Future proofing the benefits of urban tree planting

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The Urban Futures Project

- Multi-disciplinary research team
- EPSRC funding - urban resilience
- Our vision:

Today's sustainability solutions will continue to function, whatever the future holds

https://connect.innovateuk.org/web/urban-futures1

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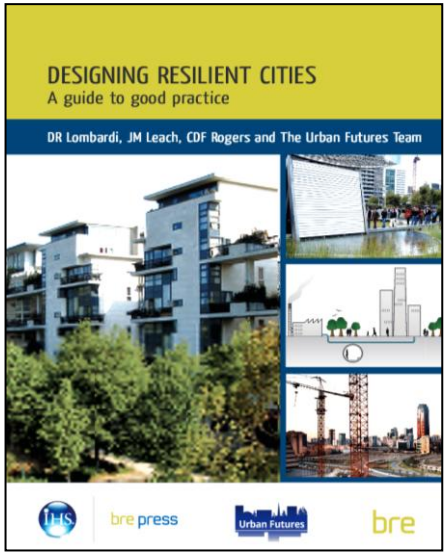
EPSRC Engineering and Physical Sciences Research Council

The Urban Futures Method

- Explores the vulnerability of today's sustainability solutions
- New ways to think about sustainability and resilience
- Free online tool - www.designingresilientcities.co.uk/
- Guidance and worked examples
- Today's focus - planning and management of urban trees



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“Off the shelf” sustainability and resilience

- Large investments in built, social and natural infrastructure for sustainability.
- Focus is on installation.
- What about longevity?
- Implicit assumption – investments will be valued and retained indefinitely!

Many “sustainability solutions” have failed over time.

