# Managing flood footprints for a resilient economy and society in the UK

## Researchers

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**The accurate estimation of the socio-economic impact of flooding is crucial for efficient investment in adaptation and for minimising broader damages amongst small businesses**

## Research Aims

Figure 1. Direct damage in transport sector will imply falls in productivity through commuting delays

A number of extreme flooding events have made headlines in the international media in recent years. Traditionally, impact assessments of such incidents have mainly focused on direct damages to physical assets and people. These assessments are useful both for understanding the immediate implications of damages, and for marshalling the pools of capital and supplies required for re-building after an event. However, the intricate links that bind together the UK economy can result in impacts rippling far beyond the physical location of the event and can lead to substantial indirect damage to supply chains and wider social networks. Risk management frameworks and impact assessments have traditionally failed to account for the total economic impact of flooding largely because they fail to incorporate these indirect damages. With this in mind, the SESAME project proposes the Flood Footprint, an entirely new concept that provides a damage accounting framework to measure the total socioeconomic impact that is directly and indirectly caused by a flood event to the economic systems and social networks in the wider area.

## Benefits from the Flood Footprint assessment

The Flood Footprint framework helps optimise investment in flood risk management by identifying the blind-spots in critical infrastructure and vulnerable sectors in economic supply chains and social networks. This supports adaptation measures for the affected regions to reduce the level of damage from future events. Adaption to flood risk is not limited to the flooded area. It also extends to entire socio-economic networks and this must be considered in order to minimise the magnitude and probability of cascading damage to the non-flooded regions.

## Flood Footprint framework

The Flood Footprint model is based on Input Output (IO) modelling. The core of a standard IO model is a set of balances: supply of each commodity equals demand; total costs or outlays of a sector equal its sales; total income equals total consumption, etc. The entire economy can be viewed in terms of a single circular flow with a number of separate “loops” connecting various sub-groups with each other.

The post-disaster situation imbalances the economy. Damage to production infrastructure (factories, workers, communication channels), and to the labour force (health complications, household flooding, commuting delays, etc.) imposes new constraints on production capacity, and this capacity may not be sufficient to satisfy post-disaster demand. Post-disaster demand can also change significantly, both due to reconstruction demand and because of changes to consumer behaviour.

Until a factory has been repaired, it cannot produce to its full potential and its customers will be forced to abide by some form of rationing. A similar situation arises if the factory cannot receive its deliveries. Lack of demand can also prevent a factory from producing, if a downstream client has been hit by the extreme event. The effects can spread through the entire production chain after a shock. In the post-disaster situation, small businesses incur production losses (i.e. indirect damage) because of these forward and backward consequences of lost productive capacity.

## Flood Footprint model for the City of Sheffield

For the City of Sheffield, the model for assessing the Flood Footprint was adapted to focus on the city scale and to quantify the total economic impact of past flooding events.

The modelling process consists of gathering data about the regional economy and about the damage caused to it by past events. The latter comprises, for example, damage to capital assets, equipment, households, public services. Figure 2 shows a map of the flooded area, which is the primary input for estimating the direct damage.

On the other hand, information on economic variables relates to the regional economy and provides the context in which the economy's imbalances and restoration process interact during recovery.

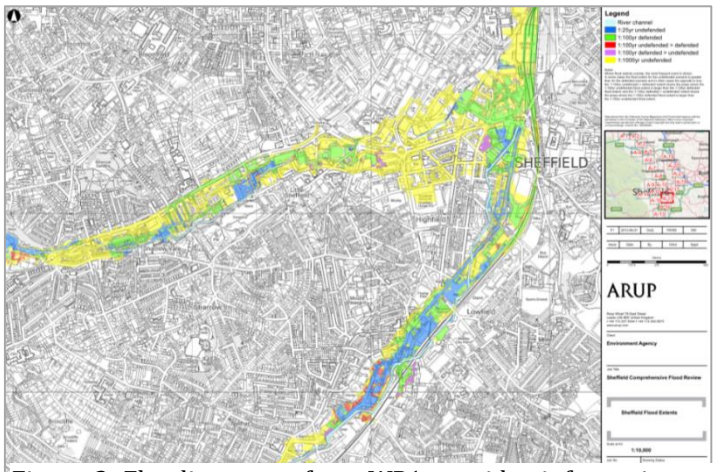

Figure 2. Flooding maps from WP1 provides information on extreme events which will be translated in the direct damage of the event

Flood Footprint modelling requires substantial amounts of data concerning the behaviour of producers and consumers. Because it inquired into the consequences of small businesses responses to previous flood events, the SESAME project offers unique access to data for the calibratione the Flood Footprint model.. The information comprises the characterization of each interviewed business, the damage suffered in previous flood events, their response to allocate remaining resources to different client categories, labour reaction and adaptation. This information defined the behavioural parameters of the model for assessing the total economic impact of past flooding in the City of Sheffield.

## Preliminary results

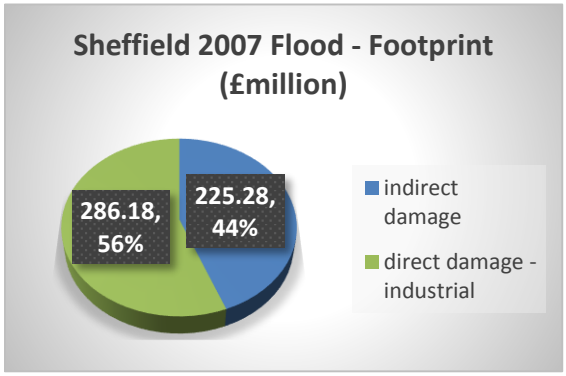

Figure 3. Relation direct/indirect damage

The model estimates the Flood Footprint, i.e. the direct economic loss – computed as a proportion of industrial capital damage relative to total capital stock – plus the indirect economic loss – computed as the difference between pre and post disaster output. The model allows analysis at the level of economic industrial sector.

The model estimates that after the 2007 flood it would have taken at least 17 months for the Sheffield's economy to fully recover and the damage would represent a flood footprint accounting for £571m, or 6.2%, of the city's Gross Value Added. From this figure, the direct and indirect losses account for £298m and £225m respectively. These figures indicate that indirect losses account for around one half of the total flooding damages

## More information

Please visit our website at http://sesame.uk.com or contact Prof. Dabo Guan (Dabo.Guan@uea.ac.uk).

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