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## Highlights of Science

Article

# From Blue Economy to Blue Justice: Ensuring Inclusive Sustainability in Rawa Pening's Resource Utilization

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**Abstract** Rawa Pening, a crucial wetland ecosystem in Central Java, Indonesia, is facing significant challenges due to environmental degradation and resource overexploitation. While efforts under the blue economy and blue growth concepts have been implemented to enhance the region's economic potential, these approaches have often led to socio-economic inequalities and ecological damage. This study aims to analyze the failures of blue economy and blue growth in managing Rawa Pening's natural resources and to explore the application of blue justice as a more inclusive and sustainable alternative. Utilizing in-depth interviews with 50 local stakeholders, including fishers, farmers, and water hyacinth harvesters, the research investigates issues such as unequal resource access, limited community participation, and the ecological impact of current management practices. The findings highlight the importance of adopting blue justice principles to ensure fair distribution of resources, empower marginalized communities, and promote environmental sustainability. This research suggests that integrating blue justice into Rawa Pening's resource management could offer a pathway for achieving both ecological restoration and social equity, addressing the shortcomings of previous development models.

**Keywords** Rawa Pening; blue economy; blue growth; blue justice; resource management; sustainability

## 1. Introduction

The discourse on the blue economy emerged as an effort to reposition aquatic ecosystems, including oceans, lakes, and wetlands, as foundations for economic development, employment creation, and food security. Over time, this discourse has increasingly converged with the logic of blue growth, which prioritizes industrial expansion, tourism development, and resource-intensive innovations across maritime and freshwater sectors [1,2]. While these approaches promise economic prosperity, critical scholarship has demonstrated that they often reproduce patterns of resource commodification, spatial exclusion, and social marginalization, particularly among communities whose livelihoods depend directly on aquatic ecosystems [3].

These contradictions have stimulated the emergence of the concept of blue justice, which foregrounds questions of equity, recognition, and participation in aquatic resource governance. Rather than assuming that economic growth automatically translates into social well-being, blue justice interrogates who benefits from blue economy initiatives and who bears their associated social and ecological costs. Bennett et al. (2021) [4] identify a range of injustices associated with blue economy and blue growth interventions, including restricted access to resources, marginalization of women and Indigenous communities, epistemic injustice arising from the devaluation of local knowledge, and unequal distribution of economic and environmental costs. Building on these critiques, blue justice emphasizes recognition, procedural, and distributional justice as essential conditions for achieving socially legitimate and ecologically sustainable aquatic development.

Recent scholarship has further problematized the tendency to treat blue economy and blue growth as conceptually distinct or normatively opposed. Critics argue that the blue economy discourse often already presupposes growth-oriented development trajectories and therefore risks reproducing the same inequities associated with blue growth when justice considerations are not explicitly embedded [5,6]. From this perspective, blue justice should not be viewed as a

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complementary ethical add-on, but rather as a critical framework for evaluating and reshaping blue economy practices across both marine and freshwater contexts.

Within this broader debate, freshwater systems, particularly lakes and wetlands, remain underexplored despite their central role in sustaining local livelihoods and regional economies. Lakes function not only as ecological infrastructures that provide water regulation, food production, and climate regulation, but also as social and cultural spaces in which multiple livelihood practices intersect [7,8]. When lake governance is dominated by technocratic or growth-oriented approaches, these systems become especially vulnerable to ecological degradation and social exclusion.

Rawa Pening, a natural lake and wetland system located in Central Java, Indonesia, exemplifies these challenges. The lake supports a range of blue economy activities, including small-scale fisheries, rice farming, water hyacinth harvesting and handicrafts, tourism, and sand extraction. For decades, Rawa Pening has served as a critical livelihood base for surrounding communities. However, intensified resource exploitation, sedimentation, nutrient loading, and upstream land-use change have pushed the lake into a hypereutrophic state, significantly reducing its ecological carrying capacity [4,9]. In response, government-led revitalization programs, such as dredging and large-scale water hyacinth removal, have prioritized ecological restoration and economic efficiency, often without adequate recognition of local knowledge or meaningful participation by resource-dependent communities.

As a result, interventions framed under blue economy and blue growth logics have generated new forms of social tension. These include restricted access to fishing grounds, loss of income for water hyacinth harvesters, and uneven distribution of benefits among different resource user groups. Such dynamics raise critical questions about justice in freshwater governance and highlight the limitations of growth-oriented management approaches when applied to socially embedded ecosystems such as Rawa Pening.

This study examines the governance of Rawa Pening through the lens of blue justice by asking how and why blue economy and blue growth approaches have failed to address social and ecological inequalities in lake management. It further explores the potential of blue justice as a more inclusive and sustainable framework for freshwater resource governance. By foregrounding community experiences in a lake-based context, this study contributes empirical insight to ongoing debates on blue justice beyond marine and coastal settings.

### 1.1. Blue Justice in the Context of Blue Economy and Blue Growth

Blue economy and blue growth are frequently used to describe sustainability-oriented approaches to the management of aquatic and marine resources, emphasizing economic development alongside environmental stewardship [1,2,10]. Within policy discourse, the blue economy is often framed as a strategy for promoting efficient resource use while ensuring that economic benefits are shared broadly across society. This framing has been widely adopted to support the development of sectors such as fisheries, tourism, and marine and freshwater energy, particularly in the context of achieving the Sustainable Development Goals related to resource governance and food security.

However, critical scholarship has increasingly questioned the assumption that blue economy initiatives are inherently more sustainable or socially inclusive than blue growth strategies. Studies have shown that, in practice, blue economy policies often remain embedded within growth-oriented development logics that prioritize investment, infrastructure expansion, and productivity gains [5,6]. As a result, the conceptual boundary between blue economy and blue growth is frequently blurred, with both approaches producing similar patterns of resource commodification, spatial exclusion, and uneven distribution of benefits. This critique challenges the tendency to treat blue economy and blue growth as normatively opposed and highlights the need for a more explicit engagement with justice considerations.

