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# FROM STATUES TO SYSTEMS: EVALUATING LEGAL AND POLICY COHERENCE FOR BLUE GREEN INFRASTRUCTURE IN ENGLAND AND CANADA

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**ABSTRACT**

Flood risk management is increasingly challenged by climate change and continued development in flood-prone areas, exposing the limitations of traditional grey infrastructure such as levees, dikes and flood walls. Blue green infrastructure (BGI) has emerged as a nature-based approach that can support flood mitigation while delivering wider ecological and social benefits. Despite growing policy support, the adoption of BGI remains uneven across jurisdictions. This paper examines how legal and policy frameworks shape the conditions under which BGI is implemented in flood risk management. It compares two common law jurisdictions facing rising flood risk England and Canada each operating under different governance arrangements: a more centralised system in England and a polycentric, multi-level governance structure in Canada. The study analyses legislation and policy across flood risk management, planning and environmental governance using four analytical dimensions: legal and policy mandates, governance allocation, resources, and enforcement and monitoring. The findings highlight how institutional design influences the implementation of BGI and provide insights for strengthening governance frameworks supporting nature-based flood management.

**KEYWORDS:** Blue Green Infrastructure; Flood risk management; Legal frameworks; Adaptive governance; England; Canada.

## 1 INTRODUCTION

Flooding is occurring more frequently across many developed countries as climate change, urbanisation and changing rainfall patterns intensify hydrological pressures (IPCC, 2022). In England, one in six properties is at risk of flooding which is likely to increase under future scenarios (Sayers et al., 2020; Environment Agency, 2022). These tendencies suggest that traditional grey flood infrastructure, designed for more stable hydrological conditions, is becoming increasingly strained

by more variable flood risks (Dong et al., 2017) Blue–green infrastructure (BGI) offers an alternative approach that works with natural processes through networks of wetlands, bioswales, floodable parks and green corridors that slow runoff while delivering wider environmental and social benefits (O'Donnell et al., 2017). Although policy support for BGI has strengthened, the integration of BGI measures into flood risk management remains patchy. This is largely due to legal, institutional and governance barriers that still favour hard engineering solutions (Matthews et al., 2015).

This paper examines how law and policy influence the uptake of BGI in flood risk management through a comparison of England and Canada. Both are predominantly common-law countries facing increasing flood risk but operating under different governance arrangements. England depends on a more centralised, statute-driven system, while Canada operates through a polycentric, multi-level governance regime involving the federal, provincial and municipal government. The analysis reviews flood, planning and environmental legislation and policy documents through four analytical lenses statutory duties; policy integration; governance arrangements; and enforcement and funding. Using this framework, the paper traces how responsibilities are distributed among key actors, including the Environment Agency, lead local flood authorities and planning bodies in England, and federal departments, provinces, municipalities and conservation authorities in Canada. The aim is to illustrate how legal and policy decisions may either enhance or restrict the systematic implementation of BGI in flood risk management, as well as to bring to light lessons that may assist in the design or reform of flood governance systems in different contexts.

## 2 METHODS

This paper employs a qualitative research design based on the systematic analysis of documents. This study aims to explore the way in which England and Canada are using BGI in law and policy to support flood resilience. Laws, policies and strategies are not just treated as technical rules, but as dynamic statements of how a society understands risk, distributes responsibility and what kinds of interven-tion are considered acceptable. Consequently, the approach is interpretative rather than doctrinal in nature. No interviews or questionnaires were conducted; all findings are derived from existing legal and policy documents. The analysis focuses on laws, statutes, strategies and guidance documents that were in force, or under active revision, between 2010 and 2024. This period was selected because climate adaptation and nature-based solutions gained prominence quickly on policy agendas during these years (IPCC, 2022). The aim is not to evaluate implementation in a concrete project but to investigate the formal opportunities and constraints created by the legal and policy framework for BGI in flood risk management. England and Canada were selected as case studies because they are both common law jurisdictions facing growing flood risk, yet they differ significantly in territorial scale, governance structure and planning traditions (Golnaraghi et al., 2020; Mehryar and Surminski, 2020). In comparative policy analysis, this type of pairing is often described as a most different systems design, where cases share a similar core problem but differ in important institutional features (De Wee, 2022). This design allows the analysis to investigate how different territorial/country governance arrangements shape the legal and policy terrain for BGI and to identify enabling and constraining conditions that are associated with national and sub national contexts, rather than the common law tradition or the general reality of rising flood risk. In each country, the first step was to identify core documents focusing on instruments which clearly govern the four mandated domains: flood risk management, spatial planning, water management and climate adaptation. These domains were selected as they constitute the principal mechanisms through which BGI is planned, funded and delivered (Awara, 2025). The initial list of instruments was then expanded in an iterative manner. Initial documents were identified through targeted searches of official government and agency websites, including national legislative databases, departmental policy portals, and environmental and planning authority websites in England and Canada. The search was guided by keywords such as flood risk management, blue-

green infrastructure, nature-based solutions, spatial planning, water governance, climate adaptation, policy, strategy, Act, and guidance.

