

# Flood Risk Analysis, Placemaking and Blue Green Infrastructure for Liveable, Resilient Places

## INTRODUCTION

In urban coastal areas, waterfronts and blue green spaces form part of an integral network of public open space and encompass a range of uses, bringing social, cultural environmental and economic benefits. The impacts of climate change, urbanisation and population growth are overwhelming traditional grey infrastructure solutions to flooding, threatening these mixed-use spaces. Furthermore, grey infrastructure has been criticised for harming people, place and the environment, necessitating a new approach to flood resilience. However, there is limited understanding of how adaptation measures can integrate with placemaking in ways which deliver multiple benefits for people, place and the environment. Developing an understanding of how adaptation measures can integrate with placemaking is particularly pressing in Scotland, where policy is steered towards a placemaking approach to achieving blue green, water resilient cities making BGI not a desire, but a requirement for all local authority areas in Scotland.

My PhD research investigates how flood risk analysis, placemaking and blue green infrastructure (BGI) can combine to develop flood resilience and deliver multiple benefits. It has a focus on Dundee and Broughty Ferry in Scotland. Dundee City scores highly on the Scottish Indices of Multiple Deprivation and faces flooding from a range of sources, bringing a complex set of challenges. Thus, there is a need to address flood risk in an integrated way. My research takes a multi-pronged approach, bringing together flood analysis to estimate level of risk in addition to policy analysis, stakeholder interviews and co-creation workshops to develop a holistic methodology which can be adapted by multiple cities. My PhD also contributes to several Sustainable Development Goals, figure 1, making this research globally relevant.



Figure 1: The Sustainable Development Goals this research contributes to.

## METHODS

- Literature review to understand role and impacts of placemaking and BGI and barriers to delivery.
- Analysis of flood management, planning, climate change and sustainability policy to understand how placemaking and BGI is integrated into policy.
- Papathoma Vulnerability Assessment (PTVA) to understand level of flood risk to structures in the study area from storm surge and sea level rise. The surface water and watercourse flooding risks will also be considered to generate a complete picture of flood risk. This will enable place-based, BGI solutions to be designed by communities for areas at risk.
- Semi-structured interviews with practitioners and community members to determine views and experiences of placemaking and BGI and to interpret these within the context of the literature.
- Collaborative, hands-on workshops with the community to create place-based BGI solutions to flooding in the locations identified in ways which also deliver multiple benefits.

Figure 2 shows how these complex and interlinked aspects come together in my research:

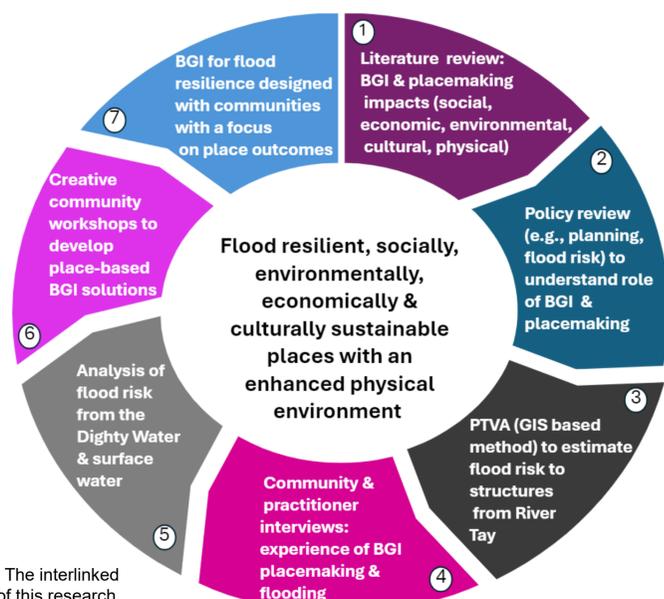


Figure 2: The interlinked aspects of this research

## RESULTS AND DISCUSSION

### Literature Review

The findings from the literature review revealed that placemaking and BGI can bring multiple, interlinked benefits which have a core role in enhancing liveability, as shown in figure 4. The literature review also highlighted a range of barriers to the successful delivery of placemaking and BGI. These include a preference for grey infrastructure among communities and top-down, expert-led processes which lack a collaborative approach with communities.

