International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 21s, 2025
https://theaspd.com/index.php

Toward CLIMATE-RESILIENT WATER GOVERNANCE: A LEGAL AND POLICY ANALYSIS OF MALAYSIA'S WATER SECTOR

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Abstract
Climate change presents mounting challenges to water security and sustainability, especially in developing countries with fragmented governance systems. This paper examines the extent to which Malaysia's legal and policy frameworks integrate climate change adaptation into water governance, focusing on the Water Services Industry Act 2006 (WSIA), the Environmental Quality Act 1974 (EQA), state-level water enactments, and recent policy instruments such as the National Water Resources Policy, Water Sector Transformation 2040 (AIR2040) roadmap, and the forthcoming Climate Change Act. Using a doctrinal analysis complemented by policy review, the study identifies significant gaps in legal mandates for adaptation despite policy-level recognition of climate vulnerability. It proposes reforms to embed adaptation into statutory instruments, strengthen federal–state coordination, and integrate risk assessments and ecosystem-based approaches into legal and planning systems. These recommendations are aligned with Sustainable Development Goals 6 and 13. The Malaysian case illustrates broader lessons for embedding climate resilience in water law across federal or devolved systems in the Global South. This paper contributes to sustainability governance literature by highlighting how legal reform can bridge the gap between policy aspiration and operational resilience in water management under climate stress.
Keywords: *Climate Change, Water, Legal Framework, Sustainability, Malaysia*

INTRODUCTION

Climate change refers to long-term shifts in global temperatures and weather patterns. These changes are increasingly driven by human activities such as fossil fuel combustion, deforestation, and industrial emissions that raise greenhouse gas concentrations in the atmosphere (Afshar & Fahmi, 2019). One of the most serious consequences of climate change is its impact on water resources. Rising temperatures, altered rainfall patterns, and more frequent extreme weather events affect the hydrological cycle. This includes evaporation, runoff, and groundwater recharge, which in turn influence water quality, availability, and social vulnerability (Ciampittiello et al., 2024; Mujere & Moyce, 2016, 2017). These effects appear in biological, physical, and chemical changes to water systems. Warmer water temperatures increase microbial growth and reduce oxygen levels. At the same time, intense rainfall and prolonged dry periods put pressure on water infrastructure, increase sediment buildup, and worsen pollution (Strzepek et al., 2015; Dimlo et al., 2024).

The severity of these impacts varies across regions. Some areas face more floods, others experience long droughts. Malaysia is already experiencing both. The 2021 floods in Selangor disrupted water treatment operations. In the northern states, recurring droughts have reduced river flows and concentrated pollutants (Yeong, 2024). These events threaten the reliability of water supply, the health of ecosystems, food and energy security, and public well-being. However, the country's legal and institutional responses have not kept pace. They remain reactive, fragmented, and focused on existing threats rather than future risks.

Malaysia's water laws, such as the Water Services Industry Act 2006 (WSIA), the Environmental Quality Act 1974 (EQA), and various state water enactments, were not designed with climate change in mind. Although national policies like the National Water Resources Policy 2012 and the National Climate Change Policy highlight adaptation as a goal, they do not impose clear legal duties or provide strong governance tools (Keeton-Olsen, 2020). The lack of requirements for vulnerability assessments, scenario-based planning, or adaptive regulatory standards points to deeper legal and institutional gaps.

This article critically examines how well Malaysia's water governance framework responds to the challenges of climate adaptation. It focuses on key federal laws such as the WSIA and EQA, selected state water enactments, and new initiatives including the proposed Climate Change Act and the Water Sector Transformation 2040 roadmap. The analysis is guided by the principles of sustainable development, especially Sustainable Development Goals (SDG) 6 on clean water and sanitation, and SDG 13 on climate action. It also draws on current climate science and regulatory theory. This study highlights that technical solutions alone are not enough. Legal reform is necessary to address gaps in design, policy coherence, and institutional coordination. These reforms should be forward-looking, enforceable, and integrated across sectors and levels of government. Malaysia's experience offers useful lessons for other federated and developing countries that are also working to align their water governance systems with the realities of a changing climate.

METHODOLOGY

This research employs a doctrinal legal analysis combined with a qualitative review of policy documents, reports, and secondary literature. The doctrinal approach involves examining Malaysia's legal instruments governing water and the environment to determine whether and how they incorporate climate change adaptation principles. Main statutes such as WSIA and the EQA are analysed based on their provisions on water resource management, pollution control, and any references (direct or implied) to climate or disaster risk management. In addition, several state-level water enactments are reviewed to assess sub-national integration of adaptation measures.

The qualitative component involves analysing official policies and reports. This includes national policy documents such as the National Water Resources Policy 2012 and the National Policy on Climate Change 2009, as well as recent updates like the draft National Policy on Climate Change 2.0 and Malaysia's communications under the United Nations Framework Convention on Climate Change, such as the Nationally Determined Contribution update 2021. These documents are evaluated to build an understanding of the conceptual and strategic framework for climate adaptation in the water sector. Furthermore, reports from government agencies such the Water Sector Transformation 2040 roadmap, under development National Adaptation Plan and reputable research institutes are considered, along with data from recent journal articles (2019 onwards) examining climate impacts on Malaysian water resources.

This study also reviews secondary sources such as peer-reviewed journal articles, scholarly commentaries, and news reports from 2019–2024 that provide insight into the implementation and effectiveness of laws and policies. These sources help to triangulate findings, for example, news of water crises and government responses can reveal how legal frameworks operate in practice. Based on doctrinal legal analysis with a broader policy and literature review, this methodology allows for a comprehensive assessment. It not only identifies what the laws state de jure about climate adaptation, but also considers de facto developments such as amendments in progress, policy initiatives, and real-world challenges that influence how well Malaysia's water governance is adapting to climate change.

LITERATURE REVIEW

Climate change is increasingly recognised as a primary stressor on water systems, threatening both infrastructure and governance across scales. A growing body of literature documents the physical, institutional, and socio-economic risks posed by climate variability and extremes. Yet, responses remain fragmented. While technical and empirical studies model future water scenarios and infrastructure vulnerabilities, far fewer explore how legal and regulatory frameworks can evolve to manage these risks. This literature review surveys global and regional scholarship on climate-water linkages, infrastructure exposure, and the limitations of existing governance systems, with particular attention to legal underpinnings. It aims to identify conceptual and regulatory gaps that constrain the development of climate-resilient water governance, especially in federated systems like Malaysia where legal responsibility is shared across national and subnational levels.

Early empirical works, such as Hall et al. (2024), present modelling that reveals a central tension: in regions reliant on seasonal precipitation, shifting water availability can leave late-season demands unmet,

even when annual water sufficiency appears nominal. This dynamic risk challenges traditional assumptions embedded in water rights and allocation frameworks, which are often static and historically determined. It undermines the foundational premise of riparian rights and necessitates a legal reconfiguration of water allocation regimes that do not reflect hydrological variability.

