Social and ecological resilience: are they related? *Progress in Human Geography*, 24(3), 347–364. <https://doi.org/10.1191/030913200701540465>
- Afandi, A. (2020). Participatory action research (PAR) metodologi alternatif riset dan pengabdian kepada masyarakat transformatif. *Workshop Pengabdian Berbasis Riset Di LP2M UIN Maulana Malik Ibrahim Malang*, 53(9), 1689–1699.
- Afandi, A., Laily, N. L., Wahyudi, N., Umam, M. H., Kambau, R. A., Rahman, S. A., ... Wahid, M. (2022). *Metodologi Pengabdian Masyarakat* (I; A. Suwendi, A. Basir, & J. Wahyudi, Eds.). Jakarta: Ditjen Pendis Kemenag RI.
- Afriansyah, A., & Sukmayadi, T. (2022). Nilai Kearifan Lokal Tradisi Sedekah Laut dalam Meningkatkan Semangat Gotong Royong Masyarakat Pesisir Pantai Pelabuhan Ratu. *Jurnal Penelitian Ilmu-Ilmu Sosial*, 3(1), 38–54. <https://doi.org/10.23917/sosial.v3i1.549>
- Ahmad, M. (2020). Urban Women, Their Religion, and Response to Environmental Crisis: Empirical Evidence in Green School and Majelis Taklim Ulin Nuha. *Muwazah Jurnal Kajian Gender*, 12(1), 33–52. <https://doi.org/10.28918/muwazah.v12i1.8575>
- Aipira, C., Kidd, A., & Morioka, K. (2017). Climate Change Adaptation in Pacific Countries: Fostering Resilience Through Gender Equality. *Climate Change Management*, 225 – 239. [https://doi.org/10.1007/978-3-319-50094-2\\_13](https://doi.org/10.1007/978-3-319-50094-2_13)
- Anggraeni, D. (2021). *Buku Pedoman KKN Berbasis PAR*. Banten: BBC.
- Anggraeni, D., Hadiyanto, A., & Hakam, A. (2023). Multicultural Islamic Religious Education Based on Local Wisdom: The Analysis of "SILAS" Values in Sundanese Culture. *Indonesian Journal of Islamic Education Studies (IJIES)*, 6(1), 93–108. <https://doi.org/https://doi.org/10.33367/ijies.v6i1.3649>
- Anjum, G., & Aziz, M. (2025). Climate change and gendered vulnerability: A systematic review of women's health. *Women's Health*, 21. <https://doi.org/10.1177/17455057251323645>
- Bangun, B. H. (2020). Ecofeminism and Environmental Protection: A Legal Perspective. *Jambe Law Journal*, 3(1 SE-Articles), 1–18. <https://doi.org/10.22437/jlj.3.1.1-18>
- Bezerra Guimarães, V. M. (2023). Ecofeminism, rights of nature and climate justice: relational webs and planetary restoration. *Simbiótica Revista Eletrônica*, 10(3), 15–30. <https://doi.org/10.47456/simbitica.v10i3.41072>
- Carroll, S. (2022). Climate change, faith and theology in the Pacific (Oceania): the role of faith in building resilient communities. *Practical Theology*, 15(5), 409–419. <https://doi.org/10.1080/1756073X.2022.2097978>
- Cornish, F., Breton, N., Moreno-Tabarez, U., Delgado, J., Rua, M., de-Graft Aikins, A., & Hodgetts, D. (2023). Participatory action research. *Nature Reviews Methods Primers*, 3(1), 34–44. <https://doi.org/10.1038/s43586-023-00214-1>

- Danugroho, A., Rustinsyah, R., Adib, M., & Idris, U. (2025). Climate adaptation and livelihood strategies in the Madurese community of Sumenep, Indonesia. *Development in Practice*.  
<https://doi.org/10.1080/09614524.2025.2551852>
- Datta, R., & Kairy, B. (2024). Decolonizing Climate Change Adaptations from Indigenous Perspectives: Learning Reflections from Munda Indigenous Communities, Coastal Areas in Bangladesh. *Sustainability*, Vol. 16, pp. 769–775. <https://doi.org/10.3390/su16020769>
- Diemberger, H. (2025). A Historical Case Study in Women-Led Socio-Ecological Innovation: How Gender and Environment Came to Matter in 15th-Century Tibet (and Now). In *The Routledge International Handbook of Himalayan Environments, Development and Wellbeing* (pp. 44–57). <https://doi.org/10.4324/9781003450894-6>
- Firmansyah, R., & Rahayua, S. (2024). Pemodelan Banjir Rob di Kota Pekalongan. *Ruang*, 10(1), 48–59. <https://doi.org/https://doi.org/10.14710/ruang.10.1.48-59>
- Fitriyani, F., & Anggraeni, D. (2024). Optimalisasi Ketahanan Pangan Desa Rowolaku Melalui Pemberdayaan Tim Penggerak PKK dalam Program Kebun Gizi. *Jurnal Pengabdian Masyarakat Bangsa*, 2(7), 2808–2817. <https://doi.org/https://doi.org/10.59837/jpmmba.v2i7.1338>
- Haris, A., Widodo, A., Tantri, I. D., & Sarah, S. (2024). Eco-Maqāsid in Climate Change Campaigns: From an Ecolinguistics Study to the Philosophy of Islamic Law. *Al-Manahij: Jurnal Kajian Hukum Islam*, 18(2), 219–236. <https://doi.org/10.24090/mnh.v18i2.10652>
- Hartatik, E. S. (2018). *Dua Abad Jalan Raya Pantura: Sejak Era Kerajaan Mataram Islam hingga Orde Baru*. Yogyakarta: Nurmahera.
