How can ecosystem services help us plan better urban GI?

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SGIF Conference 6th October 2015

Outline

- Context
    - *urbanisation pressures*
    - *what is urban GI?*
    - *urban GI functions / benefits*
    - *trends in urban natural capital and ecosystem services*
    - *the need for better strategic planning of urban GI?*
- Demand led planning of urban GI – a conceptual framework
- Spatial modelling of urban GI demand
    - *runoff reduction services – an example*
- Planning for multiple benefits
- Delivery mechanisms for strategic urban GI

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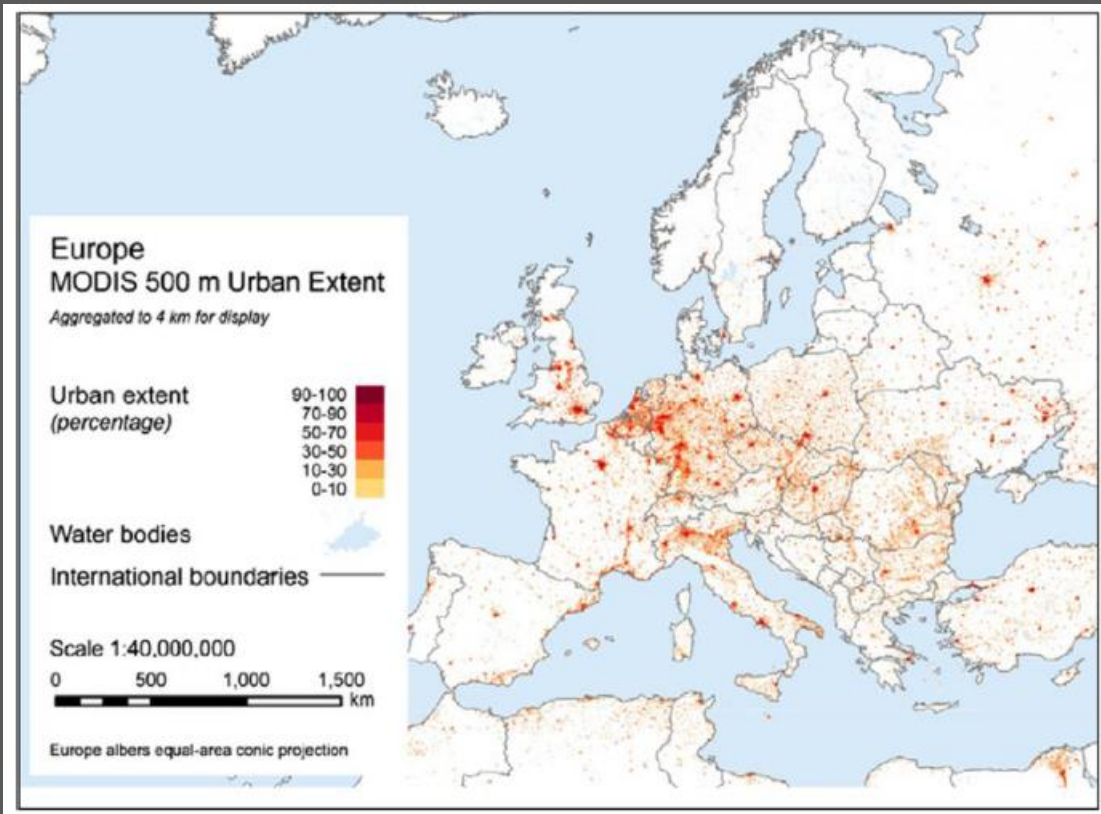
Urbanisation places pressure on the urban land resource



Globally, urban areas occupy 0.5% of the world's land area

In Europe, approximately 72.5% of the population currently lives in urban areas (2010 data)

By 2050, it is anticipated that approximately 82% of Europe's population will live in urban areas

The map to the left shows the current (2010) extent and location of urban areas in Europe

This is the land area where 72.5% of Europeans make their home

Extent and location of urban areas in Europe (2010)

(Adapted from: Schneider *et al*, 2009; EEA, 2015)

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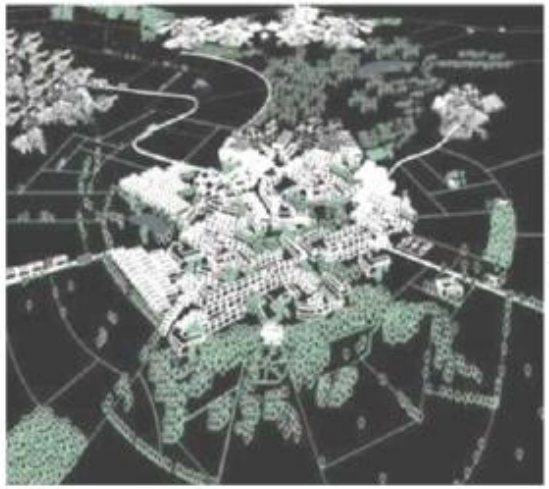
In cities *green* and *natural environment* type land uses provide a 'backbone' of greenspace and semi-natural habitats

Green infrastructure planning at the *neighbourhood* scale

- Street trees
- Rain gardens
- Swales
- Small scale attenuation basins
- Roof gardens and green roofs
- Pocket parks
- Collective and/or private gardens
- Community growing spaces
- Urban plazas
- Ponds and small woodlands
- Footpaths

Green infrastructure planning at the *town or city district* scale



- City parks and gardens
- Urban canals and waterways
- Multi-user routes
- Urban commons
- Urban forest parks
- Country parks and estates
- Continuous waterfronts
- Municipal plazas
- Major sports and recreational spaces
- Regional SuDS schemes

Green infrastructure planning / design at different scales

(Adapted from: Landscape Institute, undated; EEA, 2006; Baro *et al*, 2015)