The emergence of the concept of blue justice reflects growing concern over these contradictions. Initially articulated in the context of small-scale fisheries governance, blue justice draws attention to the social and political dimensions of aquatic resource management that are often overlooked in growth-centered frameworks [3,11]. The range of injustices raised by blue economy and blue growth approaches are not incidental outcomes but are frequently produced through governance processes that privilege certain actors and forms of knowledge over others.

To address these challenges, blue justice emphasizes three interrelated dimensions of justice. Recognition justice involves acknowledging local identities, values, and knowledge systems that

shape everyday interactions with aquatic environments. Procedural justice focuses on meaningful participation in decision-making processes, particularly for communities directly affected by resource governance interventions. Distributional justice concerns the fair allocation of benefits and burdens arising from development and conservation initiatives. Together, these dimensions provide an analytical framework for assessing whether blue economy and blue growth initiatives contribute to socially legitimate and ecologically sustainable outcomes [3,12].

Recent contributions to the literature have extended blue justice debates by explicitly questioning the centrality of economic growth in aquatic governance. Scholars working from blue degrowth perspectives argue that justice-oriented governance requires not only more inclusive processes but also critical reflection on the scale, pace, and purpose of economic activities in aquatic environments [5,13,14]. Others emphasize that blue justice must be understood as an ongoing political process rather than a fixed policy outcome, shaped by contestation over access, knowledge, and authority [3,15]. These insights are particularly relevant for freshwater systems, where governance interventions often intersect with long-standing livelihood practices and locally embedded forms of resource use.

In the context of Rawa Pening, blue justice offers a lens for examining how lake management policies framed under blue economy narratives shape access to resources, participation in governance, and the distribution of benefits among different livelihood groups. Government-led revitalization programs emphasize ecological restoration and economic efficiency, yet frequently rely on technocratic approaches that limit community involvement. Applying a blue justice perspective allows for a critical assessment of how such interventions may simultaneously address environmental degradation while reproducing social inequalities within the lake-based economy.

## 1.2. The Role of Lakes in Blue Justice: Ecosystem Services and Sustainable Management for Social Equity

Lakes are socially embedded ecosystems in which ecological processes, livelihood practices, and governance arrangements are deeply interconnected. Beyond their biophysical functions, lakes provide essential ecosystem services such as water regulation, food provision, climate buffering, and nutrient cycling, which directly support local livelihoods and regional economies [16]. As shared resource spaces, lakes are also arenas where multiple social groups interact, negotiate access, and contest the use and management of natural resources.

Recent literature emphasizes that justice-oriented lake governance requires moving beyond purely technocratic or conservation-driven approaches toward more inclusive and participatory management models [17,18]. When lake management prioritizes ecological indicators or economic efficiency without adequate attention to social dynamics, interventions may disproportionately affect communities whose livelihoods depend on everyday access to the lake. Such dynamics are particularly evident in cases where zoning regulations, access restrictions, or large-scale biomass removal programs reshape patterns of resource use and livelihood opportunities.

From a blue justice perspective, lakes should be understood as spaces of livelihood interaction in which different user groups, such as fishers, farmers, and aquatic plant harvesters, experience environmental change and governance interventions in uneven ways. Empirical studies of aquatic resource governance show that injustices often arise not only from environmental degradation but also from decision-making processes that exclude local voices and undervalue experiential knowledge [15,19]. Epistemic injustice is a recurring concern, particularly in freshwater contexts, where local understandings of ecological change are frequently subordinated to external scientific or managerial expertise [20].

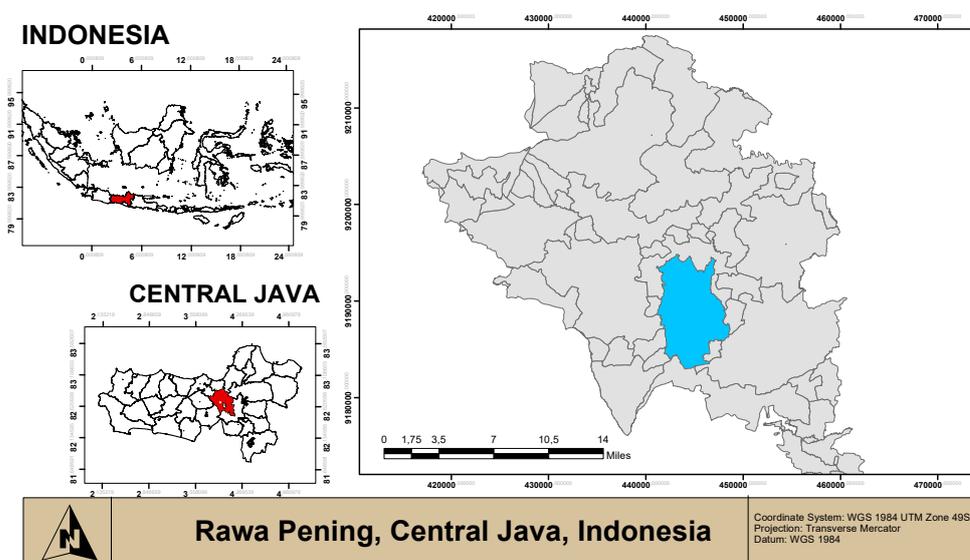
Rawa Pening illustrates how lake-based governance interventions can generate differentiated social outcomes. The lake functions as a critical livelihood base for multiple groups, including small-scale fishers, rice farmers, and water hyacinth harvesters and artisans [7,8]. Management measures aimed at addressing eutrophication and sedimentation, such as dredging and large-scale water hyacinth removal, have altered access arrangements and reshaped livelihood strategies. While these measures are often justified through environmental and economic rationales, their social implications are unevenly distributed and remain insufficiently addressed within prevailing governance frameworks.