- Jasmine, L. F., Saharuddin, Murdianto, & Abdulkadir, M. (2023). Perilaku Masyarakat Adat terhadap Kearifan Lokal dalam Pengelolaan Sumber Daya Alam (Kasus: Masyarakat Adat Baduy). *Jurnal Sains Komunikasi Dan Pengembangan Masyarakat [JSKPM]*, 7(2), 249–265. <https://doi.org/10.29244/jskpm.v7i2.951>
- Kethoilwe, M. J. (2013). Improving resilience to protect women against adverse effects of climate change. *Climate and Development*, 5(2), 153–159. <https://doi.org/10.1080/17565529.2013.789788>
- Khalid, F. M. (2002). Islam and the Environment. In *Encyclopedia of Global Environmental Change* (pp. 332–339). Chichester: John Wiley & Sons, Ltd.
- Khalil, M. B., Jacobs, B. C., McKenna, K., & Kuruppu, N. (2020). Female contribution to grassroots innovation for climate change adaptation in Bangladesh. *Climate and Development*, 12(7), 664 – 676. <https://doi.org/10.1080/17565529.2019.1676188>
- Kiky, K. (2025). Menag Minta Ekoteologi dan Pelestarian Alam Masuk Kurikulum Pendidikan Agama.
- Koehrsen, J. (2018). Religious agency in sustainability transitions: Between experimentation, upscaling, and regime support. *Environmental Innovation and Societal Transitions*, 27(June), 4–15. <https://doi.org/10.1016/j.eist.2017.09.003>
- Leal, K. L. R., & Carreño, J. N. (2024). Indigenous Women and Climate Change in the Colombian Amazon. In V. (Vicky) Demos & M. T. Segal (Eds.), *People, Spaces and Places in Gendered Environments* (pp. 123–143). Emerald Publishing Limited. <https://doi.org/10.1108/S1529-212620240000034008>
- Matin, I. A. (2012). *Greendeen: Inspirasi Islam dalam Menjaga dan Mengelola Alam* (Aisyah, Ed.). Jakarta: Zaman.
- Nunn, P. D., Kumar, R., Barrowman, H. M., Chambers, L., Fifita, L., Gegeo, D., ... Waiwai, M. (2024). Traditional knowledge for climate resilience in the Pacific Islands. *Wiley Interdisciplinary Reviews: Climate Change*, 15(4), 1–25. <https://doi.org/10.1002/wcc.882>
- Nur Aulia, R., M. Jasin, F., Anggraeni, D., Mardhiah, I., & Hadiyanto, A. (2020). Environmental Management Model in Coastal Area (Case Study of Ekopesantren al-Khairat Palu Sulawesi Tengah). *International Conference on Global Resource Conservation (ICGRC)*. Malang: International Conference Partner. <https://doi.org/10.11594/nstp.2019.0301>
- Nurlidiawati, & Ramadayanti. (2021). Peranan Kearifan Lokal (Local Wisdom) dalam Menjaga Keseimbangan Alam (Cerminan Masyarakat Adat Ammatoa di Kajang). *Al-Hikmah*, 23(1), 40–53. <https://doi.org/10.24252/al-hikmah.v23i1.21726>
- Oktarina, T. N., & Yulianti, A. (2022). The Role of Women in Sustainable Development and Environmental Protection: A Discourse of Ecofeminism in Indonesia. *Indonesian Journal of Environmental Law and Sustainable Development*, 1(2), 107–138. <https://doi.org/10.15294/ijel.v1i2.58137>
- Orsatti, J., & Dinale, D. (2024). Livelihoods, work, women and climate change: women’s voice in just transition. *Labour and Industry*, 34(1), 27–49. <https://doi.org/10.1080/10301763.2024.2363598>
- Panji, T. (2022). Kota Pekalongan Kian Tenggelam.
- Perkim. (2021). PKP Kota Pekalongan.
- Prasetyo, E. (2024). Ecofeminism in Indonesian Environmental Law : Gender Equality for Sustainable Natural Resource. *SPECTRUM: Journal of Gender and Children Studies*, 4(2), 111–123. <https://doi.org/https://doi.org/10.30984/spectrum.v4i2.1185>

- Prianto, A. L., Nurmandi, A., Qodir, Z., & Jubba, H. (2021). Climate change and religion: from ethics to sustainability action. *E3S Web of Conferences*, 277. <https://doi.org/10.1051/e3sconf/202127706011>
- Publikasi, T. K. (2025a). Aksi Serentak Peringatan Hari Lingkungan Hidup Sedunia 2025, Kota Pekalongan Tanam Ribuan Bibit Mangrove.