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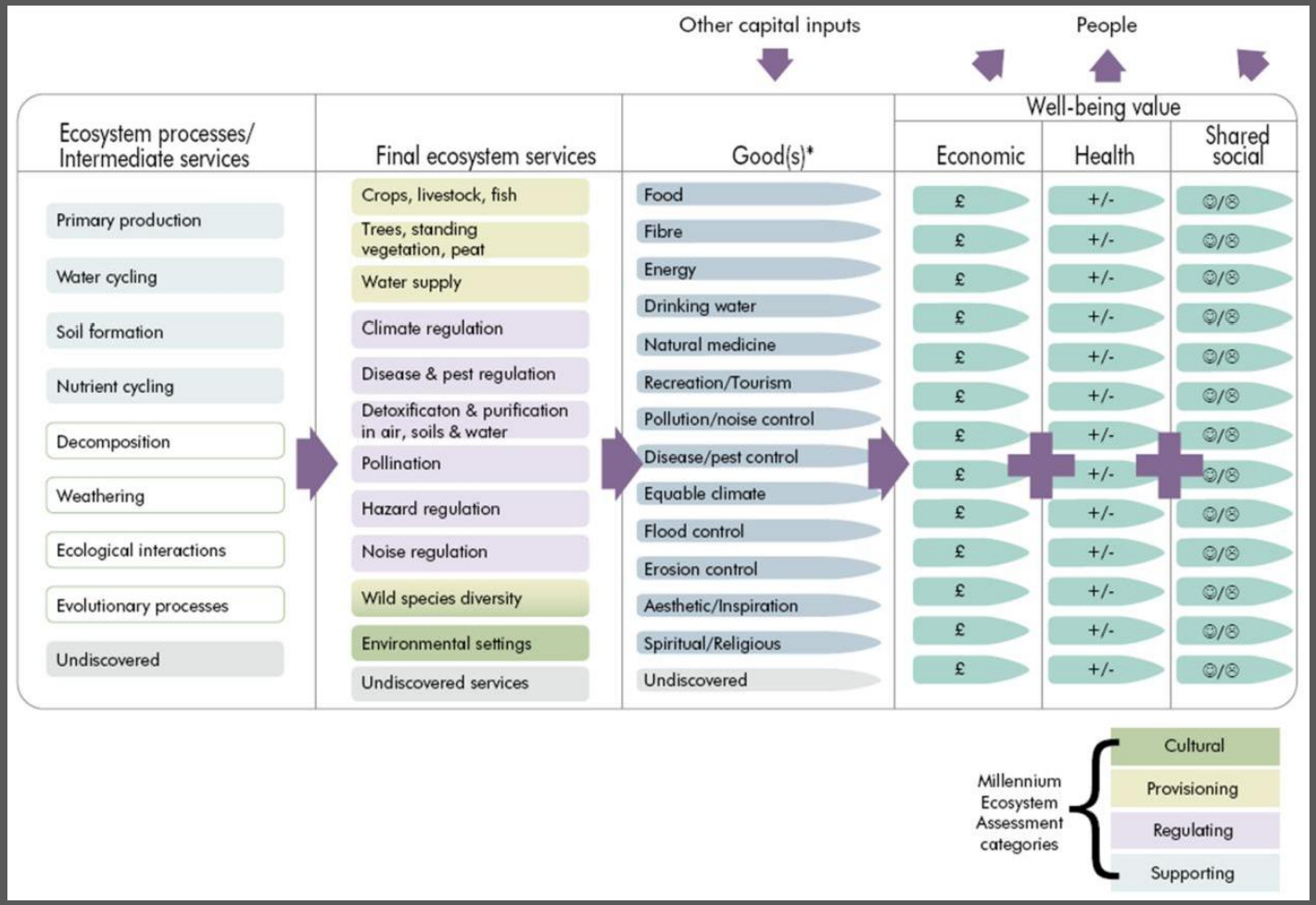
Urban GI provides a range of functions / benefits – *ecosystem services*



UKNEA ecosystem services framework

(Source: Mace *et al*, 2011)

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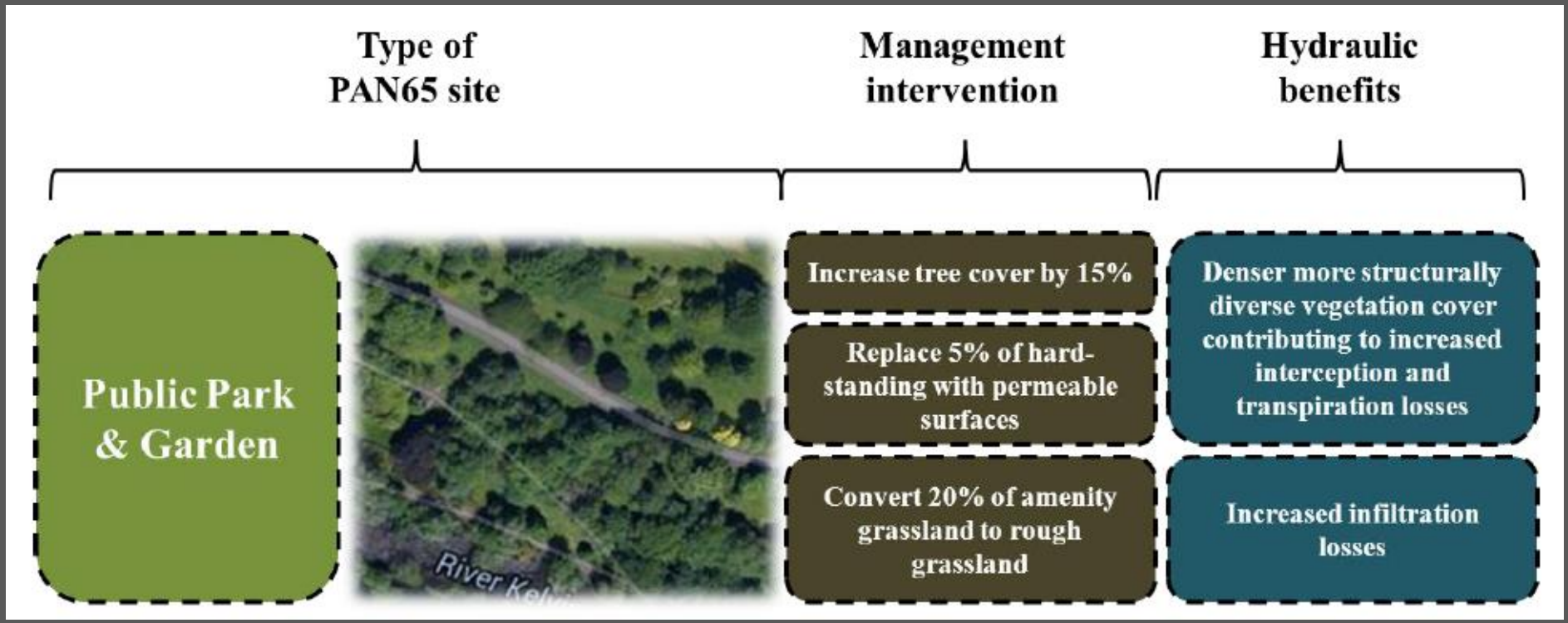
Urban GI provides a range of functions / benefits – *ecosystem services*