Understanding the role of lakes in blue justice, therefore, requires attention to the interactions between ecosystem services, governance decisions, and livelihood dynamics over time. Justice-oriented Lake governance recognizes lakes as socio-ecological systems in which sustainable outcomes depend on meaningful participation, recognition of local knowledge, and equitable

distribution of benefits and burdens [21]. In this regard, Rawa Pening provides an important freshwater case for extending blue justice debates beyond marine and coastal settings and for examining how justice principles can inform more socially sustainable approaches to lake management.

## 2. Materials and Methods

This research was conducted in June–July 2024 at Rawa Pening, Semarang Regency, Indonesia. Rawa Pening was selected as the research site due to its critical role in the local ecosystem and the livelihoods of communities that depend on its natural resources. As one of the largest lakes in Central Java, Rawa Pening presents a complex challenge in terms of resource management, which includes fisheries, seasonal agriculture, and crafts based on water hyacinth. The diversity of land and resource use around the lake makes it a relevant case for exploring the challenges and opportunities in applying the concept of blue justice. A detailed map of the research location can be seen in Figure 1.



**Figure 1.** Research location.

This study employs a descriptive qualitative approach with a case study method to analyze the application of blue economy, blue growth, and blue justice concepts in the management of natural resources at Rawa Pening. The research sample consists of 50 respondents, categorized across various livelihoods, including fishers, seasonal farmers, and artisans, selected using an accidental sampling method. This sampling technique was based on the availability and accessibility of respondents during the research period, as well as their relevance to the research objectives, which focus on communities directly involved in the utilization of natural resources around Rawa Pening.

Primary data was collected through in-depth interviews with local communities and policy stakeholders, along with participatory observation techniques. Secondary data was gathered from literature, research reports, and natural resource management policy documents. This study also draws on Blue Economy and Blue Growth theories proposed by the World Bank & United Nations Department of Economic and Social Affairs [10], as well as the Blue Justice theory introduced by Bennett et al. (2021) [4]. Data triangulation and member checking will be used to ensure the validity and reliability of the data by comparing interview results, observations, and document studies. This method was chosen to provide a comprehensive understanding of the socio-economic and ecological impacts of policies implemented at Rawa Pening.

## 3. Results

### 3.1. Respondent Characteristics

The sample consists of 50 participants, categorized into three main occupation groups: fishers (17 respondents), farmers (17 respondents), and water hyacinth harvesters (16 respondents). This distribution offers a comprehensive overview of the socio-economic and demographic profiles of

individuals whose livelihoods are closely connected to the utilization of natural resources in the Rawa Pening area. Table 1 presents the demographic characteristics of the respondents engaged in resource utilization at Rawa Pening, Semarang, Indonesia.

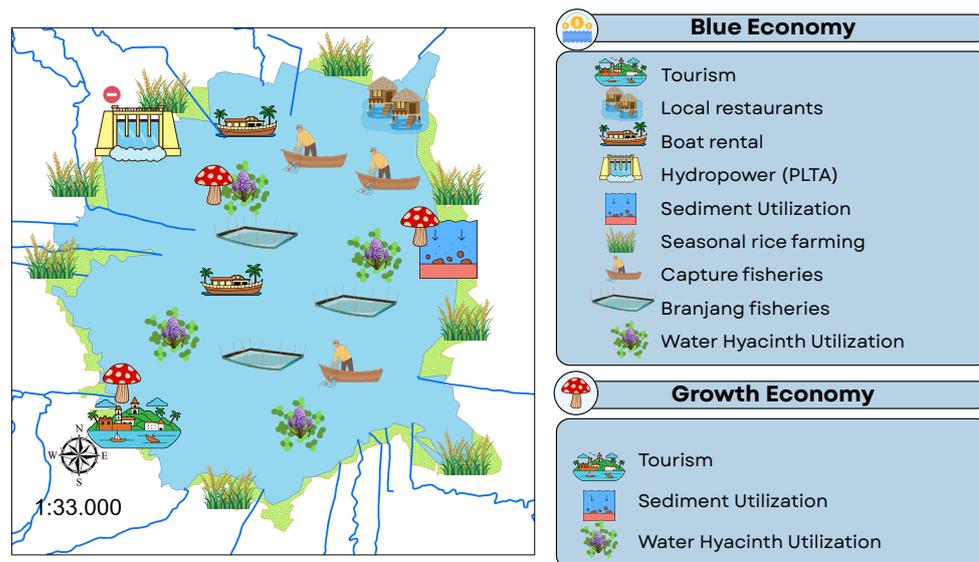
**Table 1.** Respondent characteristics.