Similarly, Howard et al. (2016) highlight that water and sanitation systems face compounding risks such as flooding, drought, and groundwater depletion. While both studies underscore escalating physical threats, they fail to address how existing legal regimes perpetuate vulnerabilities through outdated regulatory structures. Many standards remain tied to historical baselines, lacking mandates for forward-looking risk assessments or adaptive planning tools within utility licensing or infrastructure investment. Although the technical evidence is compelling, the legal implications are insufficiently explored.

Water scarcity, while a familiar narrative, acquires new dimensions under climate stress. Zakar et al. (2012) argue that climate variability exacerbates scarcity, threatening human security in fragile socio-political contexts. However, their analysis relies heavily on secondary qualitative assessments and provides limited guidance for regulatory responses. In contrast, Schilling et al. (2020) advance the discussion with a vulnerability framework that quantifies exposure, sensitivity, and adaptive capacity in North Africa. Nonetheless, their nationally aggregated analysis may overlook critical intra-country disparities, particularly relevant in Malaysia, where water vulnerability is localized. Together, these works demonstrate that while the connection between climate, water scarcity, and instability is well-recognised, the challenge lies in designing legal systems flexible enough to account for local nuances.

A growing strand of scholarship emphasises that climate adaptation requires not only better science and infrastructure but also a profound rethinking of legal design. Legal scholars such as Craig (2010), Cosens et al. (2017), and Garmestani and Benson (2013) have argued that climate-related volatility exposes the limitations of regulatory systems built on assumptions of environmental stability. Known as the doctrine of stationarity, this outdated premise still shapes many water laws, including those in Malaysia, which allocate water rights, set licensing thresholds, and govern infrastructure investment based on static historical norms. Adaptive governance theory challenges this rigidity by promoting laws that are flexible, iterative, and capable of evolving with new data, shifting baselines, and ecological feedback. In the water sector, this requires legal mechanisms that institutionalise anticipatory planning, inter-agency coordination, redundancy in service design, and the ability to revise licences or rights in response to hydrological change. Without this shift, as Ruhl (2011) argues, legal frameworks will continue to lag behind the climate science they are meant to operationalise.

Infrastructure fragility is prominent in several studies, though methodologies vary. Żywiec et al. (2024) observe that climate change research increasingly acknowledges infrastructure failure risks. However, bibliometric studies reflect research trends rather than real-world behaviours. Fan et al. (2021) and Lawrence et al. (2020) provide field-specific and model-based evidence of how water infrastructure deteriorates under compounded climate stresses. Their findings, especially regarding cascading failures across interdependent sectors, suggest that resilience must be engineered as a fundamental design and regulatory principle. However, none of these studies critically examine how regulatory rigidity, delayed investment, or fragmented institutional mandates contribute to infrastructure exposure to climatic shocks. This is precisely the concern raised by adaptive governance theorists such as Craig (2010) and Cosens et al. (2017), who advocate for dynamic legal frameworks capable of adjusting to environmental volatility, revising standards over time, and facilitating cross-sectoral coordination. Law must act not merely to mandate stronger pipes or treatment plants but to institutionalise risk-informed, flexible system management as a legal obligation.

From the perspective of adaptive governance theory, legal frameworks that maintain rigid command-and-control structures or rely on historical baselines for design criteria are ill-suited for conditions of deep uncertainty. Craig (2010) and Garmestani & Benson (2013) argue for dynamic legal design, where laws incorporate flexibility, iterative learning, and ecological thresholds. In the water sector, this implies embedding forward-looking risk assessments, redundancy planning, and inter-agency coordination into

licensing regimes and infrastructure regulation. Without such adaptive legal scaffolding, infrastructure remains not only physically vulnerable but also institutionally unsupported.

The water-food-energy nexus is another area where climate impacts are inadequately matched by governance responses. Elliott et al. (2014) caution that increasing freshwater scarcity may force a retreat from irrigated agriculture back to reliance on rainfed systems, with profound implications for global food security. While the projection is stark, it remains rooted in macro-level analysis and offers limited insight into how such risks play out within specific governance settings, especially in semi-arid tropical countries like Malaysia. Takele et al. (2024), through their work in the Upper Blue Nile basin, offer a more granular approach by combining hydrological and socio-economic models to forecast irrigation and hydropower deficits. Yet, the specificity of their basin model, along with the speculative nature of future development trajectories, raises questions about how far such findings can be generalised. What both studies make clear, however, is that water cannot be managed in isolation. Effective adaptation demands governance systems that recognise and respond to the deeply interlinked nature of water, agriculture, and energy security. This kind of integrated thinking remains underdeveloped in Malaysia's water law, where sectoral silos continue to hinder a cohesive legal response to nexus challenges.

Urban water management under climate stress reveals similarly uneven adaptation. Biswas et al. (2023) found that in Queensland, despite clear recognition of surface water vulnerability, water authorities continued to favour traditional supply-side strategies while underutilising demand-side tools like pricing reforms. Arnell and Delaney (2006), in an earlier study of England and Wales, similarly identified a tendency among water utilities to react to regulatory prompts rather than proactively internalise climate risks into planning. These findings highlight a crucial governance flaw, where technical awareness of climate impacts does not translate into institutional or regulatory change unless embedded within legally enforceable standards. The inertia observed in more mature water sectors serves as a cautionary signal for Malaysia, where regulatory modernisation is still underway.

Freshwater ecosystems are increasingly threatened by climate-induced hydrological shifts, yet legal frameworks often fail to protect these systems beyond anthropocentric priorities. Li (2024) and Allan et al. (2020) document how glacier melt, sea-level rise, and altered precipitation patterns destabilise riverine and coastal freshwater ecosystems. Despite these ecological transformations, most water laws remain structurally resistant to incorporating ecosystem-based adaptation. As adaptive governance scholars such as Cosens et al. (2017) emphasise, effective resilience requires legal systems to adopt ecological reflexivity, the capacity to respond to environmental feedback and adjust governance strategies accordingly. However, in many jurisdictions including Malaysia, water laws continue to prioritise extraction, abstraction, and supply reliability over ecological flows and basin health. Embedding ecological resilience into water law, through environmental flow mandates, wetland protection clauses, or climate-informed abstraction limits, would operationalise the principles of adaptive governance and strengthen long-term sustainability.

A thorough examination of the literature reveals significant methodological and governance gaps. Howard et al. (2016) note that most adaptation efforts remain incremental and technologically biased, a pattern echoed in Żywiec et al.'s (2024) findings. Despite the sophistication of integrated hydrological and socio-economic models used by Takele et al. (2024) and Elliott et al. (2014), there is a persistent failure to translate scientific insights into enforceable regulatory frameworks. Without legal mandates to operationalise adaptation strategies, even the most advanced technical models risk remaining merely academic exercises.

In sum, while science and policy discourses have advanced in recognising climate-induced water risks, the legal literature continues to lag behind. There is a persistent reliance on non-binding strategies, pilot programmes, and fragmented regulatory responses. Yet, the urgency of climate change demands binding legal mandates that compel adaptation planning, protect water-related ecosystems, and ensure institutional coherence. The reviewed studies offer valuable insights but largely stop short of addressing how climate resilience can be embedded in statutory water frameworks, particularly in federalised contexts where coordination challenges are pronounced. This paper responds to that gap by critically analysing Malaysia's water-related legal instruments and governance structures, assessing their integration of climate

adaptation, and proposing doctrinal and institutional reforms grounded in sustainability governance principles.