Managing urban GI for runoff reduction ecosystem services

(Source: Phillips, 2014)

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Critical urban ecosystem services are in decline – *regulating services*

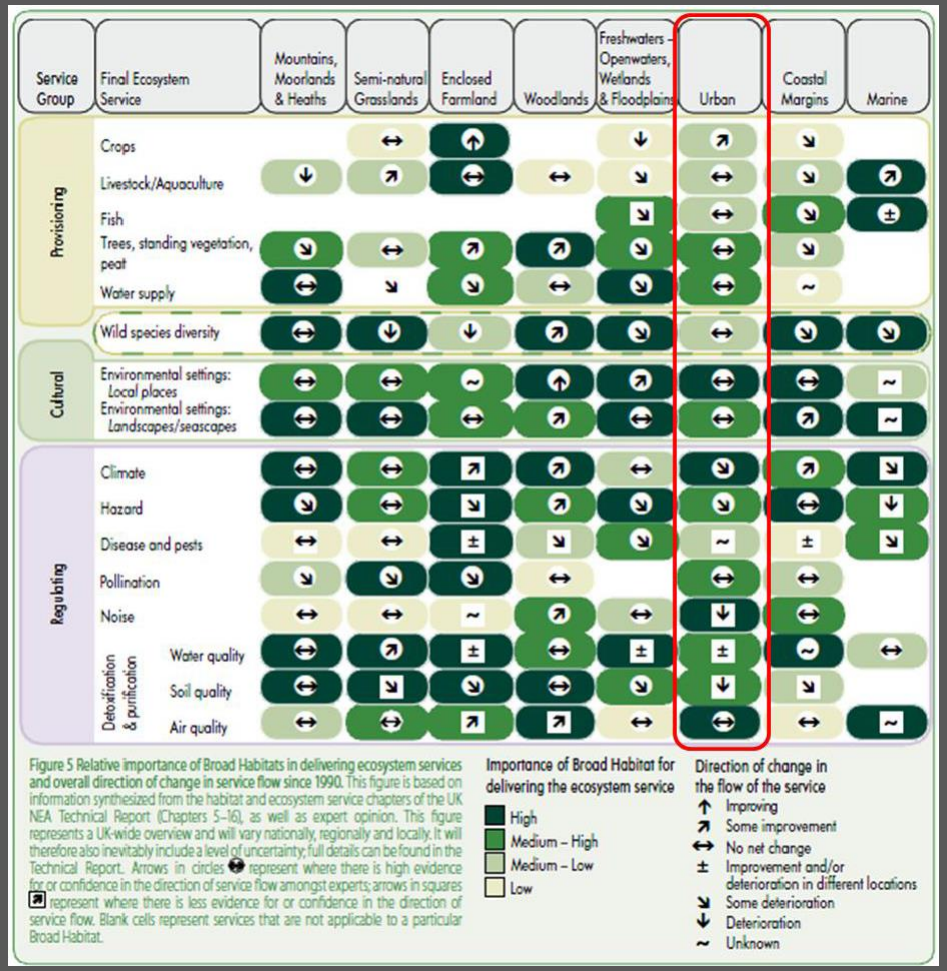

Figure 5 Relative importance of Broad Habitats in delivering ecosystem services and overall direction of change in service flow since 1990. This figure is based on information synthesized from the habitat and ecosystem service chapters of the UK NEA Technical Report (Chapters 5–16), as well as expert opinion. This figure represents a UK-wide overview and will vary nationally, regionally and locally. It will therefore also inevitably include a level of uncertainty; full details can be found in the Technical Report. Arrows in circles represent where there is high evidence for or confidence in the direction of service flow amongst experts; arrows in squares represent where there is less evidence for or confidence in the direction of service flow. Blank cells represent services that are not applicable to a particular Broad Habitat.

"The UK's ecosystems are currently delivering some services well but others are in long term decline"

"The UK population will continue to grow […] this is likely to increase pressure on ecosystem services…"

(UKNEA, 2011 p.5)

Trends in UK ecosystem service flows since 1990

(Source: UKNEA, 2011)

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There is a need for better strategic planning of urban GI to ensure the provision of critical ecosystem services in the right places

- Recognition at the project level of the need to work *with* rather than *against* nature (Susdrain, 2012; Gret-Regamey *et al*, 2013)

- Great policy framework in Scotland (Scottish Government, 2011a; Scottish Government, 2011b; Scottish Government, 2014)

- **But we are lacking <u>practical</u> tools / techniques / frameworks to help urban planners take a <u>strategic view</u> of GI assets in their city** (Chan et al, 2006; Gret-Regamey *et al*, 2013; Labiosa *et al*, 2013)**:**

  - *what do we have now / what needs to be protected?*
  - *what might we need in the future and where?*
  - *how can we prioritise investment?*

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Demand led planning of urban GI – a conceptual framework

- Causal variables (after Eigenbrod *et al*, 2010; Sheate *et al*, 2012; Bellamy and Winn, 2013)
- Rapid evidence assessment (REA) to determine causal variables for key ecosystem services
- Integration of causal variables with new GIS based spatial models