Category	Fishers ( <i>N</i> = 17)	Farmers ( <i>N</i> = 17)	Water Hyacinth Harvesters ( <i>N</i> = 16)
<b>Gender</b>			
Male	14 (82%)	11 (65%)	12 (75%)
Female	3 (18%)	6 (35%)	4 (25%)
<b>Age (years)</b>			
<26	1 (6%)	0 (0%)	0 (0%)
26–40	6 (35%)	4 (24%)	2 (13%)
41–55	7 (41%)	10 (59%)	9 (56%)
56–70	2 (12%)	2 (12%)	4 (25%)
>70	1 (6%)	1 (6%)	1 (6%)
<b>Education Level</b>			
No formal education	6 (35%)	2 (12%)	5 (31%)
Elementary School (SD)	3 (18%)	4 (24%)	5 (31%)
Junior High School (SMP)	5 (29%)	8 (47%)	6 (38%)
Senior High School (SMA)	3 (18%)	3 (18%)	0 (0%)
<b>Income</b>			
<1,000,000 IDR	5 (29%)	3 (18%)	6 (38%)
1,000,000–2,000,000 IDR	9 (53%)	11 (65%)	7 (44%)
2,000,001–3,000,000 IDR	3 (18%)	3 (18%)	2 (13%)
3,000,001–4,000,000 IDR	0 (0%)	0 (0%)	1 (6%)
>4,000,000 IDR	0 (0%)	0 (0%)	0 (0%)
<b>Years of Work</b>			
<10	1 (6%)	3 (18%)	3 (19%)
10–20	5 (29%)	7 (41%)	5 (31%)
21–30	4 (24%)	3 (18%)	4 (25%)
31–40	4 (24%)	2 (12%)	2 (13%)
>40	3 (18%)	2 (12%)	2 (13%)

The demographic data shows that the fishing sector in Rawa Pening is predominantly male; while farming and water hyacinth harvesting are more inclusive of women. The majority of workers are aged 41–55, with 10–20 years of work experience, indicating a rich local knowledge in resource management. Limited education and relatively low incomes (1–2 million IDR) suggest a high dependency on natural resources, but with disparities in access and resource management. This highlights the need for more equitable and inclusive management, as well as the empowerment of local communities to ensure fair benefits from resource utilization in Rawa Pening.

### 3.2. Transition from Blue Economy to Blue Growth

The transition from blue economy to blue growth in Rawa Pening must be critically identified because it marks a profound shift in how natural resources are conceptualized, valued, and governed. Blue economy embodies a paradigm of ecological balance and livelihood diversification, where multiple sectors coexist, such as fisheries, hydropower, seasonal rice farming, and local restaurants, each contributing modestly to community resilience. Blue growth, however, represents a selective prioritization, elevating tourism, water hyacinth utilization, and sediment use as strategic pillars of development. These sectors are singled out precisely because they promise stronger multiplier effects, higher value chains, and broader market integration compared to subsistence-based activities. The transition is visually summarized in Figure 2, which depicts representative sectors classified as part of the blue economy and blue growth in the Rawa Pening socio-ecological system.



**Figure 2.** Mapping blue economy and blue growth.

Tourism transforms ecological and cultural landscapes into economic capital, integrating Rawa Pening into wider circuits of consumption and mobility. Its growth potential lies not only in direct revenues but also in backward and forward linkages across hospitality, transport, and creative industries. According to Tang et al. (2025) [22], tourism can play a significant role in local development by promoting economic benefits while also raising environmental awareness. Water hyacinth utilization illustrates circular economy logic: reframing an invasive species as raw material for handicrafts, furniture, and household items, while also expanding into innovative products such as paper, textiles, bioplastics, eco-friendly packaging, bio-briquettes, and biogas [23,24]. Export-oriented hyacinth crafts further connect local livelihoods to global green markets, reframing a local ecological burden into an opportunity for international trade, as demonstrated by studies on sustainable resource management [24,25]. Sediment use, meanwhile, redefines an environmental liability into a productive asset. Beyond its application as fertilizer for agriculture, sediment is increasingly used for brickmaking, construction aggregates, and land reclamation, exemplifying the principle of resource recovery [26]. These applications simultaneously address environmental restoration and economic diversification, making sediment a critical component of blue growth strategies. According to Henny et al. (2026) [25], incorporating sustainable practices in sediment management fosters both economic growth and environmental resilience, emphasizing the potential for such practices in wetland areas like Rawa Pening. Table 2 explains the conditions of blue growth in the Rawa Pening area.

The concentration on these three sectors invites critical debate. *Why are fisheries and small-scale farming marginalized in the growth agenda?* The answer lies in the scalability and profitability demanded by growth-oriented policies, yet such logic risks undermining distributive justice. Furthermore, while these sectors embody the dual promise of ecological restoration and economic growth, their sustainability is contingent on governance design. Tourism without carrying-capacity management could erode the very assets it markets. Hyacinth industries without inclusive cooperatives could marginalize women and small-scale producers. Sediment extraction without ecological safeguards could redistribute pollutants and threaten long-term food security. Identifying these sectors as the locus of blue growth is thus not merely descriptive but diagnostic; it reveals the contested terrain where ecological sustainability, economic efficiency, and social equity intersect. The trajectory of Rawa Pening will ultimately depend on whether blue growth is steered toward inclusive prosperity or devolves into exclusionary exploitation.

### 3.3. How Injustice Manifests in Rawa Pening?

Injustice in the context of Rawa Pening arises when the benefits derived from the area’s natural resources are not equitably distributed among its users. This situation is exacerbated by a lack of inclusivity in decision-making processes, where external interests and large investors dominate, sidelining the local communities—particularly small-scale fishers, farmers, and water

**Table 2.** Assessment of blue growth aspects in Rawa Pening.

Blue Growth Aspect	Indicator	Condition in Rawa Pening
Resource Efficiency	Utilization of by-products	Water hyacinth is used for handicrafts, fertilizer, and briquette fuel
	Fisheries productivity	Fish production from floating net cages is high, but it suppresses traditional fishers
	Business diversification	Fisheries, tourism, handicrafts, and agriculture (rice, vegetables)
Circular Economy	Waste processing	Some water hyacinth waste is processed, but much remains a problem
	Local supply chain	Fish caught are sold directly at the village market, and agricultural products are also sold
Social-economic Justice	Fair access to resources	Large investors control fish cage areas and agricultural land; small-scale fishers and farmers are marginalized
	Distribution of economic benefits	Small-scale fishers and farmers earn low income, while owners of large fish cages and land dominate
	Empowerment of vulnerable groups	Women are active in fish processing, handicrafts, and agricultural products
Innovative & Green Economy	Ecotourism	There are boat tours, fish culinary experiences, photo spots, and agricultural tourism
	Environmentally friendly technology	Biofilters and sustainable farming are still limited
Ecological Resilience	Water quality	Affected by agricultural, household, and fish feed waste, as well as pesticide use
	Biodiversity	Endemic fish are becoming rarer, decline in flora and fauna biodiversity
	Weed control	Water hyacinth covers much of the water body; other weed problems also affect agriculture

hyacinth harvesters. As a result, these communities are increasingly marginalized, facing restricted access to critical resources, such as fishing grounds and agricultural land, leading to the erosion of their livelihoods. Table 3 presents the forms of injustice observed in the Rawa Pening lake ecosystem.