ANALYSIS

This section critically examines how Malaysia's legal and policy frameworks address the integration of climate change adaptation into water governance. Despite growing recognition of climate risks in national planning and policy discourse, the core legal instruments governing water services, pollution control, and water resources remain largely shaped by assumptions of environmental stability. The WSIA, the EQA and various state-level enactments offer limited or indirect support for adaptation, often lacking explicit mandates, enforceable obligations, or coordination mechanisms. At the same time, national policies such as the National Climate Change Policy, National Water Resources Policy, and the forthcoming Climate Change Act signal a shift toward adaptive governance, albeit without full legal integration. This analysis explores the extent to which these instruments enable or constrain adaptation and identifies key legal and institutional gaps that must be addressed to ensure climate-resilient water management in Malaysia.

Water Services Industry Act 2006

The Water Services Industry Act 2006 (WSIA) remains the principal federal statute regulating treated water supply and sewerage services in Malaysia. Enacted as part of Malaysia's post-2004 water restructuring programme, WSIA centralised regulatory authority at the federal level through the establishment of the National Water Services Commission (SPAN) and introduced a licensing framework aimed at improving service delivery, efficiency, and accountability across the water industry. However, crucially, WSIA was designed prior to the institutional mainstreaming of climate change governance, and its text reflects this legacy. It contains no explicit reference to climate change, climate risk, or adaptation. This statutory silence on adaptation is increasingly problematic given the sector's exposure to climate extremes such as drought, flooding, saline intrusion, and infrastructure failure.

Across its core provisions, including licensing (sections 4–28), regulatory compliance (Part VII), and infrastructure obligations (sections 34–36), the WSIA does not impose any duties on licensees or regulators to assess climate risks, incorporate hydroclimatic projections, or adjust operational standards to accommodate a non-stationary climate regime. Instead, WSIA maintains an operational logic grounded in stationarity and regulatory fixity, assuming environmental conditions will remain broadly stable over time, a premise widely discredited in climate adaptation literature (Craig, 2010; Hall et al., 2024).

Despite these limitations, certain WSIA provisions offer doctrinal footholds for climate adaptation, if interpreted and applied purposively. For example, section 34 requires licensees to ensure continuous water services, and section 35 compels licensees to maintain their water systems in "good and sufficient repair." When read in the context of mounting climate-induced disruptions, such as the widespread treatment plant shutdowns during the 2021 Selangor floods (Yeong, 2024), these obligations could be construed as implying a duty to anticipate and manage climate impacts on service continuity. Similarly, section 36, which mandates the provision of water services in an "efficient and economical" manner, could potentially encompass climate resilience as a component of service quality and cost-effectiveness over time. Yet without explicit statutory language or regulatory guidance, these potentialities remain underdeveloped and unenforceable.

The Water Services Industry (Amendment) Act 2025 (A1744), assented on 27 January 2025 and gazetted on 7 February 2025, introduces section 121(1A) criminalising contamination of watercourses or water-supply systems causing disruption, with penalties stretching up to RM15 million- and 15-years' imprisonment. The Act also empowers courts to order polluter-pays compensation for environmental restoration. While the amendment was not explicitly framed as a climate adaptation measure, it nonetheless addresses a main compound climate stressor: pollution risks intensified by declining river flows, a pattern likely to become more frequent under climate change (Howard et al., 2016; Zakar et al., 2012). This illustrates how climate-relevant reforms may emerge in piecemeal fashion, even in the absence of a formal adaptation mandate.

Another latent mechanism within WSIA with potential relevance to adaptation is section 56, which provides the Minister with special powers during emergencies. Under this provision, the Minister may restrict water usage, impose consumption quotas, suspend water operations, or direct the Commission to take control of supply systems in the event of an emergency. Notably, the law defines "emergency" to include excessive drought or any event posing a threat to public safety or health, circumstances increasingly linked to climate extremes. In theory, Section 56 could be activated during climate-induced droughts to prioritise domestic and ecological water needs, enforce equitable rationing, or temporarily halt unsustainable abstractions. Yet the provision's architecture is fundamentally reactive. It does not mandate the use of scientific climate data in emergency declarations, nor does it require inter-agency coordination or follow-up resilience planning. The Minister's decisions are shielded from judicial review under section 56(5), raising concerns about transparency and accountability. Furthermore, there is no institutionalised mechanism to link emergency interventions to longer-term adaptive governance processes.

The absence of forward-looking regulatory instruments marks a significant doctrinal gap in Malaysia's water law. Tools such as climate vulnerability assessments, scenario-based infrastructure standards, and legally binding adaptation planning requirements remain notably absent from the current legal framework. While the National Water Research Institute of Malaysia (NAHRIM)'s hydrological climate projections and the Department of Irrigation and Drainage, Malaysia (DID)'s updated flood hazard maps represent substantial progress in technical modelling, these outputs have not been legally embedded into design codes, water safety plans, or infrastructure financing decisions under the WSIA. This reflects a broader challenge noted in both domestic and international literature: the failure to translate climate science into enforceable legal norms (Fulazzaky et al., 2023; Żywiec et al., 2024).

As currently framed, the WSIA supports climate resilience only incidentally, through general duties, pollution controls, and emergency powers, not systematically. This limits Malaysia's ability to proactively manage water sector vulnerability in an era of accelerating climate disruption. From a regulatory design perspective, the Act operates under a command-and-control paradigm poorly suited for managing dynamic, non-linear risks. The conceptual shift required is not only legislative but epistemological: the WSIA must evolve from governing water under static assumptions to one that supports adaptive management, anticipatory planning, and institutional learning. This entails embedding legal obligations for resilience audits, infrastructure screening for climate risks, and adaptive licensing regimes, as proposed under frameworks like the AIR2040 and the forthcoming Climate Change Act.

In summary, while the WSIA contains provisions that may be interpreted or amended to support aspects of adaptation, it does not yet form part of a coherent legal architecture for climate-resilient water governance. Its current structure reflects the legacies of a pre-climate era and requires fundamental reorientation to align with Malaysia's broader adaptation commitments under the National Adaptation Plan, AIR2040, and Sustainable Development Goals (SDG 6, 13, and 16).

Environmental Quality Act 1974

The Environmental Quality Act 1974 (EQA) is Malaysia's umbrella environmental law, focused mainly on pollution control (water, air, waste) and environmental impact assessments. While the Act has undergone amendments, including the significant Environmental Quality (Amendment) Act 2024 which introduced stricter penalties and clearer definitions, it still lacks explicit mention of "climate change" or "adaptation". The EQA's relevance to water and adaptation lies in its role in safeguarding the environmental quality of water bodies and regulating activities that could exacerbate climate vulnerability. For instance, through the EIA process, the EQA can regulate deforestation of watersheds or draining of wetlands, which, if unchecked, would reduce natural buffers against floods and droughts. However, the EQA's implementation has not systematically required considering future climate risks; an EIA for a project near a river, for example, evaluates present-day impacts but typically does not assess how climate change might alter the river and whether the project should be designed differently to account for that.