Ecosystem service	Causal variable/contextual factor affecting service provision
Flood storage – see section 7.2	• **Fluvial flood risk:** flood extent and receptors affected under 1/200 year event, anticipated location of flooding within the catchment • **Morphology:** presence and location of culvert and realignment pressures • **Floodplain vegetation**: type and location of existing vegetation cover, ecological potential to create new natural/semi-natural habitat – floodplain woodland and wetland • **Floodplain topography**: floodplain cross-section gradient, presence and location of fine scale topographical features in the floodplain
Runoff reduction – see section 7.3	• **Pluvial flood risk:** flood extent under 1/200 year event • **Topography:** location of steeply sloped ground • **Surface waterbodies:** location, immediate catchment area • **Impermeable ground:** location, immediate catchment area
Ecological networks – see section 7.4	• **Habitat patches:** location, size • **Functional habitat networks:** location, size • **Ecological potential of land for habitat establishment:** location, value

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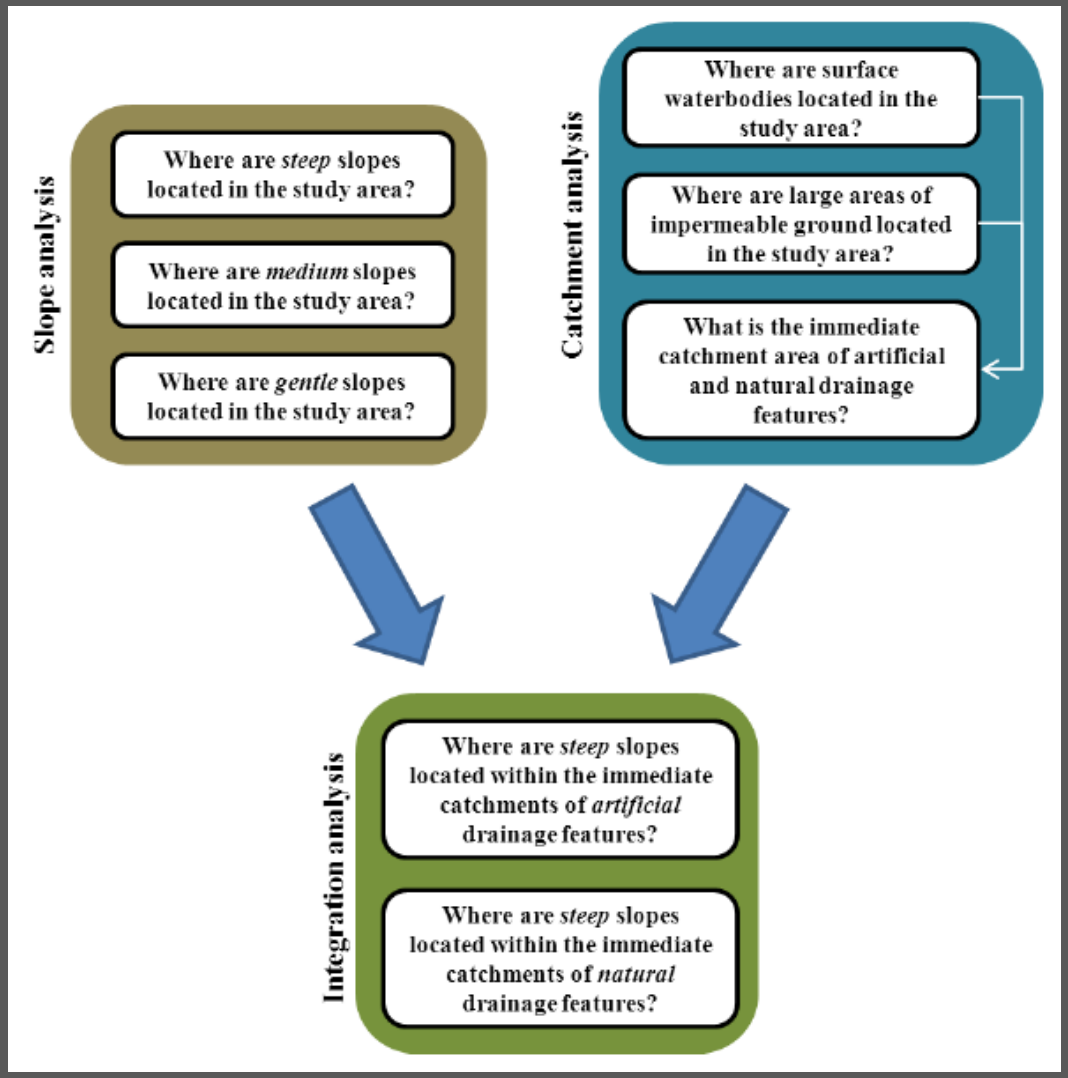
Spatial modelling of urban GI demand – *runoff reduction*



Overall structure of runoff reduction model
(Source: Phillips, 2014)

