

The implications of the movement of water through an urban catchment on the delivery of a range of ecosystem services

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An ecosystem approach: policy context

- Millennium Ecosystem Assessment (2005)
- Regional and national ecosystem assessments
- Policy-makers:
 - Global e.g. Sustainable Development Goals
 - Regional e.g. EU WFD implementation report (2012)
 - National scale e.g. UK Government Environment White paper (2011)



An ecosystem approach: research context

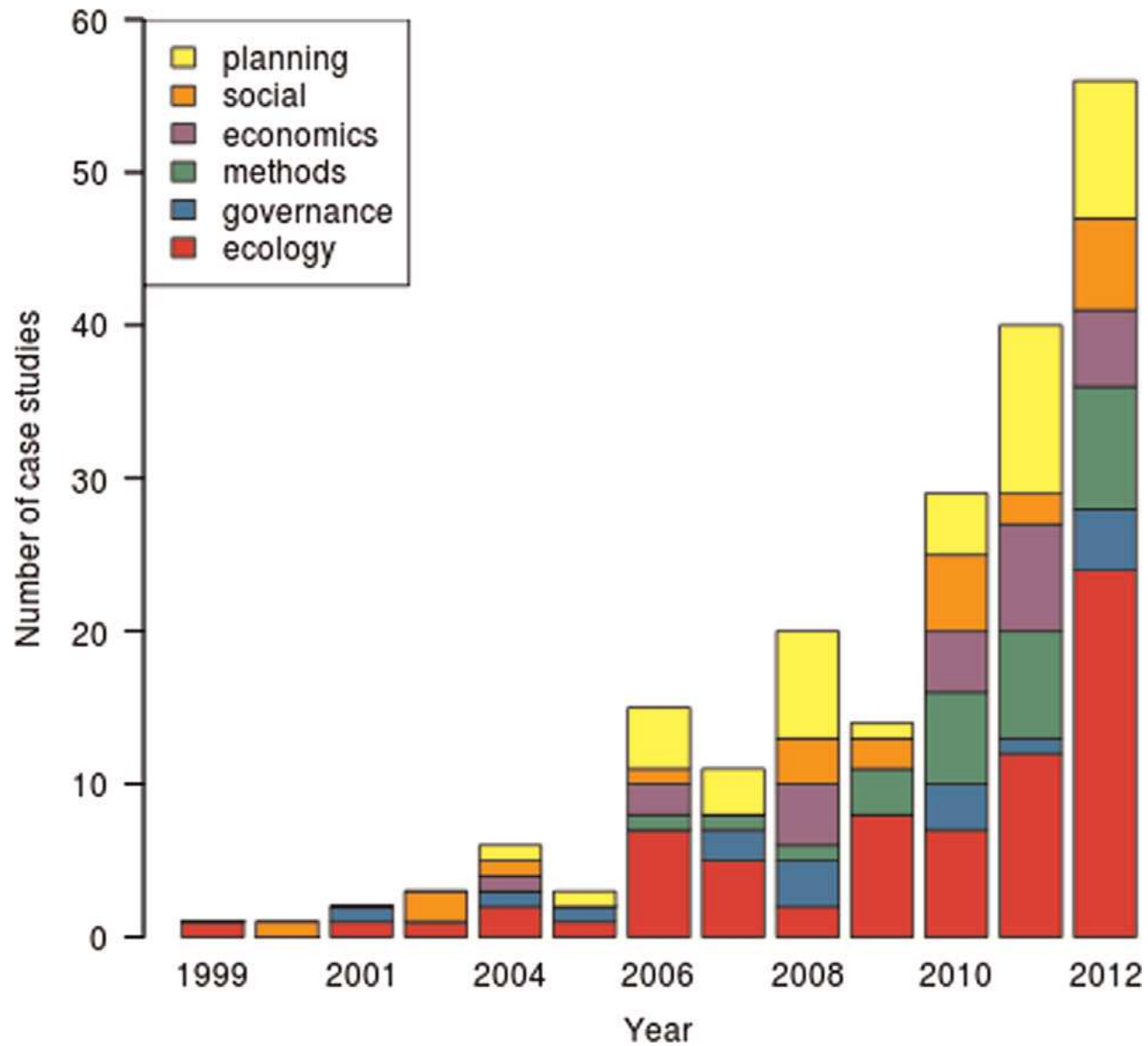
- recognizes that humans, with their cultural diversity, are an integral component of ecosystems
- “Emerging science.....to inform sustainable urban planning ”
- “Useful concept for further understanding the human-nature interface..... “
- “its operationalisation is challenging”