Recognizing these limitations, the government announced a two-phase amendment to the EQA. Phase 1, gazetted in June 2024, focused on increasing penalties for environmental offences (Environmental Quality (Amendment) Act 2024). Phase 2 is anticipated to be a broader review that may incorporate new elements after stakeholder consultations. One element under discussion is the inclusion of climate change considerations within the Act's scope such as water and air pollution control (Bernama, 2024). An interdisciplinary task force has considered adding climate change definitions and provisions, debating whether to integrate climate policy into the EQA or address it through a separate Climate Change Act. The emerging consensus suggests that broad climate governance will be handled by a dedicated Climate Change Act, while the EQA could be updated to complement that, for example, by ensuring that regulations and standards under the EQA consider climate change impacts. Including climate adaptation in the EQA could mean mandating that certain developments include climate risk assessments as part of EIAs or empowering environmental authorities to take anticipatory action, such as managing river flows or protecting climate-sensitive habitats. As of April 2025, these proposals remain under consideration.

State Water Enactments and Water Resource Governance

Malaysia's Federal Constitution divides responsibilities between the federation and the states: water resources (such as rivers, lakes, and groundwater) fall under the State List (Ninth Schedule), while water services (treatment, supply, and sewerage) were brought under concurrent and federal jurisdiction through the enactment of the WSIA, with the agreement of most states. Consequently, each state has its own laws governing water resources, often establishing a state water management authority and incorporating provisions for water rights allocation, river protection, and usage permits. Examples include the Selangor Waters Management Authority (LUAS) Enactment 1999 and similar enactments in Kedah, Kelantan, and other states. Many of these enactments historically drew inspiration from the Water Act 1920, which governed few states water administration such as Perak, Pahang, Negeri Sembilan, Selangor, Malacca and Johor, although the Act's influence has diminished over time. Later coordination efforts through the National Water Council (NWC) sought to harmonize state approaches to water governance, but legislative models remained state-driven. These state enactments are critical for climate adaptation because many adaptation measures, such as catchment conservation, floodplain zoning, and drought management, must be implemented at the river basin or state level.

Integration of climate change considerations into Malaysia's state water laws remains limited and, in many cases, it is very minimal. Most state enactments were developed before widespread climate policy discourse emerged and thus primarily address traditional regulatory concerns such as water allocation between sectors, licensing of abstraction, and pollution control. Nonetheless, several existing provisions indirectly support climate adaptation efforts. For instance, states are empowered to gazette forest reserves as water catchment areas under state forestry laws or water resource enactments. Malaysia's Fourth National Communication to the UNFCCC reported that approximately 170 forest reserves have been designated as water catchment areas, a strategic move aimed at maintaining reliable reservoir inflows amid changing rainfall patterns (Government of Malaysia, 2024). Beyond legislative provisions, Integrated River Basin Management (IRBM) initiatives have been developed in several states, incorporating flood control, erosion management, and ecosystem preservation components. IRBM has been strongly promoted through national policies such as the National Water Resources Policy 2012, which explicitly recognizes climate variability as a key consideration for water governance and calls for the nationwide implementation of Integrated Water Resources Management (IWRM) and IRBM (Department of Irrigation and Drainage Malaysia, 2014). Implementation of IRBM strategies, including gazetting river reserves, designating flood-prone areas, and improving coordination among state agencies, relies on the authority of state water and land enactments (United Nations, 2020). Although these activities are not formally labelled "climate adaptation" within state laws, they function as practical adaptive measures contributing to Malaysia's broader climate resilience agenda.

A significant governance mechanism is the National Water Council (NWC), chaired by the Prime Minister and comprising Chief Ministers of each state and relevant federal ministers. The NWC is an executive coordination body but was established to harmonize water management across states. Through the NWC, the federal government has pushed for certain uniform measures. Adaptation could be better

integrated if such a framework were in place, mandating, for example, that states prepare Water Resource Adaptation Plans or cooperate on inter-state basin management under climate stress scenarios. As of now, adaptation actions at state level depend on political will and guidance from national policies rather than any binding legal requirement. This fragmentation is a notable gap: climate risks do not respect state boundaries, and differences in state capacity and priorities mean some areas might lag in adaptation. For instance, one state might actively enforce catchment protection, while a neighbouring state upstream allows deforestation that increases flood risk downstream. Thus, strengthening the legal integration may require either a federal law that sets minimum standards for climate adaptation in water management (with state consent) or amendments to each state's laws guided by a national model.

Legal Instrument	Purpose	Climate Change Integration	Recent Developments	Gaps
Water Services Industry Act 2006	Regulates treated water supply and sewerage services at the federal level.	No explicit reference to climate change or adaptation; recent amendments strengthen pollution control.	March 2025 amendment: Higher penalties for pollution, new offence for contaminating water supply systems.	Lacks mandatory requirements for climate risk assessment and adaptation planning by operators.
Environmental Quality Act 1974	Regulates pollution control and environmental impact assessment across sectors.	No explicit reference to climate change; Phase 2 amendment under discussion may include climate risk considerations.	2024 amendment increased penalties; Phase 2 may introduce climate change definitions and climate risk considerations.	Lacks systematic requirement for EIA to consider future climate impacts.
State Water Enactments and Governance	Regulates water resources management (rivers, lakes, groundwater) at state level.	Minimal explicit integration of climate adaptation; IRBM and catchment conservation efforts exist indirectly.	National Water Council pushing for a consolidated water resources bill; state-level adaptation depends on voluntary measures.	Fragmented adaptation measures; lack of binding obligation for states to adopt climate resilience strategies.

Table 1: Summary for National Water Law and Climate Change Integration

Policy Frameworks and Adaptation Integration

Beyond formal statutes, Malaysia's national policies provide direction on climate change and water management. These policies are not legally binding like acts of Parliament, but they influence legislation, administration, and on-ground programs.

National Climate Change Policy (2009) and National Policy on Climate Change 2.0

Malaysia's National Policy on Climate Change (NPCC), launched in 2009, established a framework for integrating climate change considerations into national development planning. The policy emphasized principles such as sustainable development, coordinated implementation, and the integration of climate responses into national planning. One of its key thrusts was to mainstream climate change through the wise management of resources and enhanced environmental conservation. The NPCC recognized water resources as a vulnerable sector and called for adaptive measures such as water conservation, flood control, and cross-sector collaboration. However, the NPCC remained a high-level policy without specific

regulatory mandates, serving more as a reference for ministries and state governments to justify adaptation projects rather than mandating specific actions (Ministry of Natural Resources and Environment Malaysia, 2009). Recognizing emerging challenges, the Malaysian government launched the National Policy on Climate Change 2.0 (NPCC 2.0) in late 2024. The updated policy incorporates the latest scientific insights, including scenarios from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report, and provides more concrete strategic direction for adaptation across sectors, including water (Ministry of Natural Resources, Environment and Climate Change Malaysia, 2024). NPCC 2.0 emphasizes strengthening climate resilience through integrated resource management and explicitly acknowledges the need for coherence between sectoral legislation and climate governance. It also aligns with the forthcoming Climate Change Act to ensure that national policy and legal frameworks work in tandem toward Malaysia's low-carbon and climate-resilient future.