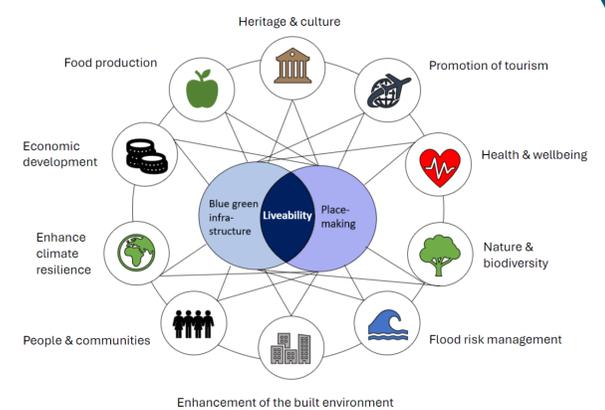


Figure 4: Multiple and interlinked benefits of placemaking and BGI author's diagram, distilled from literature review findings.

### Semi-structured interviews

The interviews expanded on the findings from the literature review. Participants agreed that there was a clear role for placemaking and BGI to improve health and wellbeing and enhance liveability. However, concerns were raised that placemaking interventions can have a limited impact on socio-economic issues in the area and that BGI can suffer from fragmented long-term management, impacting on both function and aesthetic appeal. In addition, communities and practitioners reported that getting a consensus on change was difficult, as was getting people engaged in placemaking and BGI projects. This necessitates an inclusive, collaborative and innovative approach to community engagement in these areas.

### Discussion

Understanding the locations most at flood risk, the socio-economic and environmental issues in the area and the perceptions of BGI and placemaking from a stakeholder and practitioner point of view is the first step in the process of developing solutions to flooding which deliver multiple benefits.

The next step was to build on the findings from the PTVA, literature and stakeholder interviews, engaging with communities to develop a deeper understanding of flood risk and to co-create solutions to address this in ways which bring multiple benefits. This necessitated a bottom-up approach with communities fundamental to the design process.

### Co-creation workshops

The workshops engaged communities in developing these solutions in a creative way, using a serious play ethos, figure 5. These workshops did not require participants to possess expertise in flood management or urban design. In addition, the method is suitable for all ages and abilities. The results provide a foundation for future interventions which can be validated with the community before being taken forward by community and practitioner stakeholders.



Figure 5: Co-creating place-based BGI solutions to flooding with the local community.

## RESULTS- PTVA

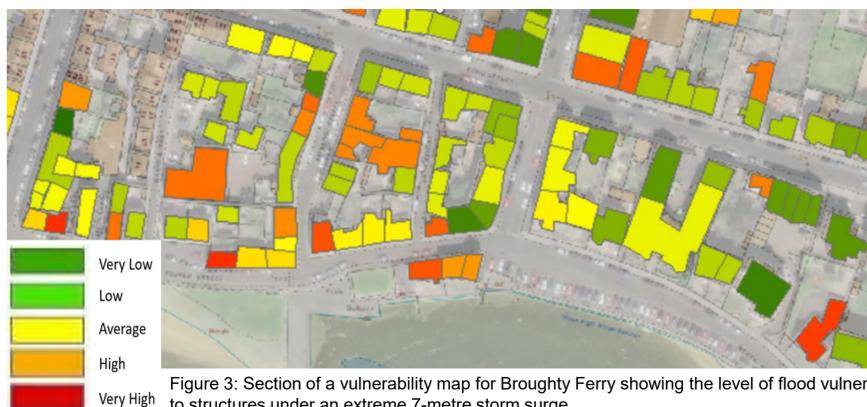


Figure 3: Section of a vulnerability map for Broughty Ferry showing the level of flood vulnerability to structures under an extreme 7-metre storm surge.

This involved collecting structure-specific information, such as the number of stories and type of foundation as well as information regarding the surroundings of a building, such as the presence of a sea wall and natural flood barriers. This data was inputted into the ArcGIS PTVA model to produce an inundation map, figure 3. Current flood maps for the area provided by the Scottish Environmental Protection Agency (SEPA) are not intended to assess flood risk to individual structures. In addition, SEPA's maps show present day risk and risk in the 2080s and can't be tailored to a specific year. The PTVA maps I have created can be tailored for any year and inundation scenario. These maps highlight where property-level BGI could be utilised in addition to displaying level of flood risk.

## CONCLUSIONS

- Expanded the knowledge regarding areas and level of flood risk in Dundee and Broughty Ferry.
- Developed a comprehensive understanding of the positive and negative aspects of placemaking and BGI and how these concepts can combine to address flood risk and increase societal resilience.
- Developed an understanding of how communities and practitioners in Dundee and Broughty Ferry view placemaking and BGI and the positive and negative impacts of this.
- Developed a way of working with communities to co-create place-based and BGI solutions to flood risk which bring multiple benefits.

## FUTURE

- Influence planning and flood management policy by using Dundee waterfront as a demonstrator of how placemaking can combine with blue and green to deliver liveable places.
- Develop a suite of recommendations of how placemaking can combine with BGI to address flood risk and deliver wider social, economic, environmental and wellbeing benefits.