**Table 3.** Indicators of blue injustice in resource utilization at Rawa Pening: access, participation, and socio-economic disparities.

Aspect	Condition	Field Evidence
Fair Access to Resources	<ul style="list-style-type: none"> <li>- Large investors dominate the lake area.</li> <li>- Poor people rely on daily catches.</li> <li>- No clear fish cage quota system.</li> <li>- Catch results tend to decline each year.</li> </ul>	<p><i>“Pembatasan mengambil ikan dan eceng gondok karena ada proyek pembangunan di tengah danau, selain itu ikan sekarang sudah susah untuk ditangkap dan mencari eceng gondok.”</i> [“Fishing and farming Water Hyacinth is restricted because of construction projects in the middle of the lake, and now it’s harder to catch fish and find Water Hyacinth.”] (Fisher, and Water Hyacinth seeker, male, No. 23, 40).</p>
Local Community Participation	<ul style="list-style-type: none"> <li>- Locals are involved in village meetings regarding lake management.</li> <li>- Strategic decisions are often made by outsiders.</li> <li>- Policy socialization is uneven.</li> <li>- Active participation is limited to certain groups.</li> <li>- Some people feel their opinions are not considered.</li> </ul>	<p><i>“Rapat tidak melibatkan kelompok kami, biasanya hanya perwakilan RT/RW, jadi kami susah untuk mengutarakan pendapat di rapat-rapat.”</i> [“Meetings don’t involve our group; usually only the RT/RW (local neighborhood and community representatives) attend, so it’s hard for us to voice our opinions.”] (Water Hyacinth seeker, male, No. 13).</p>
Transparency & Accountability	<ul style="list-style-type: none"> <li>- Social assistance is distributed via the village.</li> <li>- Fish seed distribution is uneven.</li> <li>- Conservation fund usage reports are unclear.</li> <li>- Water quality information is rarely shared with residents.</li> <li>- Fish cage permit mechanisms are not transparent.</li> </ul>	<p><i>“Saya belum pernah mendapat bantuan, karena kalau minta bantuan harus gabung dengan kelompok-kelompok yang ada.”</i> [“I’ve never received aid because to request it, I have to join the existing groups.”] (Farmer, male, No. 10).</p>

**Table 3.** (Continued)

Food Security & Nutrition	<ul style="list-style-type: none"> <li>- Lake fish are the main food source.</li> <li>- Fish quality is declining due to pollution.</li> <li>- Some fish have a muddy smell.</li> <li>- During lean times, there is a protein shortage.</li> <li>- They prioritize consuming their own catch.</li> </ul>	<p><i>“Tkan bau lumpur, karena banyak sampah masuk danau.”</i> [“The fish smell muddy because a lot of trash enters the lake.”] (Fisher, male, No. 40).</p>
Protection of Traditional Rights & Culture	<ul style="list-style-type: none"> <li>- Traditional fishing methods are being abandoned.</li> <li>- Endemic species are increasingly hard to find.</li> <li>- Senior fishers still maintain old methods.</li> <li>- Younger generations are less interested in continuing the fishing profession.</li> <li>- Local knowledge of fish seasons is rarely passed down.</li> </ul>	<p><i>“Generasi sekarang tidak ada yang melanjutkan, lebih memilih bekerja di pabrik karena pendapatan yang lebih pasti.”</i> [“The current generation doesn’t continue fishing; they prefer working in factories for a more stable income.”] (Fisher, male, No. 40).</p>
Economic Benefit Distribution	<ul style="list-style-type: none"> <li>- Water hyacinth-based crafts are developing.</li> <li>- The product market is still limited locally.</li> <li>- Small fishers struggle to access capital.</li> <li>- Tourism only involves some residents.</li> <li>- There is an income gap between families.</li> </ul>	<p><i>“Sekarang banyak tambak di sekitar danau, selain itu masih sepi pariwisata, biasanya saya bantu wisatawan makan di rumah makan di tengah danau.”</i> [“There are now many fish ponds around the lake, tourism is still quiet, and I usually help tourists eat at the restaurant in the middle of the lake.”] (Fisher, male, No. 40).</p>
Pollution & Environmental Damage Control	<ul style="list-style-type: none"> <li>- Water hyacinth covers part of the lake area.</li> <li>- Sedimentation hinders water transportation.</li> <li>- Agricultural waste enters the water.</li> <li>- Water is often murky and smelly.</li> <li>- Native fish populations have drastically declined.</li> </ul>	<p><i>“Perahu susah lewat karena banyak eceng gondok, sekarang yang paling banyak sampah plastik dan popok.”</i> [“It’s hard for boats to pass because of the water hyacinth, and now most of the trash is plastic and diapers.”] (Fisher, male, No. 20).</p>
Access to Information & Technology	<ul style="list-style-type: none"> <li>- Fishers are still limited in using modern technology.</li> <li>- Few are utilizing online marketing.</li> <li>- Market price information is poorly distributed.</li> <li>- Locals need digital technology training.</li> </ul>	<p><i>“Kami dalam menangkap ikan masih tradisional, tidak ada teknologi yang kami pakai, selain itu hanya menjual di pasar.”</i> [“We still catch fish using traditional methods, don’t use any technology, and only sell at the market.”] (Fisher, male, No. 20).</p>
Intergenerational Justice	<ul style="list-style-type: none"> <li>- The lake’s depth is increasingly shallow.</li> <li>- Senior fishers worry about the future of the next generation.</li> <li>- Local traditions are increasingly eroded.</li> <li>- Many young people choose to migrate.</li> <li>- The lake is seen as less promising for long-term livelihoods.</li> </ul>	<p><i>“Kalau kita tidak bisa panen dan menangkap ikan karena danau semakin rusak ya kesian generasi anak karena pendapatan saya hanya darisana.”</i> [“If we can’t harvest or catch fish because the lake is getting worse, it will be tough for the next generation, because my income comes only from the lake.”] (Farmer and Fisher, male, No. 31,32).</p>
Protection of Vulnerable Groups	<ul style="list-style-type: none"> <li>- Women are involved in fish processing, crafts, and agricultural products.</li> <li>- Housewives play a significant role in supporting family economics.</li> <li>- Poor fishers struggle to access business capital.</li> <li>- Social assistance does not reach all vulnerable groups.</li> <li>- The poor are the most affected during fish shortages.</li> </ul>	<p><i>“Saat ini pendapatan saya tidak menentu, biasanya ada tambahan dari istri yang bekerja di kerajinan dari eceng gondok.”</i> [“Currently, my income is uncertain; usually there’s extra from my wife who works on crafts made from water hyacinth.”] (Fisher, male, No. 20).</p>