National Water Resources Policy (2012)

Malaysia's National Water Resources Policy (NWRP), launched in 2012, explicitly acknowledged climate change as a critical factor affecting water security. The policy enshrined the principles of Integrated Water Resources Management (IWRM) and aimed for "water security and sustainability for all by 2050." It emphasized the need to incorporate climate variability into water planning, advocating for measures such as protecting catchment areas and enhancing hydrological data networks to improve flood and drought forecasting (Ministry of Natural Resources and Environment Malaysia, 2012). To operationalize the NWRP, the Malaysian Water Partnership, in collaboration with the Department of Irrigation and Drainage Malaysia (DID), conducted a stakeholder forum in 2014 focused on incorporating climate resilience into the NWRP action plans. This forum engaged key stakeholders from various sectors to support the development of national adaptation responses to climate change (Global Water Partnership, 2014).

Despite these efforts, the NWRP remains a policy instrument without binding regulatory mandates, leading to uneven implementation across states. Some recommendations, such as establishing a central water data centre and legislating a comprehensive water resources law, are still in progress (Academy of Sciences Malaysia, 2016). Building upon the NWRP, the Water Sector Transformation 2040 (WST2040) roadmap serves as an implementation blueprint for water sector reforms aligned with the NWRP and the Sustainable Development Goals (SDGs). WST2040 includes a dedicated volume on Climate Change Impact and Adaptation (CCIA), offering key strategies to strengthen adaptation through IWRM and water technology. These strategies encompass improving flood early warning systems, promoting water recycling, and enhancing governance to operationalize the NWRP's goals by 2040 (Economic Planning Unit & Academy of Sciences Malaysia, 2022).

Twelfth Malaysia Plan (2021–2025)

Malaysia's Twelfth Malaysia Plan (12MP) for 2021–2025 places significant emphasis on environmental sustainability, recognizing climate resilience as a critical component of national development. The plan outlines strategies to strengthen disaster risk management and adapt infrastructure to the impacts of climate change. In the water sector, the 12MP sets specific targets, including reducing non-revenue water (NRW) levels to 25% by 2025, enhancing the robustness of water supply systems, and implementing programs focused on climate change adaptation and mitigation for the water sector (Economic Planning Unit, 2021). The 12MP also reinforces Malaysia's commitment to the Sustainable Development Goals (SDGs), particularly SDG 6 (Clean Water and Sanitation) and SDG 13 (Climate Action). It aligns national targets with these global goals, ensuring that efforts in water resource management and climate adaptation contribute to broader sustainable development objectives (Ministry of Economy Malaysia, 2021). For instance, the government has increased allocations for flood mitigation projects and plans to integrate nature-based solutions and Integrated River Basin Management (IRBM) approaches into flood management strategies (Economic Planning Unit, 2021). While the Malaysia Plans serve as strategic planning documents rather than legally binding frameworks, they guide budget allocations and set priorities for government agencies. The prominence of climate adaptation in the 12MP has prompted relevant authorities, such as the Ministry of Natural Resources, Environment and Climate Change (NRECC), the Department of Environment, and the Department of Irrigation and Drainage, to focus on delivering results. This focus can drive legal and administrative changes, including the development of

guidelines for incorporating climate considerations into project design and the updating of building codes for water infrastructure (Economic Planning Unit, 2021).

National Adaptation Plan (NAP) Development

Malaysia is actively developing its National Adaptation Plan (NAP) to ensure that climate change adaptation is systematically integrated into national development planning. As stated in Malaysia's updated Nationally Determined Contribution (NDC) submitted to the UNFCCC in 2021, the NAP aims to mainstream adaptation across various sectors, with a particular focus on water resources management and security (Government of Malaysia, 2021). The NDC identifies water resources as a critical area for adaptation, highlighting strategies such as strengthening Integrated Water Resources Management (IWRM) and Integrated River Basin Management (IRBM), incorporating climate projections into flood risk assessments, enhancing early warning systems, increasing water supply buffers through measures like off-river storage and water recycling, and diversifying water sources via rainwater harvesting and groundwater utilization (Government of Malaysia, 2021). The development of the NAP is guided by the UNFCCC's technical guidelines, which emphasize a participatory and iterative process involving the assessment of vulnerabilities, identification of adaptation options, and integration into sectoral policies (UNFCCC, 2021). While the NAP is still being formulated, it is expected to recommend specific integration steps, potentially including revisions to existing policies or the introduction of new legislative initiatives to facilitate effective adaptation measures. Progress in formulating and implementing NAPs is monitored by the UNFCCC through periodic reports. The 2023 progress report notes that many developing countries, including Malaysia, are advancing in their NAP processes, with efforts focused on integrating adaptation into national planning and securing necessary support for implementation (UNFCCC, 2023).

Sustainable Development Goals (SDGs) Alignment

Malaysia has demonstrated a strong commitment to the Sustainable Development Goals (SDGs), with its Voluntary National Review (VNR) reports in 2017 and 2021 tracking progress on goals including SDG 6 (Clean Water and Sanitation) and SDG 13 (Climate Action). These international commitments have influenced domestic integration of climate adaptation strategies. For SDG 6, Target 6.5 emphasizes the implementation of Integrated Water Resources Management (IWRM) at all levels by 2030. Malaysia's self-assessment on IWRM implementation was moderate, prompting initiatives like the National Water Resources Policy (NWRP) and the Water Sector Transformation 2040 (WST2040) roadmap to enhance water resource management (Ministry of Economy Malaysia, 2021). Achieving Target 6.1 (universal access to safe drinking water) and Target 6.4 (increasing water-use efficiency and reducing water scarcity) in the context of climate change necessitates adaptation measures. These include ensuring water supply in drought-prone areas, which may involve legal tools like water rationing plans or drought orders. SDG 13, particularly Target 13.2, focuses on integrating climate change measures into national policies, plans, and strategies. Malaysia's efforts in this regard are evident in its SDG Roadmap Phase II (2021–2025), which outlines actions to enhance the resilience of infrastructure and cities, including flood mitigation and the protection of ecosystems for climate adaptation (Ministry of Economy Malaysia, 2021). In its 2021 VNR, Malaysia highlighted its approach of combining structural measures (such as dikes and barrages) with non-structural measures (like IWRM, Integrated River Basin Management (IRBM), and Nature-based Solutions) for flood adaptation. The report also emphasized that mainstreaming adaptation for water is being pursued, and noted that regulatory interventions, including new legislation to address climate change issues, are prerequisites for sustainable water management (Government of Malaysia, 2021). This likely refers to the planned Climate Change Act, which aims to ensure long-term, future-proof water governance. Consequently, global frameworks and reporting mechanisms are playing a significant role in driving Malaysia to integrate climate adaptation into its national agenda, even if legal changes on the ground are incremental.