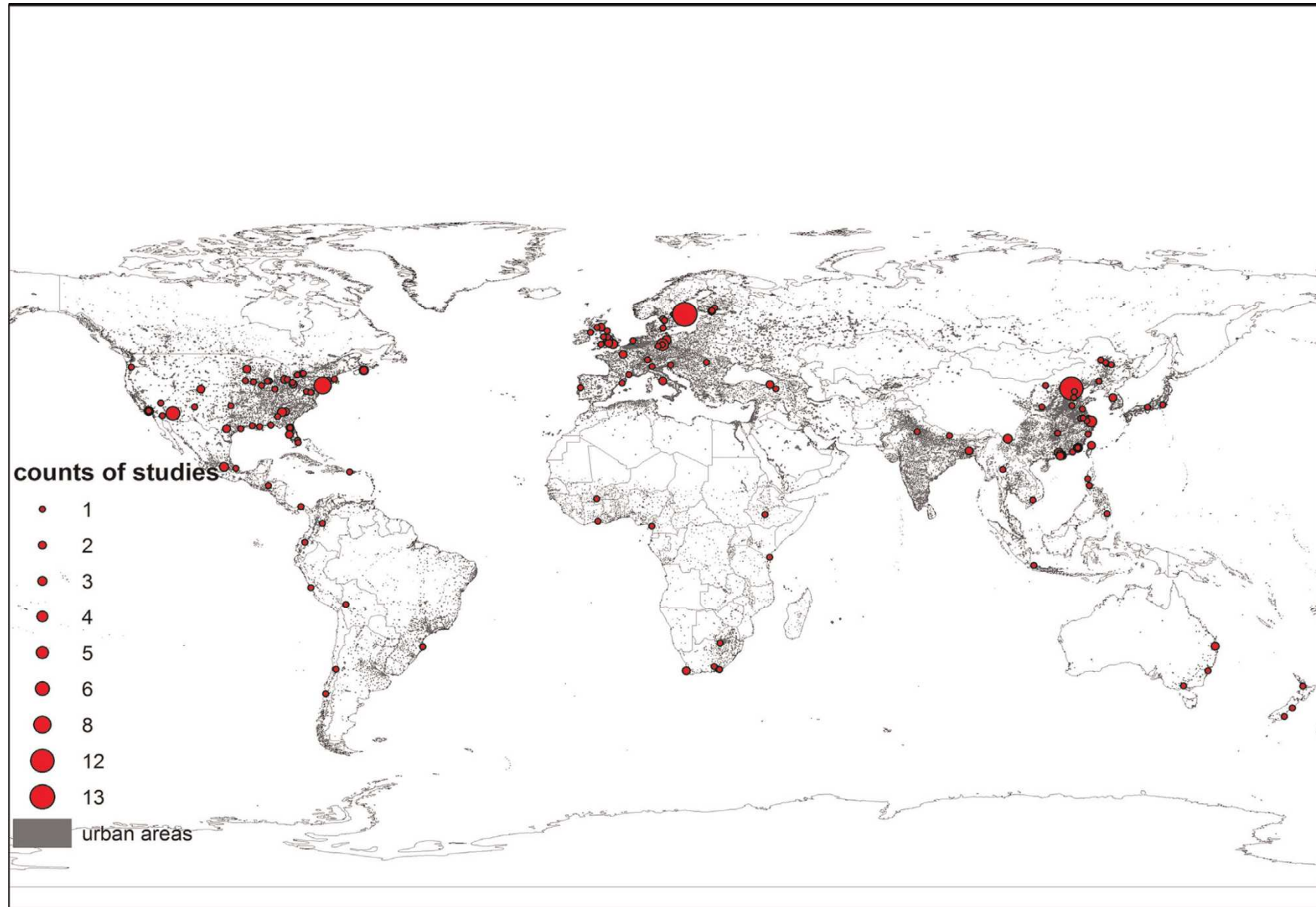
An urban ecosystem approach?