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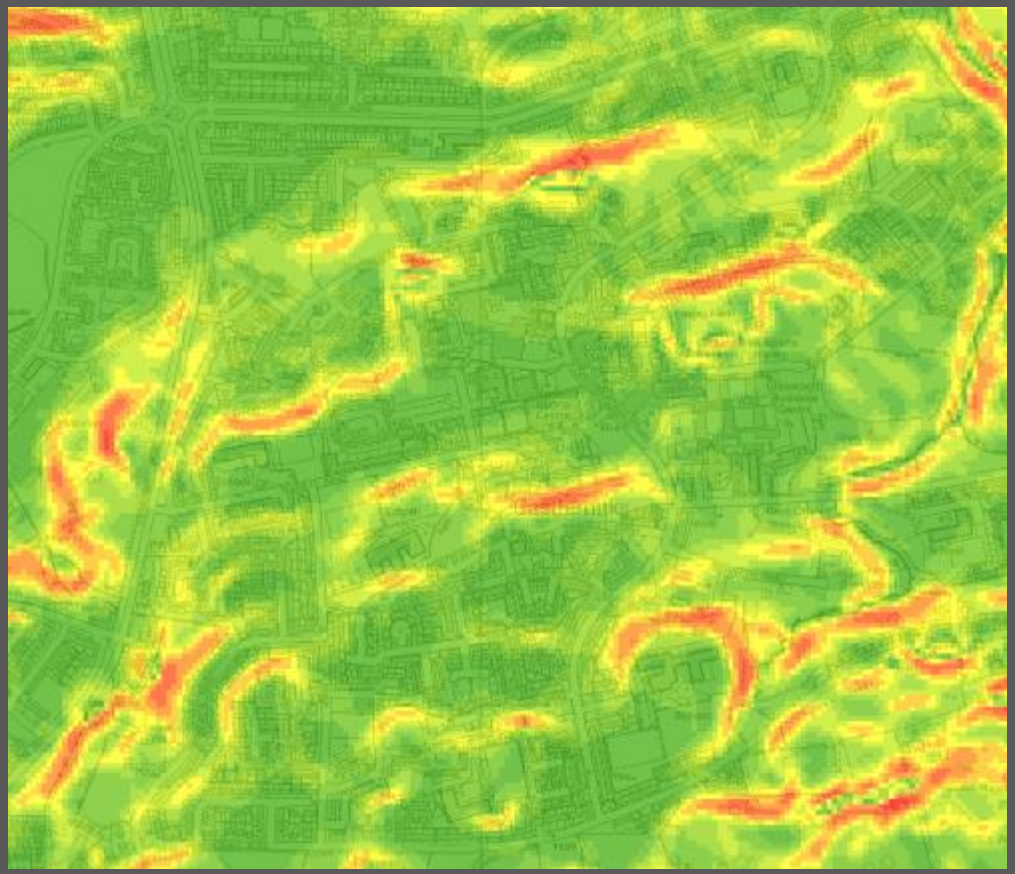
Spatial modelling of urban GI demand – *runoff reduction*



(1) Slope analysis: slope raster

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Spatial modelling of urban GI demand – *runoff reduction*

(1) Slope analysis: steeply sloped areas

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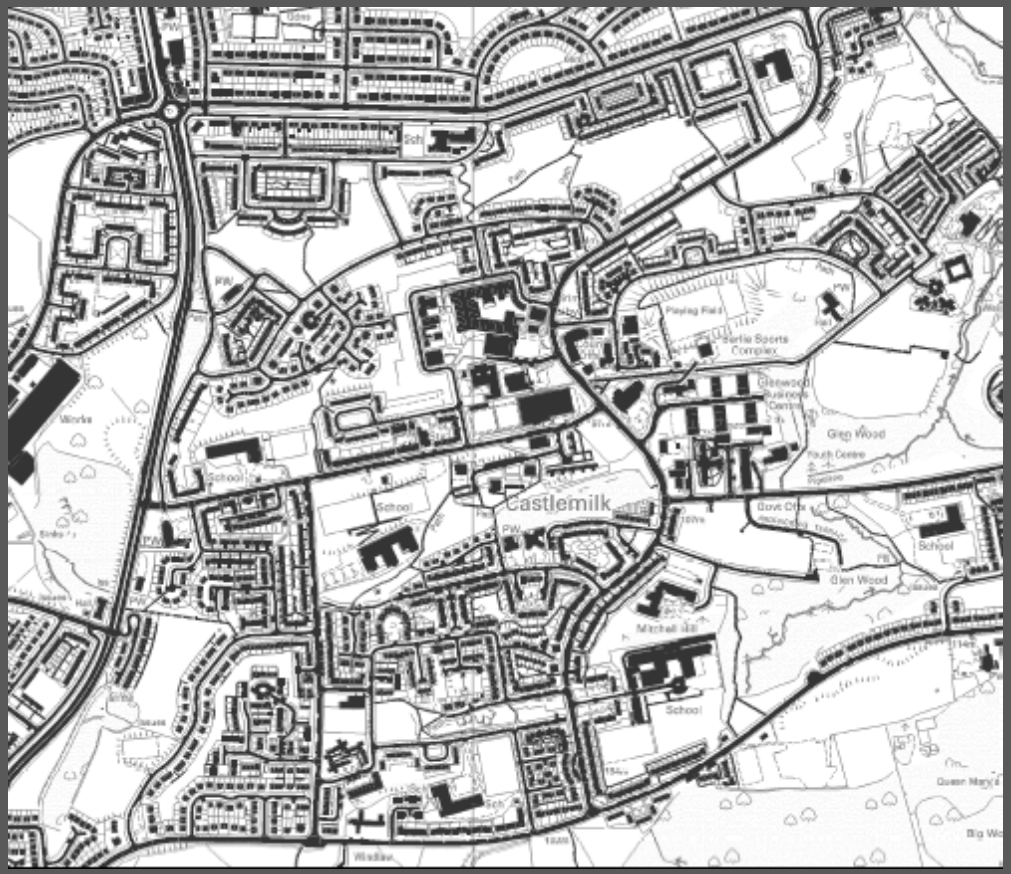
Spatial modelling of urban GI demand – *runoff reduction*



