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SURFACE WATER FLOOD RISK AND MANAGEMENT STRATEGIES UNDER FUTURE CLIMATE CHANGE: AN ABM APPROACH

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Surface water Flooding

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- In England, flooding is recognised as one of the most common and costliest natural disasters.

- Surface water flooding is the most likely cause of damage to properties.

- Climate change and increasing urbanisation are both projected to result in an increase in surface water flooding in the future.

- London has a relatively low standard of protection against surface water flooding.

- The most likely cause of flooding and poses the greatest short-term climate risk.

Public-Private Partnership

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- Public-private partnership between the UK government and the insurance industry, known as the 'Statement of Principles'.

- Flood insurance is underwritten by the private market, while government commits to flood risk management activities.

- Increase in frequency and severity of flood events requires a continued, but redefined, public-private partnership.

- April 2016: Flood Re – Non-profit flood re-insurance scheme.

- Ensure affordability and availability of flood insurance, whilst helping to smooth the transition to more risk-based pricing over 25yrs.

  - *How it will cope with changing flood risk?*
  - *Link with other flood risk management /adaptation schemes?*
  - *Flood risk reduction?*
  - *Household incentives?*

Agent-Based Model - 1

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Aim: Investigate how this partnership could influence London's resilience to surface water flooding today and in the future, including incentives for risk reduction among different partners to support flood defences, household level protection, and spatial planning.

ABM - good tool for understanding systems and their behaviour, and for simulating and visualising effects of changing behaviour over time.

Developed around GIS data to allow a realistic representation of residential buildings and surface water flood risk in London.

Incorporated spatial probabilistic surface water flood event and damage data.
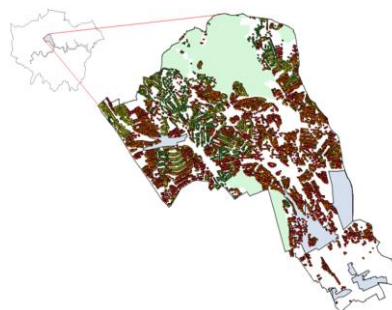
Map of the study area of Camden and its location within Greater London (inset).

Agent Based Model - 2

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People
- Own/Buy/Sell houses
- Insure homes
- Can invest in PLPMs
- Can consider flood risk when purchasing houses

Insurer
- Estimates household flood risk
- Sets premiums and excess levels
- Provides compensation following flood
- Decides whether to place high risk properties in Flood Re

Local Government
- Invest flood protection budget in SUDS
- Provide household grants for PLPMs
- Evaluate property development plans based on financial benefits and flood risk
- Sell land to developer

Developer
- Proposes to build homes to meet demand
- Identify optimal land for development
- Submit proposals to the local government
- 50% new homes built with SUDS in place

Bank
- Repossess houses where fees cannot be met
- Sell houses on market

- Characterise five agents who interact within the environment.

- Flexibility to allow the testing and analysis of different policy options, conditions, and behavioural rules.

- Visualisation of features and outputs

Key Findings - 1

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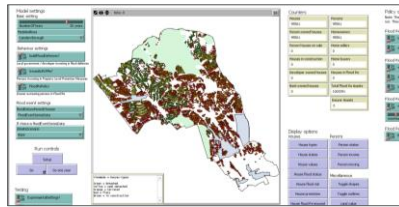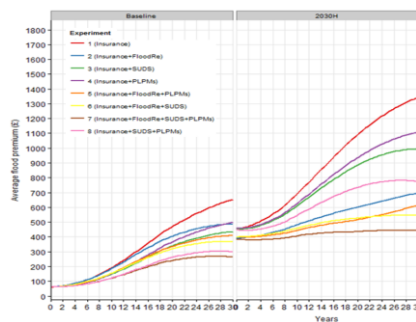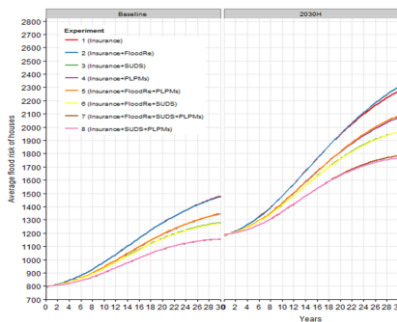
- Upward trend in surface water flood risk
- Implementation of PLPMs/SUDS in the model acts to reduce the trend in average surface water flood risk to houses over time.
- The experiments which include Flood Re suggests that this has no benefit in terms of average risk reduction.
- Main purpose of Flood Re, to limit premiums to affordable levels for the highest risk properties, is clearly visible.

Key Findings - 2

Focused on the potential role of the local government, insurer, and developer.

Premiums are highest when no developer restrictions are in place in the model (6) and lowest where numbers are limited and all must have SUDS (7).

Other options included the government being more stringent in approving new developments based on flood risk and profitability (in isolation and with developer options (13, 14)).
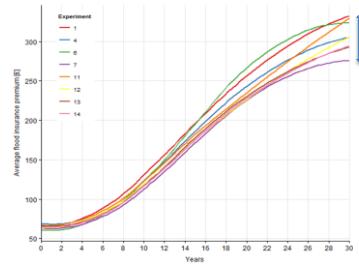
Clear divergence in the number of properties built in areas at risk of surface water flooding.

Certain options (11,12) act as a strong barrier to the development of properties in areas of high surface water flood risk.
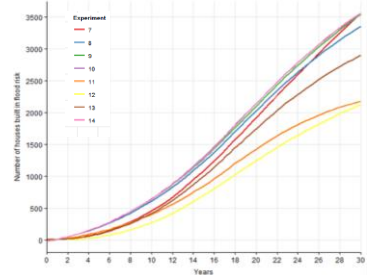
Summary of findings

- The average surface water flood risk continued to increase over time.

- Suggests Flood Re would be placed under increased strain if challenged with increasing risk as highlighted by the projections.

- Supports concerns that Flood Re is missing an opportunity to contribute to risk reduction.

- A key issue will be how the increasing gap between the level of premiums paid by high risk properties and the risk based value they would face outside this scheme is addressed and managed over time.

- Potential to bring more partners on board e.g. developers – trade offs between partners.

- Suggests further policy on planning developments, increased investment in SUDS for new and existing properties, and investment in PLPMS is required.

- Offer a new perspective on multi-sectoral partnerships, flood insurance, and surface water flood risk management under climate change.

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