The selection process was iterative. Core documents were read in full and examined for references to additional relevant legislation, policy instruments, and technical guidance. In-depth and systematic cross-checking of the documents was undertaken, alongside a review of Scopus-indexed academic literature, to identify frequently cited and policy-significant laws and policy instruments. Official government portals were also searched to identify relevant Acts, strategies, and technical guidance. Both keyword searching and full-text reading were used to ensure relevance. Documents were included where they established statutory responsibilities, informed planning or implementation practices, or were consistently referenced in policy or academic sources. All selected documents were analysed against four analytical dimensions: legal and policy mandates, governance arrangements, enforcement and monitoring, and resources. This approach resulted in a coherent yet wide-ranging corpus of legal and policy documents shaping the planning, funding, and delivery of BGI in the flood risk management context. In total, the study analysed 15 documents for England and 26 documents for Canada (10 federal and 16 provincial/municipal).

The analysis of the document was guided by adaptive governance theory, which highlights uncertainty, cross-scale coordination and learning-oriented institutional arrangements (Allen et al., 2023; Awara, 2025). Building on this literature, the study examines legal and policy frameworks across four analytical dimensions relevant to BGI for flood risk management: legal and policy mandates which refers to how laws and policies acknowledge and prioritise BGI; governance which in this context refer to the distribution of roles and decision-making power across institutions; enforcement and monitoring which refer to the mechanisms for implementation, oversight and policy learning; and resources which refer to financial capacity, technical expertise and institutional support. These dimensions serve as the analytical framework for the qualitative content analysis. Policy and legislative documents were examined to assess whether provisions enable, constrain or have mixed implications for BGI implementation. The framework structures the comparative analysis of England and Canada presented in Figure 1.

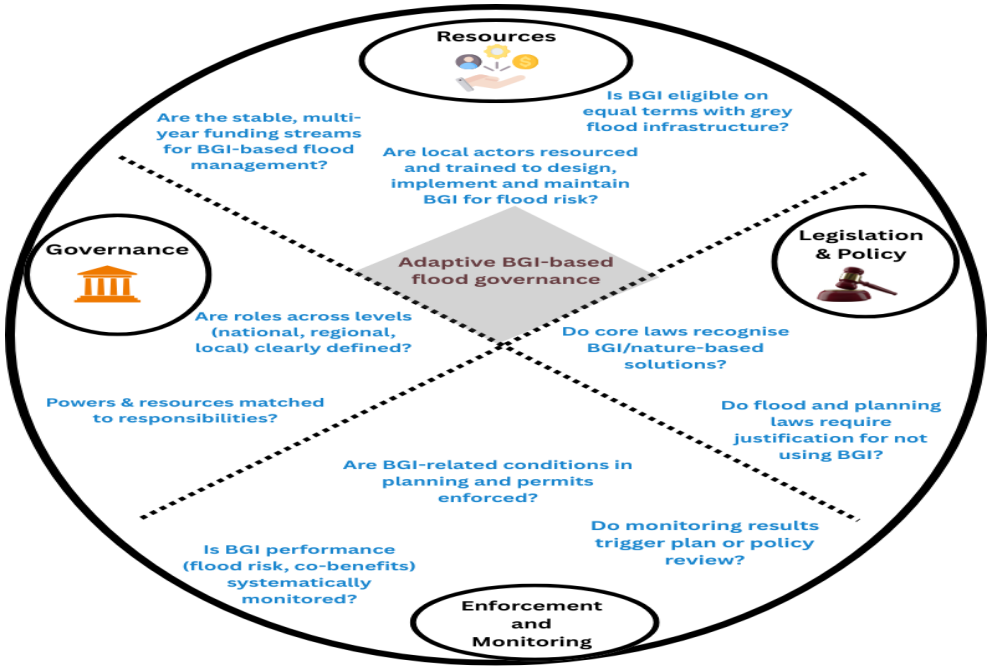


Figure 1: framework for adaptive, BGI-centred flood governance (Allen et al., 2023, Awara, 2025)