Proposed Climate Change Act and Governance Reforms

Malaysia is progressing towards enacting a comprehensive Climate Change Act, known as the Rang Undang-Undang Perubahan Iklim Negara (RUUPIN), with the draft expected to be tabled in Parliament in early 2025 (Ho, 2024). The RUUPIN aims to establish a statutory framework for climate governance, incorporating mitigation and adaptation across critical sectors (Zaid Ibrahim & Co., 2025). Main

provisions include the formation of a National Climate Change Council chaired by the Prime Minister, alongside a dedicated Climate Change Authority mandated to regulate emissions, develop carbon pricing frameworks, and manage the national climate data platform (The Edge Malaysia, 2025).

However, a closer reading of the Consultation Paper reveals significant governance and substantive gaps that may limit RUUPIN's effectiveness as a truly transformative instrument. While the bill outlines progressive mechanisms for emissions reporting, carbon trading, and data integration, it exhibits a sectoral bias toward mitigation. Notably absent are binding legal requirements to integrate climate adaptation into water governance, environmental licensing, or infrastructure planning (Nyon & Kumaresan, 2025). The draft fails to mandate climate-resilient water resource management or the inclusion of hydrological stress projections in river basin policies and abstraction licensing. These omissions are striking given Malaysia's acute exposure to climate-induced water vulnerabilities, including increasingly erratic rainfall, prolonged droughts, and flood disasters (Eco-Business, 2024).

Although the RUUPIN proposes a National Climate Fund and a Climate Registry, it is silent on how such mechanisms would prioritise adaptation financing for critical water infrastructure. Moreover, while it envisions a centralised Regulatory Entity, the draft lacks clarity regarding institutional independence, parliamentary oversight, or the accountability structures necessary to ensure fair and science-based decision-making (RUUPIN Consultation Paper, 2024). The Act also stops short of articulating procedural rights, such as public access to climate risk information or legal standing for affected communities, thereby weakening its potential as a rights-based climate law.

These shortcomings risk repeating a pattern seen in some national climate laws that foreground emissions while marginalizing water governance and ecosystem resilience. Authors like Craig (2020) and Tortajada (2010) argue that legal adaptation for water must include flexibility, participatory governance, and institutional coordination. This perspective aligns with international best practices, where some countries have begun embedding sectoral adaptation duties, such as mandatory assessments, dedicated funding streams, and implementation frameworks, into their climate legislation.

For example, Kenya's Climate Change Act 2016 explicitly mandates climate responses, including in the water sector, into national and county-level plans, with dedicated funding streams and coordination mechanisms (Climate Change Act, 2016; National Climate Change Action Plan, 2022). Colombia's Law 1931 of 2018 similarly requires that all public and private sector decisions incorporate adaptation measures across water and environmental systems (Law 1931, 2018). South Korea's legal approach is equally instructive, integrating water-related resilience measures into its Carbon Neutrality Act and allowing judicial review to protect climate-related rights (Reuters, 2024; ICAP, 2022). These jurisdictions demonstrate that climate laws can go beyond carbon metrics by mandating sector-specific adaptation obligations, public accountability, and implementation mechanisms which are the principles that Malaysia's RUUPIN must incorporate to ensure climate justice and sectoral coherence.

Complementing RUUPIN, governance reforms in late 2023 led to the restructuring of Malaysia's climate and resource portfolios. The former Ministry of Natural Resources, Environment and Climate Change (NRECC), which previously oversaw five sectors including natural resources, environment, climate change, energy, and water, was split into two separate ministries: the Ministry of Natural Resources and Environmental Sustainability (NRES) and the Ministry of Energy Transition and Water Transformation (PETRA). NRES now governs land, forestry, minerals, environment, and climate change, while PETRA oversees energy and water services. This restructuring reflects an attempt to rationalise administrative mandates and improve focus, particularly in climate governance and energy transition. However, the fragmentation of climate and water oversight across different ministries may also introduce coordination challenges, particularly in implementing cross-sectoral adaptation measures such as nature-based solutions, climate-resilient water infrastructure, and integrated resource management. These institutional tensions highlight the need for RUUPIN to clearly define inter-ministerial coordination duties and create binding mechanisms for vertical integration across federal, state, and local governments. Additionally, discussions are ongoing to develop a National Disaster Management Act to codify the roles of the National Disaster Management Agency (NADMA) and other agencies. If realized, this Act should ideally

integrate climate projections to enhance disaster risk reduction strategies, particularly in flood management (The Edge Malaysia, 2025).

DISCUSSION

This study began by identifying a core problem: Malaysia's legal framework for water governance is not structurally designed to anticipate or manage the hydrological volatility introduced by climate change. As stated in the introduction, while floods, droughts, and water pollution have intensified in frequency and severity, these risks are not adequately internalised within existing water legislation. The literature review confirms that this is not a uniquely Malaysian problem, but part of a broader global pattern where adaptation remains predominantly a technical or policy-driven exercise, poorly embedded in binding legal structures (Craig, 2010; Howard et al., 2016; Żywiec et al., 2024). What makes Malaysia's case distinct is the legal fragmentation, overlapping jurisdictions, and outdated legal doctrines that were never intended to deal with climate-related risks. This discussion examines the structural weaknesses identified in the analysis and shows how they relate to broader legal concepts and governance models for adaptation.

Static Doctrines in a Non-Stationary Climate

One of the clearest problems in Malaysia's water governance is the continued reliance on legal doctrines that assume hydrological stability. These doctrines treat water systems as if they follow predictable, historical patterns. This assumption remains embedded in both federal laws, such as the WSIA and state-level water enactments. Critically, these legal frameworks do not require climate risk assessments, forward-looking planning, or infrastructure design that accounts for climate variability. As Craig (2010) argues, any legal system that fails to acknowledge the end of stationarity is inherently maladaptive.

In the Malaysian context, the WSIA, which governs the requirement for infrastructure permits, reflects this doctrinal rigidity. The provision sets out the need for prior permission before constructing or altering any water or sewerage infrastructure, but it makes no mention of long-term climate projections, risk modelling, or adaptation planning requirements (WSIA, 2006, s.50). Similarly, state-level water laws such as the Selangor Water Management Authority Enactment 1999 and the Perak Water Resources Enactment 2023, regulate abstraction and resource allocation without incorporating climate-informed thresholds or projection-based assessments. These instruments operate on the assumption that past hydrological conditions will continue into the future.

This rigidity is particularly problematic because Malaysia is not data-poor. Institutions such as NAHRIM and the Department of Irrigation and Drainage have developed downscaled climate models, flood hazard maps, and hydrological projections based on future rainfall intensity and streamflow variability. For example, NAHRIM has published climate impact models using tools such as PRECIS and SDSM (NAHRIM, 2014; NAHRIM, 2011), while DID has produced updated flood hazard data under RCP 4.5 and RCP 8.5 scenarios (Syahmi et al., 2025). Despite these technical advancements, there is no statutory requirement for water agencies, utilities, or project proponents to incorporate such data into planning, licensing, or design approvals. The Urban Stormwater Management Manual for Malaysia (MSMA), published by DID in 2012, has also not been formally revised to reflect projected rainfall intensities, compound flood risks, or future hydrological baselines shaped by climate change (DID Malaysia, 2012). This gap reinforces a structural disconnect between scientific foresight and legal mandates.