- Publikasi, T. K. (2025b). Darurat Sampah di Kota Pekalongan, Pemkot Siapkan Percepatan Penyediaan Sarpras Non TPA.
- Purifyningtyas, H. Q., & Wijaya, H. B. (2016). Kajian Kapasitas Adaptasi Masyarakat Pesisir Pekalongan terhadap Kerentanan Banjir Rob. *Jurnal Wilayah Dan Lingkungan*, 4(2), 81–94. <https://doi.org/10.14710/jwl.4.2.81-94>
- Raha, P., Sen, A., & Biswas, D. (2025). Understanding 'Gendered' Impacts of Climate Change and the Role of Women in Adaptation: Evidence from the Indian Sundarbans. *Springer Climate, Part F644*, 105 – 121. [https://doi.org/10.1007/978-3-031-90236-9\\_6](https://doi.org/10.1007/978-3-031-90236-9_6)
- Rahman, T. (2020). *Konsep Green Deen (Agama Hijau) Perspektif Ibrahim Abdul-Matin (Studi Tafsir Ekologi Ayat-ayat Al-Quran)*. UIN Sunan Ampel Surabaya.
- Ramadhani, F. P., & Hubeis, A. V. S. (2020). Analisis Gender dalam Upaya Adaptasi dan Mitigasi Perubahan Iklim. *Jurnal Sains Komunikasi dan Pengembangan Masyarakat [JSKPM]*, 4(2), 155–166. <https://doi.org/10.29244/jskpm.4.2.155-166>
- Riviwanto, M., & Basuki, A. (2019). The role of gender as a model of climate change adaptation in fisherman settlement communities. *IOP Conference Series: Earth and Environmental Science*, 314(1). <https://doi.org/10.1088/1755-1315/314/1/012086>
- Robby, B. (2024). Banjir Rob di Pekalongan Meluas, 89 Orang Mengungsi.
- Saptiyono, D. (2025). Dalam Sehari Dua Kali Air Rob Melimpas ke Pemukiman Kawasan Pabean, Kota Pekalongan.
- Sari, S. R., Muhammad, F., Hilmy, M. F., Indrosaptono, D., Arsitektur, D., Teknik, F., ... Soedharto, J. P. H. (2025). Climate Change Adaptive Residential Design in The Coastal City of Pekalongan. *Jurnal Permukiman*, 20(1), 22–31. <https://doi.org/https://doi.org/10.31815/jp.2025.20.22-31>
- Setiawan, H. H., Susantyo, B., Irmayani, N. R., Habibullah, Ganti, M., Abdullah, ... Aldyan, R. A. (2025). Women's Resilience in Adapting to Climate Change on the North Coast of Java Island, Indonesia. *Springer Climate, Part F644*, 377 – 396. [https://doi.org/10.1007/978-3-031-90236-9\\_19](https://doi.org/10.1007/978-3-031-90236-9_19)
- Shodieva, D., Vakhitova, N., & Abbazova, L. (2014). Promoting Women's Capacity Building to Adapt to Climate Change in Uzbekistan. *Asian Journal of Women's Studies*, 20(3), 132–144. <https://doi.org/10.1080/12259276.2014.11666194>
- Swarnokar, S. C., Mou, S. I., Sharmi, S. D., Iftikhar, A., & Jesmin, S. (2025). Climate-induced risks, adaptation, and mitigation responses: a comparative study on climate-stressed coastal communities. *Frontiers in Climate*, 7. <https://doi.org/10.3389/fclim.2025.1553579>
- Tiwari, C., & Sunny, A. (2024). To the Ones Who Listen to the Mountains: Evaluating the Role of Traditional Ecological Knowledge in Conservation Efforts in the Himalayas. In *Advances in Asian Human-Environmental Research* (Vol. 2024, pp. 3–22). [https://doi.org/10.1007/978-3-031-51696-2\\_1](https://doi.org/10.1007/978-3-031-51696-2_1)
- Velmurugan, A., Swarnam, P., Subramani, T., Meena, B., & Kaledhonkar, M. J. (2020). Water demand and salinity. *Desalination-Challenges and Opportunities*, 10. <https://doi.org/10.5772/intechopen.88095>
- Widiyaningrum, R. (2025). Waspada, Penurunan Muka Tanah Pantura Jawa Kian Nyata.
- Wijayanti, R. P., Wijaya, A. P., & Rahmawaty, M. A. (2024). Pemetaan Ancaman Bencana Banjir di Kota Pekalongan Menggunakan Analytical Hierarchy Process(AHP). *Jurnal Geodesi Undip*, 13(1), 591–600. <https://doi.org/https://doi.org/10.14710/jgundip.2024.44985>
- Wishnu, W. (2023). Ditelan Abrasi, Permukiman 96 KK Dusun Simonet Pekalongan Resmi Hilang dari Peta.



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