Based on the evidence in the field, it is clear that there is an imbalance among various resource user groups, such as fishers, farmers, and water hyacinth crafters. For instance, unfair access to resources, limited community participation, and unequal distribution of economic benefits exacerbate existing inequalities. Injustice occurs when management and policies favor large investors and certain groups, while local communities are marginalized and lose access to their living spaces and livelihoods. Additionally, the lack of transparency in the distribution of social assistance, worsening environmental damage, and unequal access to information and technology further intensify socio-economic injustices. Non-inclusive management and policies that do not consider vulnerable groups, such as women and poor fishers, worsen inequality and deepen the generational gap. Therefore, it is crucial to adopt a fairer and more inclusive approach to ensure ecological sustainability and the social well-being of local communities.

Several previous studies have shown that injustices in natural resource management often stem from unequal access and control over resources vital to local livelihoods. According to Akpalu & Eggert (2021) [9], policies that favor large economic interests often neglect the rights of local communities, resulting in their marginalization in decision-making processes related to

natural resource management. Similar findings were reported by Casadei et al. (2016) [7], which indicated that unequal access to resources and the neglect of the rights of small-scale communities further exacerbate their socio-economic conditions. Furthermore, research by Bennett et al. (2021) [4] emphasizes that inclusive management based on social justice, involving active participation from all community groups, is key to creating balance in resource utilization and ensuring more equitable benefits for all parties. Adopting a fair and inclusive approach to managing Rawa Pening can be an important step toward promoting ecological and social sustainability, as well as reducing the inequalities that exist among resource user groups.

#### 4. Discussion

##### 4.1. How to Achieve Justice for the Livelihoods of Vulnerable Groups in Rawa Pening?

To achieve justice for the livelihoods of vulnerable groups in Rawa Pening, the first step is to identify and address the various challenges they face. These groups are often marginalized in decision-making processes related to natural resource management, despite being highly dependent on the lake's ecosystem for their livelihoods. Inequalities in access to resources, limited participation in policy-making, and the ongoing environmental degradation further exacerbate these conditions. Therefore, it is crucial to understand how these issues impact their well-being and the sustainability of their livelihoods. An equitable and inclusive resource management approach will be key to creating more equal welfare and ensuring the conservation of the Rawa Pening ecosystem. To illustrate the lived experiences of local communities, a respondent highlighted the cumulative effects of these injustices:

*“Perlu ada dukungan pemerintah supaya kami bisa ikut rapat dan menyampaikan pendapat, bukan hanya perwakilan RT/RW. Kadang proyek pembangunan di tengah danau jalan, kami takut kehilangan sebagian pendapatan dari ikan dan eceng gondok. Bantuan yang seharusnya bisa diterima tidak merata, sehingga kami merasa tidak diperhatikan. Kalau kami tidak bisa menangkap ikan atau memanen eceng gondok, bagaimana anak-anak nanti bisa hidup dari sini? Pendapatan kami hanya dari situ, sedangkan generasi sekarang banyak yang lebih memilih bekerja di pabrik karena lebih pasti. Harus ada mekanisme yang jelas supaya semua yang membutuhkan bisa mendapatkannya.”* [“Government support is needed so we can attend meetings and express our opinions, not just the RT/RW representatives. Sometimes, if development projects in the middle of the lake proceed, we fear losing part of our income from fish and water hyacinth. Assistance that should be available is uneven, making us feel ignored. If we cannot catch fish or harvest water hyacinth, how will our children live from this? Our income comes only from this, while the younger generation often chooses to work in factories for more stable earnings. There must be a clear mechanism so that everyone in need can receive support.”] (Fisher and Water Hyacinth Seeker, Male, No. 20,23,30,40).

This testimony underscores the urgent need for inclusive governance, equitable access to resources, and mechanisms to ensure that social assistance reaches those most vulnerable. An approach that integrates these perspectives with justice-oriented policy recommendations (Table 4) will support sustainable livelihoods, protect local knowledge and traditions, and strengthen the overall resilience of the Rawa Pening ecosystem.