As Hall et al. (2024) observe, legal regimes built on historical water rights are ill-equipped to respond to seasonal and interannual variability—an issue that is acute in monsoonal countries like Malaysia. Yet current Malaysian laws do not mandate regular updates to water safety plans, abstraction limits, or infrastructure standards based on evolving climate data. This disconnect between ecological uncertainty and legal certainty is more than a technical oversight; it is a structural failure to reconceptualise water law as a tool for navigating ecological change. Reform efforts must begin by rejecting the myth of hydrological predictability and replacing it with a legal architecture that is flexible, risk-informed, and responsive to uncertainty over time.

Jurisdictional Fragmentation

A second conceptual flaw lies in the constitutional and institutional structure of Malaysia's water governance. While the WSIA governs treated water and sewerage services under federal control, the abstraction, allocation, and land-use decisions that most directly affect climate adaptation remain under state jurisdiction. This vertical split generates what the literature refers to as "polycentric incoherence", a condition where multiple centres of authority act without sufficient legal coordination (Schilling et al., 2020; Takele et al., 2024). The doctrinal analysis of state enactments, such as Selangor's Water Management Authority Enactment 1999 or Perak's recent 2023 Enactment, shows wide variation in how climate risks are addressed. This patchwork undermines national efforts to standardise adaptation measures, such as through the National Water Resources Policy (NWRP) or the proposed Climate Change Act.

Federal-state tension becomes especially problematic when adaptation requires integrated basin-level action. For example, floodplain zoning, forest conservation, and groundwater regulation all require upstream-downstream coordination, yet Malaysian law lacks basin-wide legal instruments with binding authority across state lines. While IRBM and AIR2040 promote such integration in principle, these frameworks remain policy tools without statutory force. The literature warns that in federated systems, policy harmonisation without legal anchoring leads to symbolic rather than substantive coherence (Elliott et al., 2014; Fan et al., 2021). Malaysia risks precisely this outcome unless legal instruments (such as a Model State Water Adaptation Enactment or coordinated amendment protocols) are developed to bridge the federal–state divide with enforceable adaptation provisions.

Data-Rich but Law-Poor

Malaysia is not data-poor. On the contrary, government agencies have made commendable advances in climate modelling, flood forecasting, and vulnerability assessments. NAHRIM's downscaled hydrological models and DID's updated flood hazard maps represent significant technical progress. However, as highlighted in the findings and literature, this data remains decoupled from legal standards, planning laws, and design codes. Fulazzaky et al. (2023) and Żywiec et al. (2024) both caution that technical knowledge without legal embedding becomes advisory rather than directive. For instance, the MSMA urban drainage manual has yet to be updated to incorporate future rainfall intensities. The absence of a legal mechanism to integrate projected flood frequencies into infrastructure guidelines results in maladapted designs that assume obsolete baselines.

The doctrinal analysis confirms that Malaysia lacks statutory instruments requiring public agencies or licensees to use downscaled projections in project approvals, water allocation plans, or EIA reports. This reflects a deeper conceptual inertia where the legal system remains reactive rather than anticipatory. Law must evolve from merely codifying best practices to institutionalising scientific foresight. This requires legal innovation in secondary legislation (such as regulation-making powers under the WSIA or EQA), standard-setting bodies (such as SPAN or JAS), and judicial review mechanisms that can invalidate planning decisions inconsistent with known climate risks.

The Missing Pillars of Ecosystem and Community Resilience

The literature on adaptation increasingly recognises that resilience is not solely a function of engineering or policy, but also of ecological integrity and social inclusivity (Howard et al., 2016; Li, 2024). However, as the doctrinal review demonstrates, Malaysia's water law remains predominantly infrastructure-centric and anthropocentric. Only a few provisions address the protection of ecological flows, wetlands, or mangrove systems, despite their well-established role in buffering climate shocks. Likewise, vulnerable communities such as indigenous groups, small-scale farmers, and peri-urban populations are largely excluded from existing legal instruments. This omission is not merely normative; it has direct operational consequences. In the absence of legal mandates for participatory governance and environmental safeguards, adaptation measures risk entrenching social inequalities and weakening natural defence systems.

The lack of integration of ecosystem-based adaptation (EbA) and community resilience into statutory frameworks represents a significant blind spot. Although Integrated River Basin Management (IRBM)

strategies and "Building with Nature" principles are present in policy discourse, they remain unsupported by binding legal provisions in planning laws or state enactments. A rights-based approach, incorporating legally enforceable environmental flow standards, community participation requirements, and recognition of customary water rights, could reorient water governance toward more inclusive and adaptive outcomes. As Malaysia prepares to enact a Climate Change Act, this represents a timely opportunity to institutionalise these elements as legal obligations rather than leaving them as non-binding policy aspirations.

The Missing Architecture for Enforcement and Oversight

Perhaps the most pressing structural failure identified is the absence of legal accountability mechanisms. As the literature makes clear, adaptation without enforceability results in symbolic compliance and bureaucratic drift (Arnell & Delaney, 2006; Biswas et al., 2023). Malaysia has multiple adaptation plans and roadmaps, but no legal requirement to implement, monitor, or publicly report on their outcomes. The proposed Climate Change Act could change this, but only if it borrows from models like the UK Climate Change Act 2008, which mandates 5-yearly risk assessments, sectoral adaptation plans, and independent review.

The doctrinal review reveals that under current Malaysian law, no agency is legally obligated to demonstrate that adaptation objectives are being met. The WSIA and EQA provide enforcement tools for pollution or service failures, but not for climate inaction. This lack of "adaptation justiciability" undermines the rule of law in climate governance. Embedding regular reporting requirements, adaptation performance indicators, and judicially reviewable duties could transform adaptation from a policy commitment into a binding public law responsibility. This would not only enhance transparency and effectiveness but insulate adaptation governance from political cycles and ministerial discretion.

RECOMMENDATIONS

Drawing on the above analysis, several recommendations are proposed to strengthen the integration of climate change adaptation into Malaysia's water law and governance framework:

Enact and Implement the Climate Change Act with Clear Adaptation Mandates

The forthcoming Climate Change Act should be expedited and include specific provisions that anchor adaptation across all sectors. For the water sector, the Act should mandate the development of a National Adaptation Plan for Water Resources and Services as a sub-component of the overall NAP. This plan should be periodically updated (e.g. every 5 years) and include targets such as percentage of catchment areas protected, reduction in communities at high flood risk, and water supply resilience indicators. The Act's Climate Change Committee should have representation from water authorities (SPAN, DID, state water directors) to ensure water issues are prominently addressed. Additionally, the Act could require annual or biennial reporting to Parliament on the state of climate adaptation in critical sectors, including water – creating accountability for progress on initiatives like flood mitigation projects, drought contingency planning, and infrastructure climate-proofing.