- Ecological structures within urban areas
- Results need to be carefully contextualized:
 - values ascribed to ES vary between urban locations
 - impact on value transfer approaches
- Review of urban ES challenges: six key challenges for future research (Luederitz et al., 2015)
 - 3266 articles screened to 201 articles

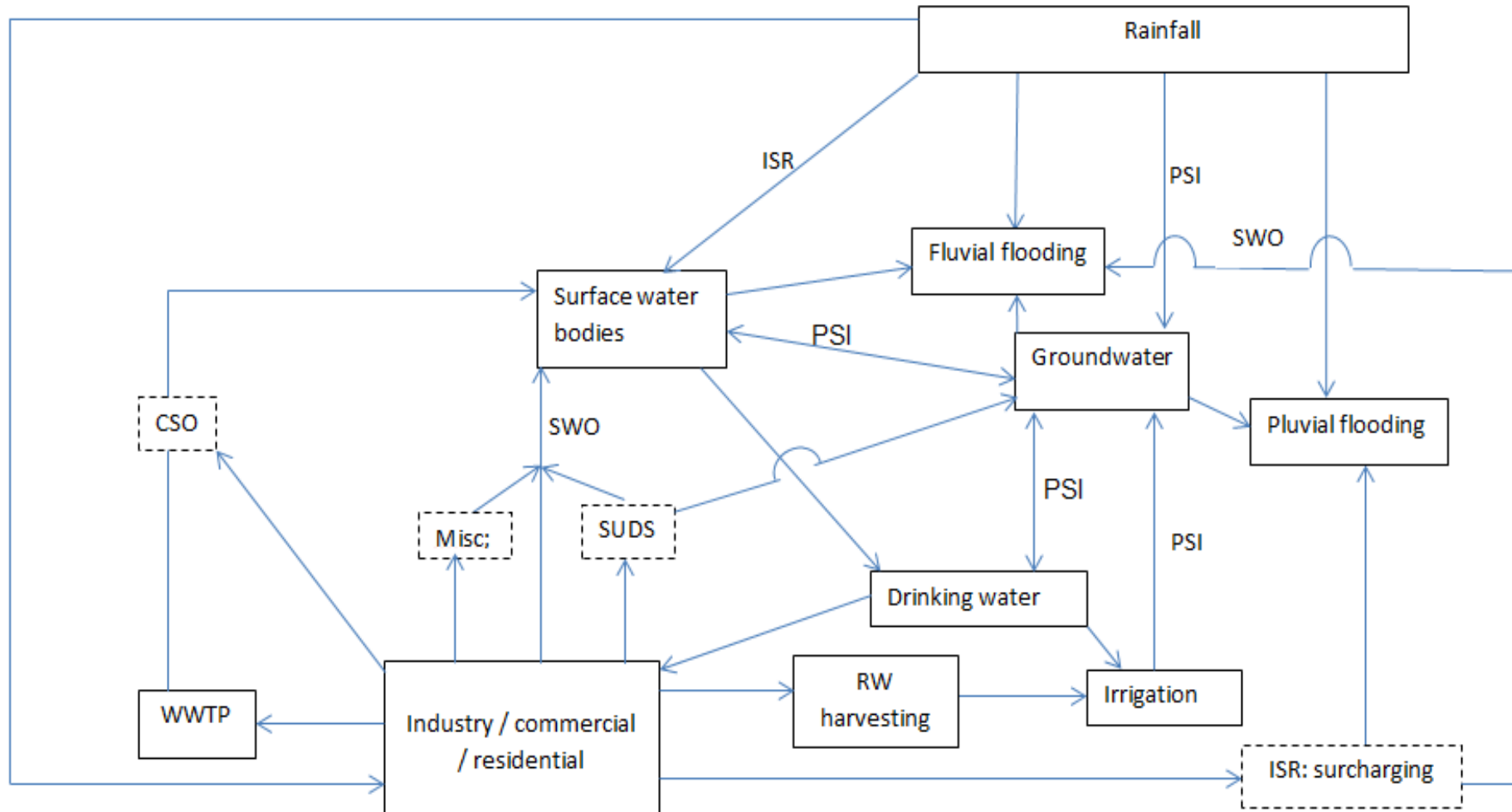
Distribution of urban ecosystem case studies and their main perspective over time