The analysis of blue justice principles in Rawa Pening highlights the need for inclusive and equitable resource management, as outlined by Bennett et al. (2021) [4]. The findings of this study demonstrate that recognizing and protecting access rights for local communities, such as securing harvesting rights for water hyacinth gatherers and land and water access for seasonal farmers, is vital for ensuring sustainable livelihoods and preventing further marginalization. The promotion of eco-farming to reduce agrochemical runoff and the use of water hyacinth for composting and value-added products represent strategies that can simultaneously mitigate pollution and strengthen local income generation, supporting the findings of Akpalu & Eggert (2021) [9], who emphasize sustainable agricultural practices. Minimizing habitat impacts through rotational harvesting and adjusting farming cycles according to water elevation also reflects adaptive management principles, aligning with van Noort et al. (2026) [3], who call for practices that preserve ecosystem resilience. Ensuring that small-scale fishers and farmers are involved in decision-making processes and promoting community-based inclusion is crucial for safeguarding livelihoods, as highlighted in the work of Penca et al. (2025) [27]. Furthermore, fostering food security by integrating local food systems and prioritizing land access for vulnerable groups contributes to reducing inequalities, supporting the concept of food sovereignty discussed by Antonova et al.

(2025) [17] and Penca et al. (2025) [27]. The implementation of cooperatives and transparent land-use allocation further promotes economic justice, ensuring that resources and benefits are equitably shared among community members. Lastly, protecting cultural practices and promoting authentic tourism ensures that social and cultural impacts are managed in a way that upholds community identity, reinforcing the principles of justice that balance ecological sustainability with social equity.

**Table 4.** Justice-oriented policy recommendations for resource utilization at Rawa Pening.

Category	Water Hyacinth Utilization	Seasonal Rice Farming	Fisheries
Recognize & protect tenure/access rights	Secure community harvesting rights	Recognize farmers' land & water access rights	Protect fishers' access in zoning
Reduce pollution	Composting & product reuse	Promote eco-farming (reduce agrochemical runoff)	-
Minimize habitat & ecosystem impacts	Rotational harvesting	Adjust planting cycles with water elevation	Carrying-capacity limits
Safeguard small-scale livelihoods	Align harvest with fishing needs	Involve smallholders in seasonal land allocation	Community-based fishers' inclusion
Maintain food security & well-being	Hyacinth income supports food	Prioritize small/poor farmers for land access	Local food supply
Equitable economic benefits	Cooperatives for fair profits	Transparent land-use allocation & fair market access	Revenue-sharing schemes
Manage social & cultural impacts	Preserve craft traditions	Preserve traditional farming practices	Authentic cultural tourism
Promote women's role	Women in leadership & markets	Female farmer reps in committees	Women leaders
Protect human & indigenous rights	Formal recognition of practices	Legal protection for farmers' seasonal rights	Rights safeguarded in planning
Inclusive governance	Multi-stakeholder councils	Participatory forums for farmers	Community boards

#### 4.2. Blue Justice in the Transition from Blue Growth in Rawa Pening

Blue justice must be central to the discussion on Rawa Pening's blue growth, as every economic opportunity also carries the potential risk of blue injustice. While tourism, water hyacinth utilization, and sediment management offer the chance to turn ecological challenges into productive livelihoods, they also risk perpetuating exclusion, elite capture, and environmental degradation without fair governance. The key analytical task is not merely to measure growth but to examine who benefits, who loses, and the institutional structures under which justice or injustice unfolds. Figure 3 illustrates the transition from blue growth to blue justice.

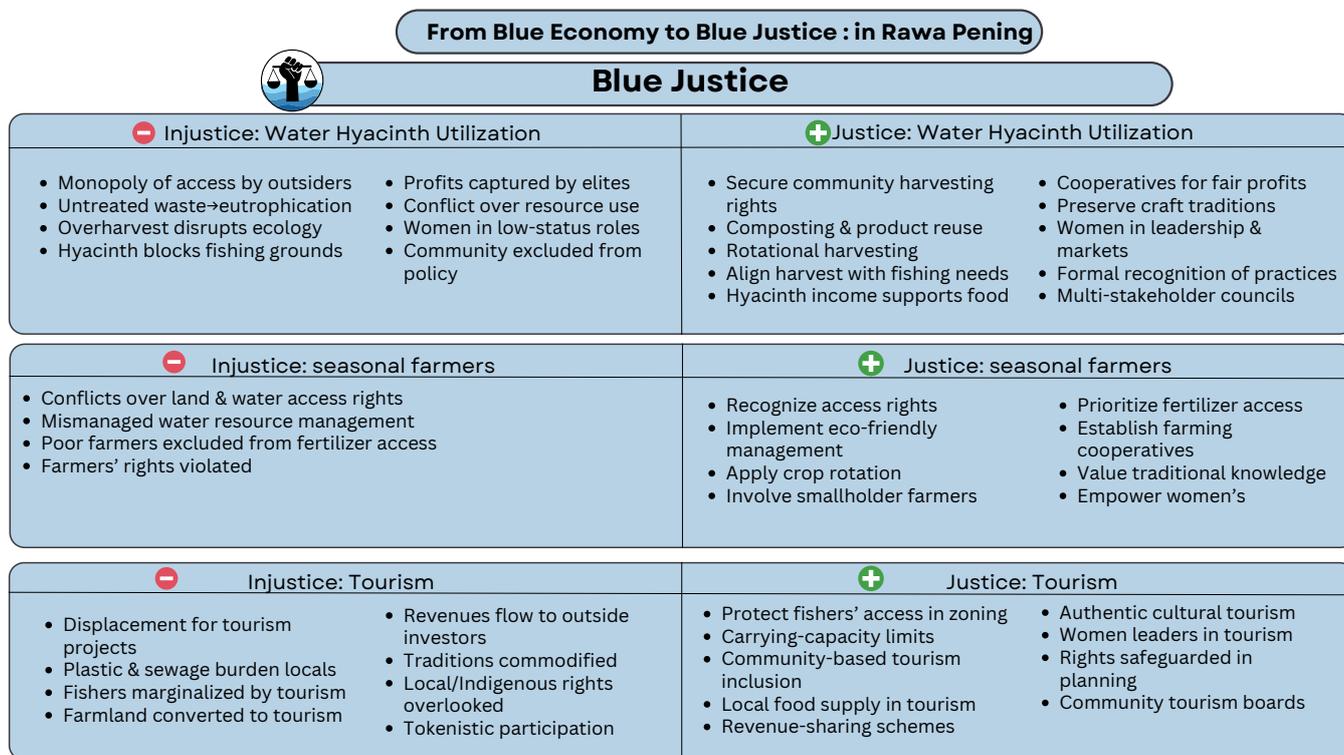
The analysis of blue justice in resource utilization at Rawa Pening calls for a comprehensive governance approach that balances ecological sustainability, economic development, and social equity. The findings suggest that community-driven management plays a critical role in ensuring sustainable resource utilization, as it strengthens local ownership and meaningful participation in decision-making processes [5,27]. In the context of water hyacinth utilization, securing harvesting rights for local communities is essential to prevent marginalization and ensure that resource benefits remain locally embedded. Regulated and rotational harvesting practices, alongside cooperative structures that enable collective management and value capture, represent mechanisms that can reduce exploitation while enhancing economic justice [9]. Furthermore, strengthening women's participation across the value chain—from production to trade—can improve gender equity and promote more inclusive benefit distribution, consistent with blue justice principles [4]. Such measures demonstrate how water hyacinth can shift from being framed solely as an ecological burden to becoming a socio-ecological asset that contributes to both economic