(2) Catchment analysis: areas of impermeable ground

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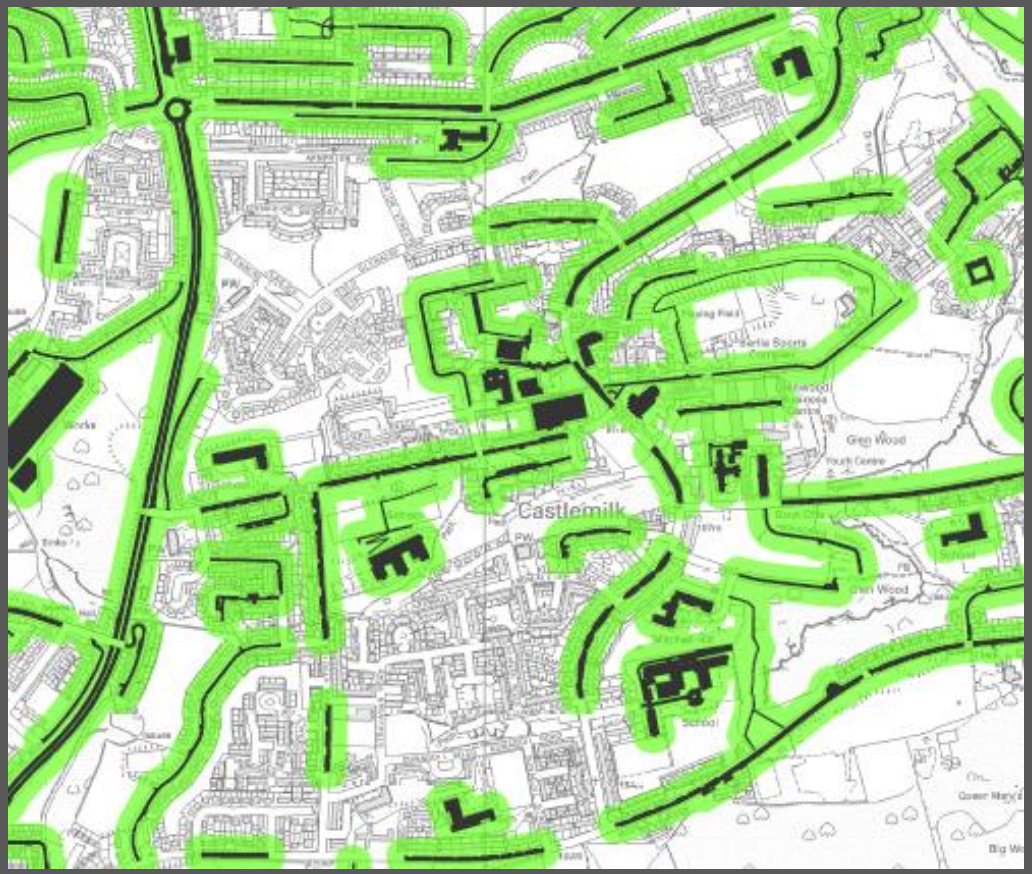
Spatial modelling of urban GI demand – *runoff reduction*



(2) Catchment analysis: large areas of impermeable ground + buffer

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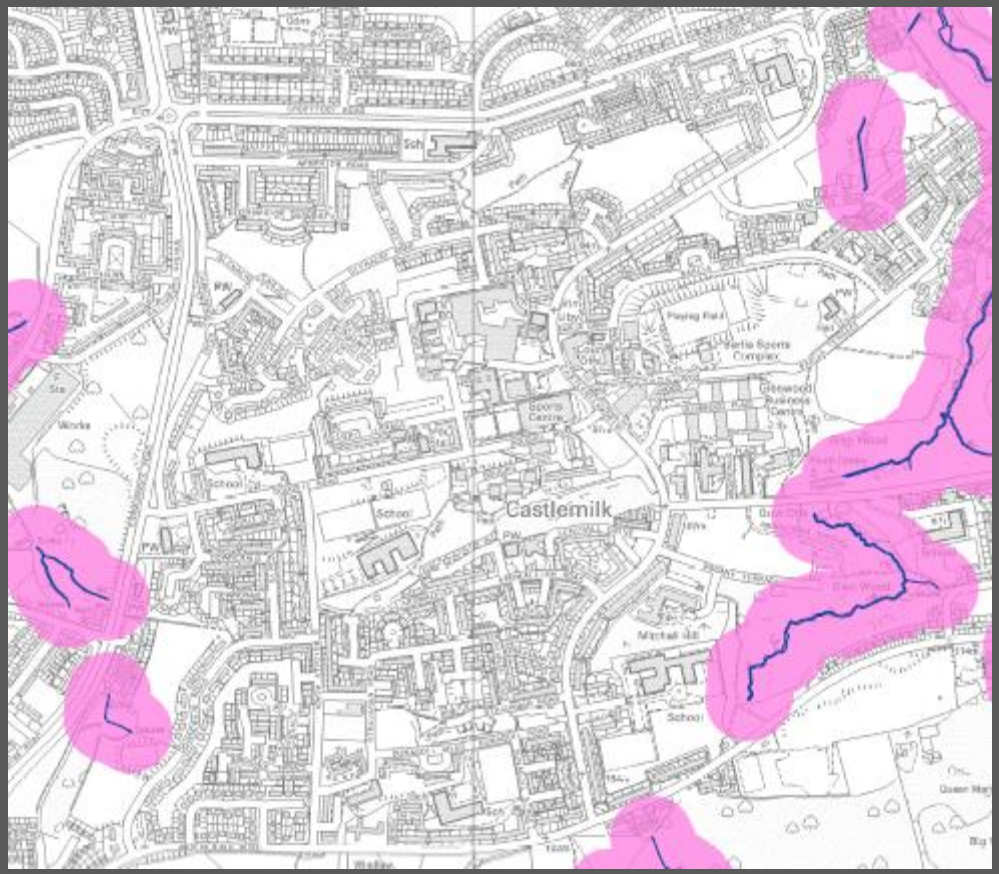
Spatial modelling of urban GI demand – *runoff reduction*