## 3 LEGISLATIVE FRAMEWORK: ENGLAND

Flood governance in England operates within a relatively centralised legislative system in which statutory responsibilities and policy direction are largely defined at the national level, with implementation carried out by local authorities and agencies (Awara, 2025). However, the institutional integration of BGI into the institutional processes of flood management agencies and actors at the national and local levels remains partial (O'Donnell et al., 2017). Within the legal and policy instruments, BGI is referenced as a mechanism for climate adaptation in the Flood and Water Management Act 2010, Environment Act 2021 and National Planning Policy Framework (Pitt, 2008; Defra, 2010; MHCLG, 2024; Grace et al., 2025). However, these provisions mainly operate through policy guidance rather than legal obligations. From a governance perspective, responsibilities for flood risk management, spatial planning and environmental regulation remain distributed across the Environment Agency, Lead Local Flood Authorities and planning authorities, creating coordination challenges (O'Donnell et al., 2017). The level of resource capacity varies significantly across local governments which influences the uneven implementation of BGI (Thorne et al., 2015). Finally, enforcement and monitoring remain fragmented, with limited systematic assessment of BGI performance. As a result, while there are strong legal and policy signals for using nature-based flood risk management approaches in England, institutional mechanisms which embed BGI into routine flood governance are limited (Scott and Hislop, 2024).

## 4 LEGISLATIVE FRAMEWORK: CANADA

Canada's flood governance architecture is shaped by a polycentric constitutional arrangement in which control of water management, land use and environmental regulation is divided among federal, provincial and municipal governments (Bakker and Cook, 2011; Renzetti and Dupont, 2017; GLC and CVC, 2018). Within this framework, support for BGI varies across the dimensions of legal and policy, governance, resources, and enforcement and monitoring. On legal and policy levels, Canada Water Act, and Fisheries Act implement principles of co-operative and ecological governance. However, federal instruments such as the Canada Water Act and the Fisheries Act do not contain explicit statutory requirements for BGI, with only limited indirect support at the provincial level (e.g. Ontario and British Columbia), and more explicit policy-driven implementation emerging at the municipal level in cities such as Toronto and Vancouver (Venton, 2016; GLC and CVC, 2018).

Most governance responsibilities in flood management are exercised at the provincial and municipal levels and there is considerable variation in actual flood management approaches and institutional capacity (Bakker and Cook, 2011; Renzetti and Dupont, 2017; Curran, 2019). Resource capacity similarly differs across jurisdictions, with larger municipalities generally better positioned to finance and implement BGI initiatives (Maloney et al., 2024; Jandrevska, 2025). The mechanisms for enforcement and monitoring remain fragmented and often sit within broader environmental reporting systems rather than dedicated flood governance systems (Zoghi et al., 2025). As a result, Canada's polycentric governance structure allows for local experimentation, but creates unequal institutional support for BGI across different provinces and territories.

## 5 COMPARATIVE SYNTHESIS: ENGLAND AND CANADA

The comparison highlights two contrasting institutional pathways through which BGI is incorporated into flood risk governance. Flood management in England operates within a relatively centralised statutory framework, in which legislation such as the Flood and Water Management Act 2010, the Environment Act 2021 and the National Planning Policy Framework sets a strong formal policy framework for environmental objectives (Awara, 2025). However, regulatory density has not yet led to coherence of cross-sectoral practices on the ground. BGI implementation is predominantly

promoted through policy guidance, non-statutory standards, and discretionary planning decisions rather than binding legal instruments. As a result, this can create uneven implementation across local authorities (Thorne et al., 2015; O'Donnell et al., 2017; Scott and Hislop, 2024). In contrast, Canada's flood governance involves an institutional structure with polycentric features in which responsibilities are distributed among all three levels of government (federal, provincial and municipal government) (GLC and CVC, 2018). The flexibility of this arrangement supports the implementation of locally driven BGI initiatives, which are often designed through a watershed-based planning and conservation authority (GLC and CVC, 2018). Yet the lack of coherent national standards results in diverging practices in BGI interpretation and implementation across jurisdictions, reflecting differences in statutory tools, fiscal capacity and technical expertise (Maloney et al., 2024).

Viewed through the analytical framework adopted in this study legal and policy, governance, resources, and enforcement and monitoring these cases illustrate the institutional trade-offs associated with centralised and polycentric governance systems. England gives clearer indications in terms of policy but is weak regarding coordination monitoring and enforcement. Alternatively, Canada supports experimentation and locally adapted solutions, but the regulatory consistency for widespread diffusion of BGI is lacking. To further illustrate this contrast, Table 1 presents the key features of the legislative and policy environment for BGI in flood risk management in both countries across the four analytical dimensions.