Integrate Climate Risk Assessment into Environmental and Water Regulatory Processes

Malaysia should formally incorporate climate change considerations into the Environmental Quality Act's regulations and the water services regulatory framework. Concretely, this means updating the Environmental Impact Assessment (EIA) guidelines under the EQA to require that all EIAs for major projects (dams, water treatment plants, large developments near floodplains, etc.) assess climate change impacts over the project's lifespan. For example, a proposal for a new dam should evaluate how climate variability could affect inflows and safety in the future, and a coastal development should consider sea level rise. Similarly, SPAN (under the WSIA) can issue directives or codes of practice for licensed water operators to conduct climate risk assessments on their supply systems – evaluating vulnerabilities of their intakes, treatment plants, and distribution networks to extreme weather (floods that might inundate facilities, droughts that might deplete sources) and to plan investments accordingly. This could be modelled as a requirement in the water services industry (such as each water utility must produce a Water Safety and Climate Resilience Plan). Such plans would dovetail with existing Water Safety Plan approaches (focused on contamination) but broaden them to include climate hazards. The regulators

would then review these plans as part of license conditions. Embedding these requirements in subsidiary legislation or licenses ensures that adaptation moves from optional to standard practice in operations.

Amend State Water Laws to Mainstream Adaptation

While national initiatives are crucial, much of the action for water adaptation (like land use control, local flood defences, water allocation during shortages) happens at state level. It is recommended that the National Water Resources Council develop a Model Climate-Resilient Water Resources Enactment or guidelines and encourage each state to adopt the relevant provisions. Key elements could include: (a) a requirement for state water authorities to consider climate projections in their river basin plans; (b) authority to declare "Climate Emergency Water Zones" during extreme droughts or floods, enabling extraordinary measures (such as temporary water use restrictions or inter-agency coordination) under a legal framework; (c) stronger protection for water catchment areas and wetlands, for instance by making it easier to gazette and harder to de-gazette forest reserves that serve as water sources (this could be done by amending forestry enactments with climate rationale, since intact forests help regulate hydrology); and (d) a mandate for establishing floodplain zoning maps that restrict or condition development in high-risk areas – essentially translating integrated flood management and IRBM principles into law. To support states in this, the federal government via NAHRIM and DID can provide technical data and potentially funding incentives, such as grants under the Malaysia Plans for states that implement adaptation measures, for instance, constructing off-river storage, improving irrigation efficiency to conserve water as per climate recommendations.

Strengthen Inter-agency Coordination and Data Sharing through Legal Instruments

Effective adaptation requires breaking silos. One recommendation is to formalize coordination mechanisms via Memoranda of Understanding or joint regulations between agencies. For example, between the Department of Environment and Department of Irrigation and Drainage for climate-flood data, or between SPAN and state water authorities for sharing information on raw water availability. The Climate Change Act's committee can be operationalized through technical working groups on sectors like water. These working groups should include scientists (from universities or research institutes like NAHRIM) and stakeholders, and their role could be written into a regulation or ministerial directive, giving them a clear mandate to propose updates to standards and practices. Malaysia could also establish a National Climate Adaptation Knowledge Portal to consolidate climate and water data, such as centralized databases of rainfall, river flows, flood events, and projections. This ties in with AIR2040's proposed Integrated Water Sector Data Centre. A recommendation is to expedite the creation of this Data Centre and ensure it is accessible to policymakers at all levels. Legal provisions might be needed to require agencies to feed data into the Centre (overcoming the common issue of data hoarding). The outcome would be better-informed decision-making and the ability to track indicators of climate stress and adaptation over time.

Emphasize Nature-Based Solutions and Community-Based Adaptation in Legal Plans

Laws and policies should explicitly encourage nature-based and community-driven adaptation measures, as these are cost-effective and sustainable. For instance, the Flood Mitigation programs can be supported by legal designation of certain zones for flood retention. A recommendation is to amend local government planning guidelines (under the Town and Country Planning Act or related regulations) to incorporate climate adaptation requiring, say, that city local plans include a section on climate resilience, identification of nature-based solution opportunities (like river naturalization or mangrove restoration along coasts), and allocation of land for those purposes. At the community level, engaging residents in water conservation and protection is crucial. The government could implement, under the WSIA's framework, demand-management regulations that promote rainwater harvesting and water recycling in homes and industries. Some of this has already exists as guidelines but making it part of building codes uniformly would help. Community-based adaptation, such as local rainwater harvesting schemes or community flood early warning systems, could be supported by small grant programs under the climate change law's purview, ensuring local knowledge and needs are addressed. Involving communities in decision-making can improve the human-centric approach of adaptation, making policies sensitive to equity and livelihoods.

Capacity Building and Public Awareness as Part of Governance Reforms

Adaptation integration is not only about rules but also about people understanding and using those rules. Therefore, it's recommended to include provisions for continuous capacity building of officials and stakeholders. This includes training judges and lawyers on environmental and climate law so that when disputes arise, the judiciary is well-versed in the context. Also, training for water managers in using climate data for planning should be institutionalized. Public awareness campaigns are equally important because an informed public will support and comply with adaptation-related measures, such as water rationing during droughts or relocation from high-risk flood zones. The government could leverage the education system and media to highlight climate-water connections and why certain legal measures such as protecting catchments or restricting water use are needed for long-term benefit. Incorporating education and awareness responsibilities into agencies' mandates will keep the human element at the forefront, ensuring that the adaptation agenda maintains a human touch and public buy-in.

Implementing these recommendations would move Malaysia closer to a climate-resilient water governance regime. The recommendations align with achieving SDG targets – for instance, improved coordination and data support SDG 6.5 on integrated management, nature-based solutions contribute to SDG 6.6 (protecting water-related ecosystems) as well as SDG 13.1 (strengthening adaptive capacity), and education aligns with SDG 13.3 (improving awareness and capacity on climate issues). By updating laws and policies with these measures, Malaysia can better safeguard its water resources and communities against climate impacts, fulfilling both national development priorities and international commitments.

CONCLUSION

Malaysia's water law landscape is evolving to acknowledge climate-related vulnerabilities, but significant legal and governance gaps persist. While policy initiatives have increasingly emphasized resilience, notably through the promotion of IWRM, IRBM, and nature-based solutions, the primary legal instruments governing water services, environmental protection, and water resource management still lack explicit climate adaptation requirements. The recent strengthening of the WSIA's enforcement provisions and ongoing EQA amendments demonstrate positive momentum, yet adaptation remains largely policy-driven rather than mandated by law.

Federal–state jurisdictional divides and uneven capacity across regions further compound the challenge of cohesive, nation-wide adaptation. Without binding obligations to assess climate risks, plan for extreme events, or prioritize ecosystem resilience, Malaysia risks fragmented and reactive adaptation responses. To secure long-term water security under worsening climate pressures, the integration of adaptation into Malaysia's water law must be deepened. This includes embedding climate risk assessment requirements into statutory frameworks, mandating sectoral adaptation plans, strengthening enforcement mechanisms, and promoting uniform standards through national coordination bodies. The proposed Climate Change Act offers a historic opportunity to institutionalize such reforms. Embedding legal accountability, structured implementation cycles, and community-ecosystem-centric approaches will be critical to ensure that Malaysia's adaptation efforts are not only ambitious on paper but operationalized effectively across governance levels. As climate impacts accelerate, adapting water law is not merely a regulatory necessity; it is a societal imperative for resilience, equity, and sustainability

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