(2) Catchment analysis: surface waterbodies + buffer

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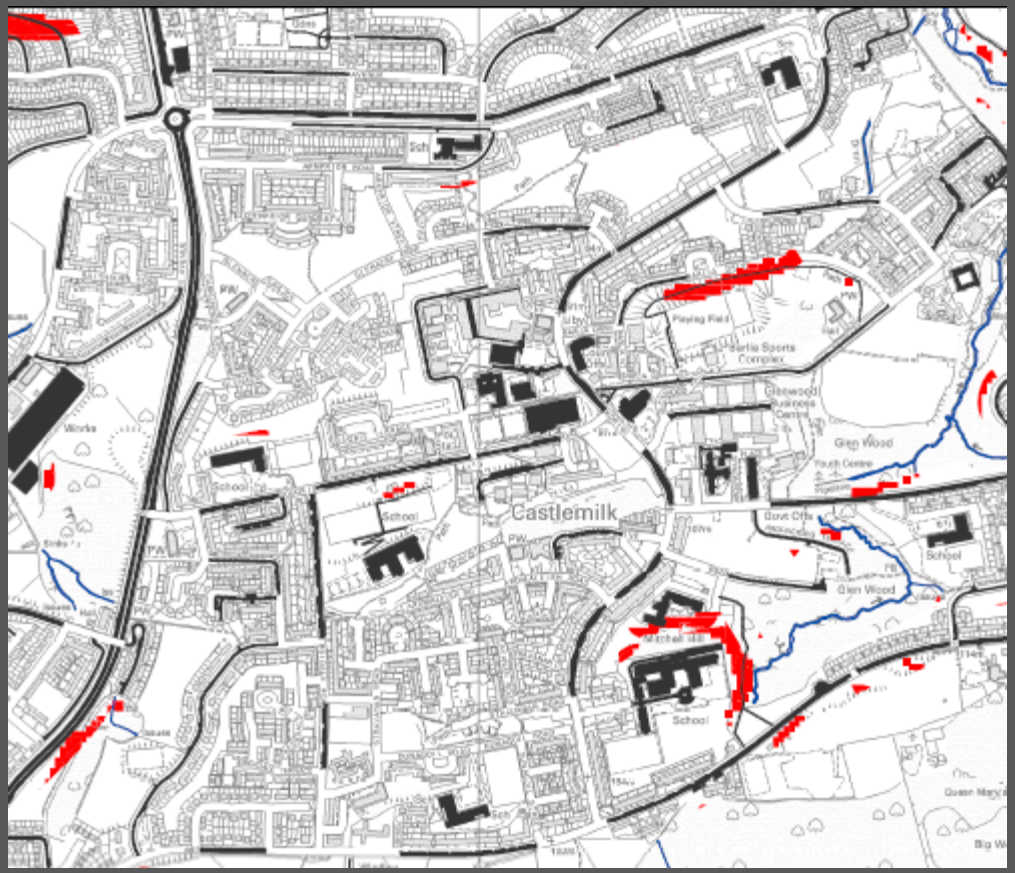
Spatial modelling of urban GI demand – *runoff reduction*



(3) Integration analysis: steep slopes and artificial drainage features

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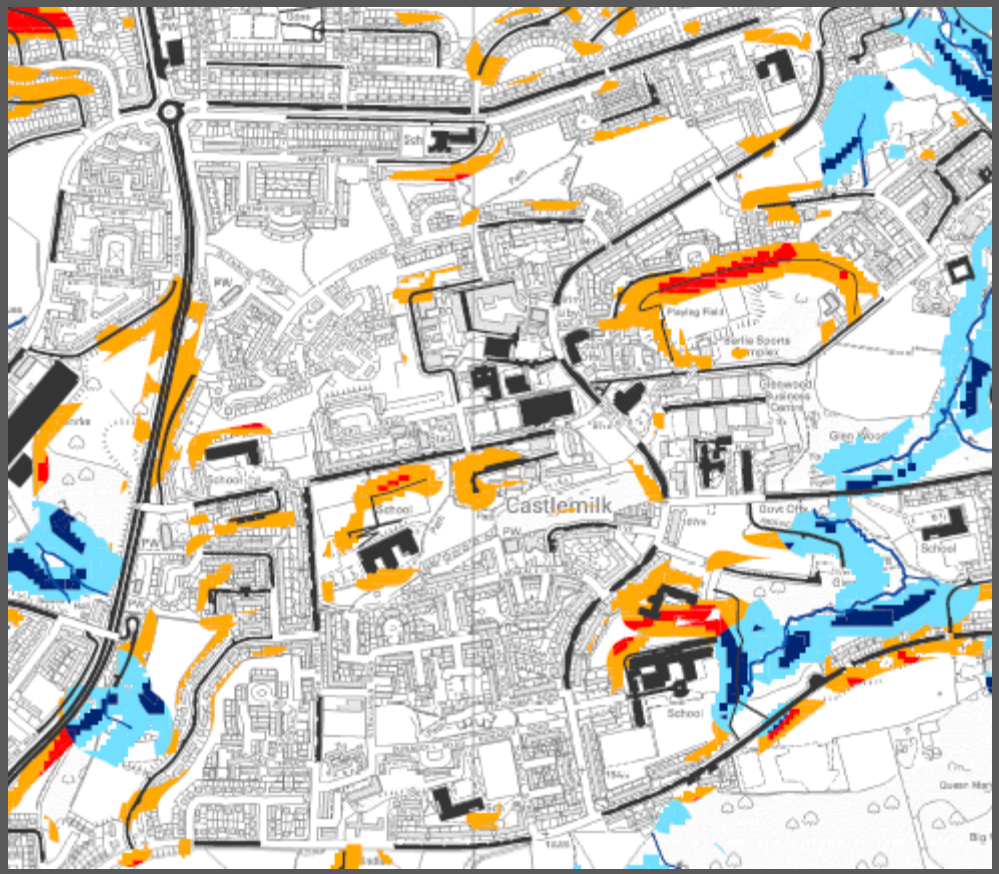
Spatial modelling of urban GI demand – *runoff reduction*



(3) Integration analysis: steep / medium slopes and artificial / natural drainage features