Table 1 Comparative assessment of legislative and policy conditions for blue–green infrastructure in flood risk governance

| Dimension | England | Canada |
|---|---|---|
| Legal mandate | Strong statutes but no binding BGI duty | Environmental laws exist; BGI mostly discretionary |
| Policy integration | Flood, planning and biodiversity policies weakly integrated | Integration varies across provinces |
| Governance | Central guidance with local implementation | Polycentric federal–provincial–municipal system |
| Enforcement & monitoring | Limited monitoring of BGI delivery | Enforcement varies by province |
| Resources | Short-term funding; uneven local capacity | Capacity depends on provincial and municipal resources |

Source: (Thorne et al., 2015; O'Donnell et al., 2017; GLC and CVC, 2018, Mell and Scott, 2023; Scott and Hislop, 2024, Maloney et al., 2024; Jandrevska, 2025, Awara, 2025)

Table 1 illustrates that the effectiveness of BGI governance is shaped less by the degree of centralisation than by the institutional alignment of legal mandates, governance responsibilities, resourcing arrangements and monitoring mechanisms. In both countries, the main constraint lies, not in a lack of policy commitment, but rather in governance systems that do not foster BGI as part of standard flood risk management practice.

## 6 DISCUSSION: FROM LAW TO LEARNING SYSTEMS

The comparison reveals a persistent tension within contemporary flood risk/management governance. Institutional frameworks in England and Canada continue to privilege regulatory

stability and hard engineering control over soft engineered / nature-based solutions and adaptive solutions/learning despite increasing climate risks and negative impacts. According to Mehryar and Surminski (2020), many flood management regimes were created under conditions of predictable hydrological risk in which governance was defined by clearly delineated responsibilities and top-down regulatory controls. With climate change introducing greater extent, frequency and uncertainty into flood risk, these institutional arrangements are turning out to be ill-suited compared to more extensive, flexible, ecosystem-based approaches such as BGI (O'Donnell et al. 2017). Despite widespread referencing of BGI in policy discourse, implementation is restricted as regulatory systems and investment practices are still favouring traditional grey infrastructure with more easily calculable flood mitigation performances (GLC and CVC, 2018; Mell and Scott, 2023; Scott and Hislop, 2024). BGI currently faces these institutional constraints needing a systemic change that considers long-term ecological processes, cross-sectoral coordination and distributed governance responsibilities (Mell and Scott 2023). As a result, stronger coordination between flood risk management, spatial planning and environmental governance is required for its implementation (Awara, 2025). Where statutory frameworks, funding mechanisms, and performance metrics remain oriented towards engineered solutions, BGI is often regarded as an add-on instead of a core solution for flood resilience (Scott and Hislop, 2024).

Such dynamics reflect deeper variants of institutional path dependency. Historical patterns of authority allocation, technical standard-setting and financial resource dispersal continue to support established infrastructure approaches limiting the change capacity of governance systems towards integrated nature-based approaches (Wiering et al., 2017). Viewed through the analytical framework developed by Awara (2025) regarding legal and policy mandates, governance allocation, resources, and enforcement and monitoring the findings highlight how fragmented responsibilities, weak monitoring systems and uneven institutional capacity undermine otherwise supportive policy commitments (O'Donnell et al., 2017). The analysis demonstrates the limits of legal reform alone. According to Awara (2025), extending statutory references to BGI does not change practice if governance systems continue to lack the necessary resources, coordination mechanisms and institutional flexibility to enable experimenting and learning. In this sense, law should not just be seen as a regulative mechanism but also a way to structurally adapt governance. This includes establishing monitoring systems that can assess the performance of BGI in flood risk mitigation and management, creating institutional pathways for learning, strengthening of effective policies, and embedding practice feedback loops into future regulatory development (Garmestani et al., 2014). In this sense, BGI provides a useful lens for assessing whether legal and policy institutions support learning, adaptation, and flexibility under conditions of climate uncertainty (De Rijke et al., 2025).

## 7 CONCLUSION

This paper argues that although England and Canada have increasingly referenced BGI in policy discourse, their legal and governance frameworks do not yet establish the necessary institutional conditions to enable its consistent implementation in flood risk management. The limited integration of BGI into routine flood management is impeded by a lack of cohesive governance arrangements, weak monitoring systems and inconsistent resourcing. This research proposes the use of a framework to translate principles of adaptive governance into four legal-policy dimensions:(1) the legal and policy mandates, (2) allocation of governance responsibilities, (3) resources and (4) enforcement and monitoring. The tool can help policymakers, planners and researchers to diagnose whether the legal and policy systems in place enable or constrain BGI implementation. Through the identification of gaps in these institutional dimensions, the framework can feed into policy reform, improve coordination of planning and flood governance, and support more adaptive and integrated approaches to flood resilience. The findings indicate that successful BGI implementation hinges less on the design of governance systems (centralised versus polycentric), and more on the extent that institutional arrangements facilitate coordination, effective monitoring and sustained investment in

nature-based flood management. For effective integration of BGI in flood risk management, policymakers need to prioritise a clear legal mandate, strong monitoring system, and stable long-term funding.

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