development and environmental restoration [28]. In this way, water hyacinth can play a central role in linking ecological restoration with socio-economic resilience in the Rawa Pening region.

In the case of seasonal farming, ensuring fair access to land and water resources remains central to livelihood security and local food systems. The findings highlight the importance of adaptive land-use management in areas characterized by fluctuating water levels and sediment accumulation [9]. Integrating sustainable agricultural practices that protect wetland ecosystems such as Rawa Pening can prevent environmental degradation from disproportionately affecting small-scale farmers. Participatory planning mechanisms are particularly important, as they allow local knowledge to inform adaptive strategies and reduce the risk of exclusion in land and water allocation decisions [3]. Protecting small-scale farmers from displacement by large-scale industrial projects is therefore not only a social concern but also an ecological one, as livelihood instability often undermines long-term environmental stewardship [29]. These measures illustrate how seasonal farming in Rawa Pening can be reoriented toward sustainability, benefiting both farmers and the wetland ecosystem.

For fisheries, safeguarding small-scale fishers’ access to fishing zones and ensuring equitable participation in economic benefits are fundamental to preventing distributional injustice. Recognizing traditional fishing practices as cultural and livelihood assets strengthens both social resilience and identity-based rights [4]. Cooperative arrangements that enhance market access and revenue-sharing capacity have been shown to improve economic outcomes while supporting sustainable resource management [9]. At the same time, effective pollution controls—particularly regarding tourism and aquaculture activities—are essential to maintain ecological integrity and prevent further income loss among fishers [30]. Without environmental safeguards, economic expansion risks intensifying ecological stress and deepening livelihood vulnerability.

More broadly, blue justice governance requires institutional arrangements that incorporate marginalized groups into formal decision-making processes. Inclusive governance frameworks have been associated with improved resource management outcomes and greater social legitimacy [8]. The findings from Rawa Pening indicate that participatory decision-making, gender inclusivity, and equitable resource allocation are mutually reinforcing dimensions of sustainable development. Embedding these principles within freshwater governance can prevent the consolidation of power among dominant actors and promote a more balanced distribution of benefits. In this way, blue justice provides a pathway for aligning ecological sustainability with socio-economic resilience in the Rawa Pening region.



**Figure 3.** The transition from blue growth to blue justice.

## 5. Conclusion

The management of natural resources in Rawa Pening, which involves fisheries, seasonal agriculture, and the utilization of water hyacinth, requires an approach based on blue justice to ensure social justice and ecological sustainability. This analysis reveals the inequalities in access to resources, distribution of economic benefits, and community participation in decision-making. Blue justice should prioritize the protection of resource access rights for local communities, develop transparent profit-sharing mechanisms, and address the needs of vulnerable groups. Inclusive management and community-based participation will create a balance between ecosystem sustainability and socio-economic well-being.

This study did not employ a longitudinal approach; therefore, the understanding of long-term dynamics in policy implementation and resource governance remains limited. In addition, some community perspectives, particularly those of less visible or informal groups, may not have been fully captured through the interviews. Future research is encouraged to apply longitudinal designs and include a wider range of stakeholder groups in order to strengthen the analysis of blue justice implementation in Rawa Pening.

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## Data Availability

No new data were created or analyzed in this work. Data sharing is not applicable to this article.

## Use of Generative AI and AI-Assisted Technologies

The authors acknowledge the use of generative AI tools during the preparation of this manuscript. Generative AI was used to assist with language editing and grammar refinement to improve clarity and readability. No AI tools were used for data collection, data analysis, or interpretation of findings. The authors remain fully responsible for the originality, accuracy, integrity, and ethical compliance of the manuscript, and confirm that all intellectual content reflects their own scholarly work.

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## Author Contributions

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## Conflicts of Interest

The authors have no conflict of interest to declare.

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