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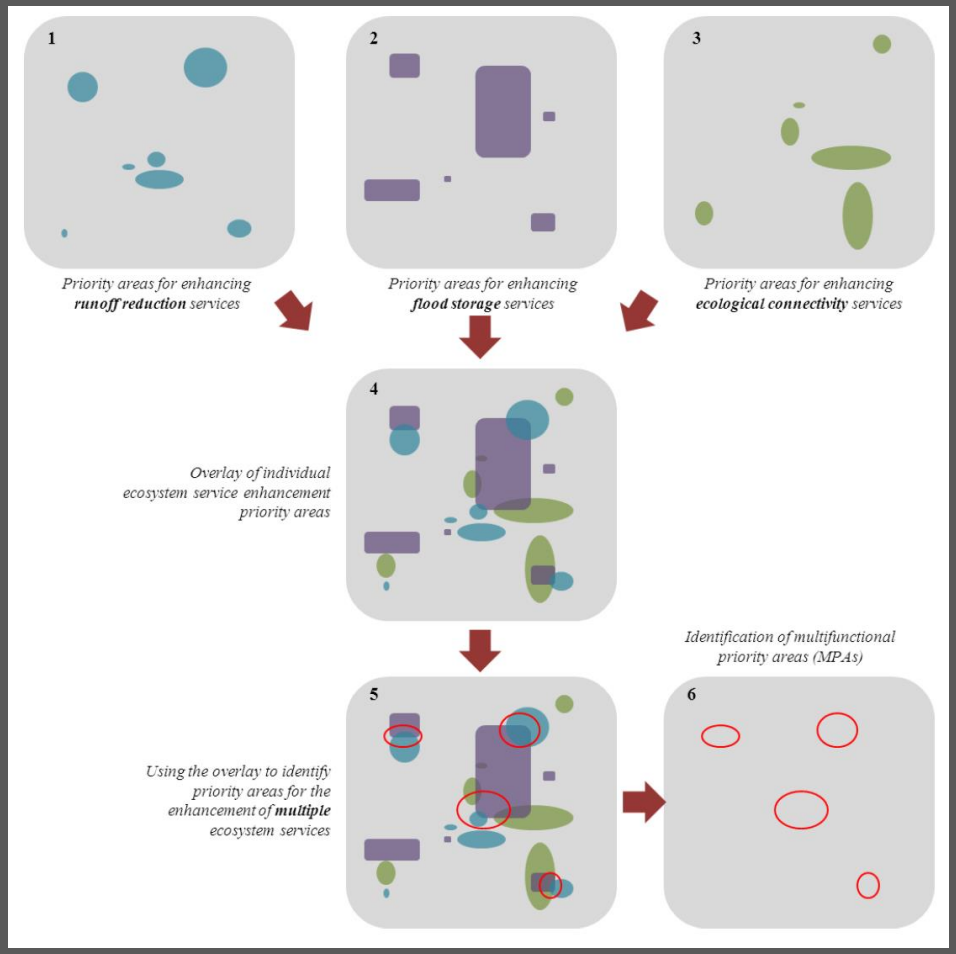
GI planning for multiple benefits – *'hotspots' of ecosystem service demand*



Principle A from the Scottish Land Use Strategy:

"Opportunities for land use to deliver multiple benefits should be encouraged"

(Scottish Government, 2011b p.4)

Multiple ES model outputs can be analysed to identify ES priority areas / 'hotspots' **(Source: Phillips, 2014)**

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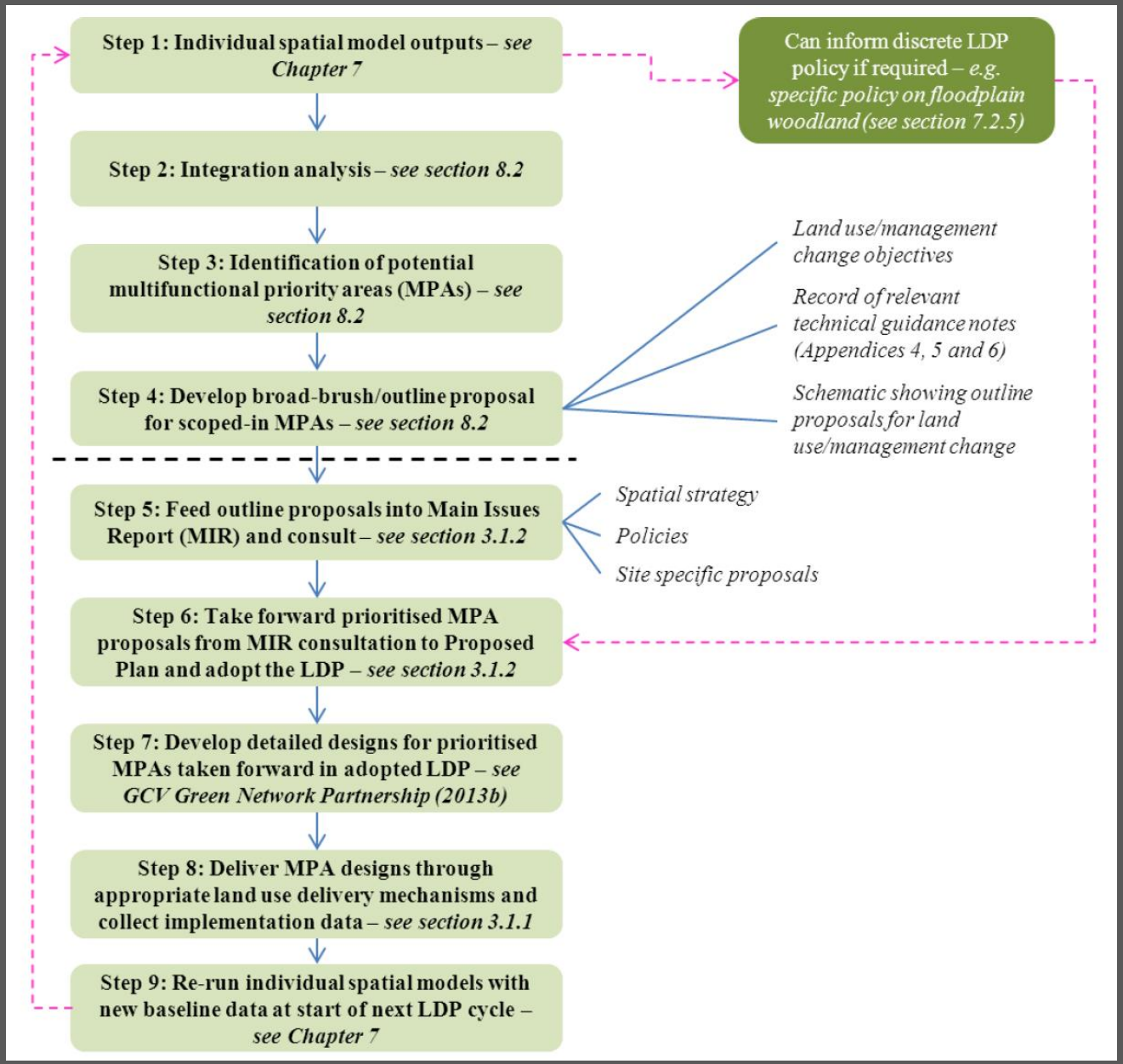
Delivery mechanisms for strategic urban GI



Possible process for integrating strategic GI priorities with LDP policy
(Source: Phillips, 2014)

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Thank you!

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