Global distribution of studies on ecosystem services conducted in urban areas covered in the review



Schematic of the primary movements of water through an urban catchment



Key: PSI = permeable surface interaction; ISR = overland impermeable surface runoff; Misc = misconnections. Box with dashed lines: transfer may or may not include this transportation process

The impact of identified urban water compartments on the delivery of selected ES

		Surface water bodies	Ground water	WWTP	RW/GW harvesting	Fluvial flooding	Pluvial flooding	SUDS
SS	Water cycling							
	Habitat							
PS	Potable water							
	Non-potable water							
RS	Climate regulation							
	Water quantity regulation							
	Water quality regulation							
CS	Recreation							
	Education							
	Aesthetics							

An evaluation of the use of alternative SUDS on the delivery of ecosystem services at a local scale

		Storage SUDS		Infiltration SUDS	Conveyance SUDS	Alternative surface
		Constructed wetlands	Retention ponds	Infiltration basin	Swales	Porous blocks with storage
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SS	Water cycling	1 (ET < grass crop)	1 (larger surface area < vegetation)	1 (infiltration to GW)	2 (infiltration plus ET)	1 (when grassed pavers)
	Habitat	3 (~diversity to natural wetlands)	2 (<vegetation than CW)	0 (temporary water body)	2 (diversity > lawns)	-1 (disrupt connectivity)

An evaluation of the use of alternative SUDS on the delivery of ecosystem services at a local scale

		Storage SUDS		Infiltration SUDS	Conveyance SUDS	Alternative surface
		Retention ponds	Constructed wetlands	Infiltration basin	Swales	Porous blocks with storage
RS	Level of protection	3 (>1:100 RI)	2 (1:100 RI)	2 (1:1 – 1:50 RI)	1 (>1:1RI)	2 (1:1 – 1:50 RI)
	Water quality regulation	2 (sedimentation and secondary treatment)	3 (extended DT and tertiary treatment)	2 (all bio-phys-chemical processes)	1 (limited DT)	2 (removal of metals, HCs and oils)
	Climate regulation	1 (ET)	2 (ET and > albedo)	1 (> albedo)	1 (> albedo)	1 (evaporate stored water)

Conclusions

- Ecosystem approach policy is far ahead of the science
- Operationalising the approach is challenging – what, how, impact...
- Existing database is insufficient to support a quantitative assessment of the impact of selecting alternative SUDS on the delivery of ecosystem services
- Further research required to understand benefits, dis-benefits and the transferability of results from one site to another



Ecosystem services associated with rainfall

Benefits:

- **Supporting service** - contributes to the ongoing functioning of the water cycle
- **Provisioning service** - a source of potable and non-potable water
- **Regulating services** - reduction in urban temperatures and an enhancement in air quality
- **Cultural services** – spiritual and cultural values

Dis-benefits

- geographically and temporally highly variable - droughts and floods