Green Walls

Tower blocks

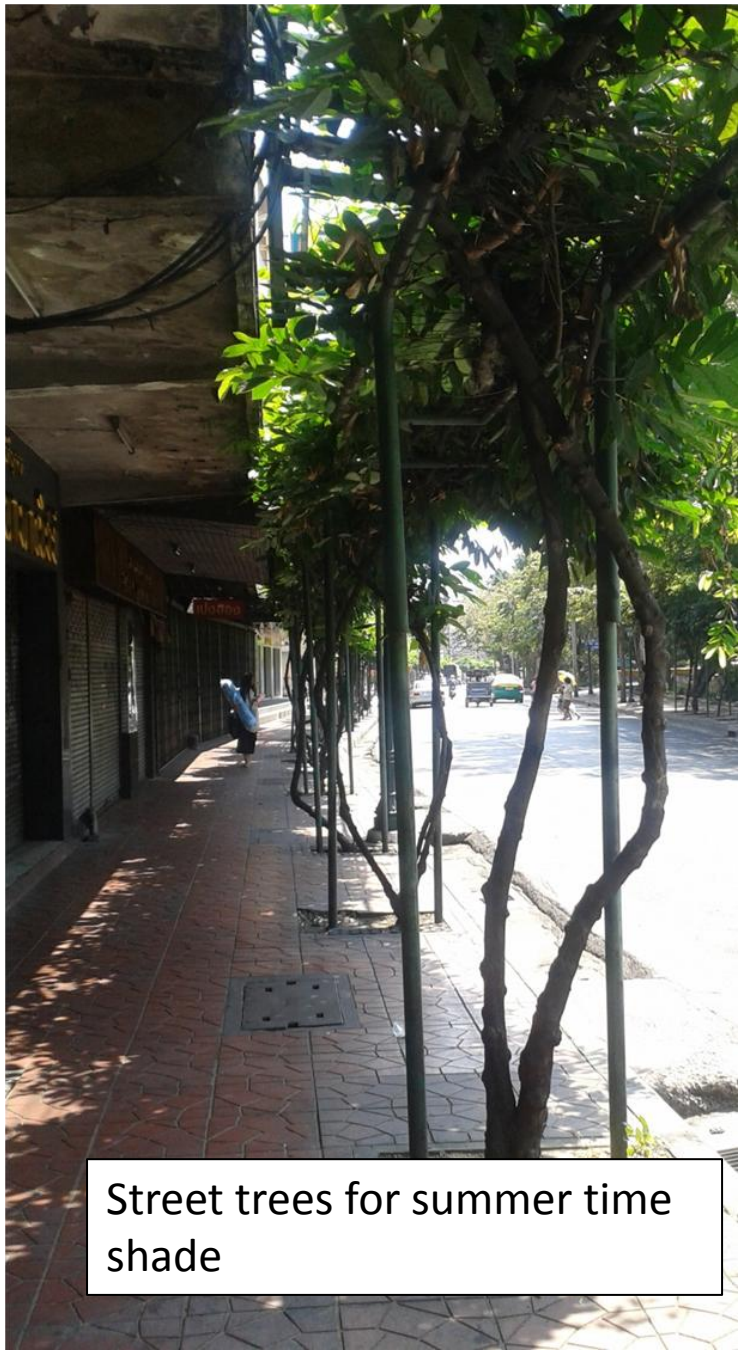
Street trees

How can we reduce the risk of failure?

What is a sustainability solution?

• An intervention with potential for delivering on key sustainability goals. e.g.

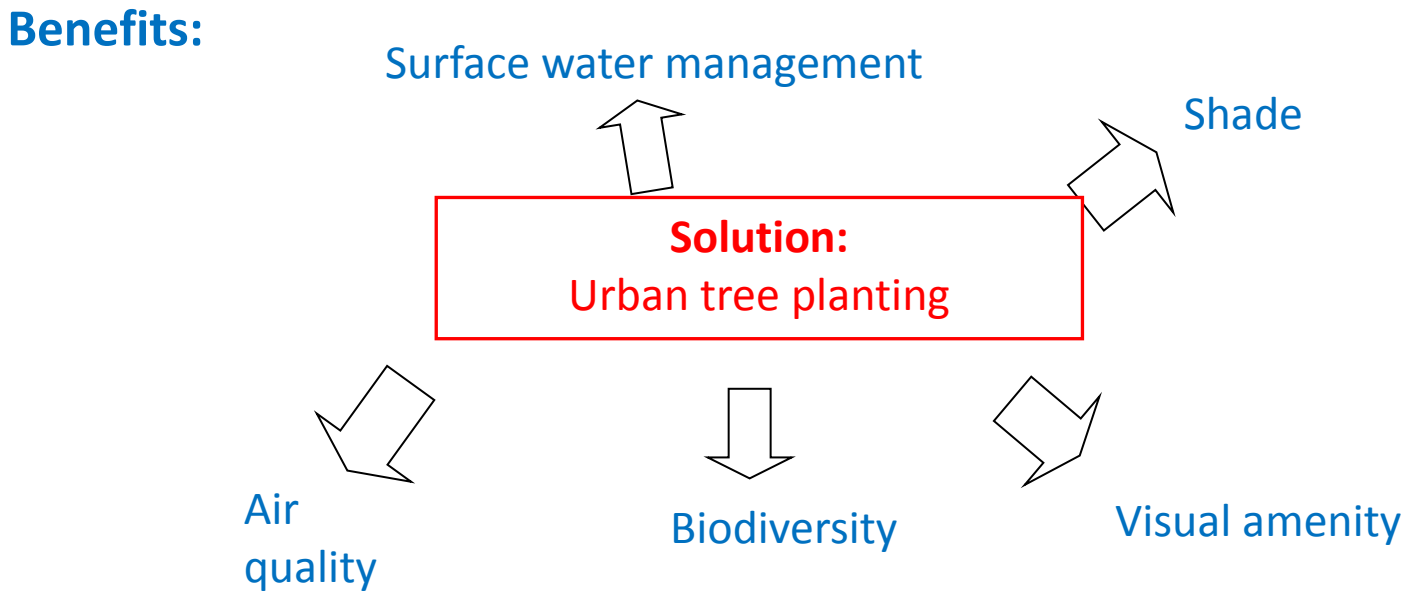
PV cells for low carbon energy



Street trees for summer time shade

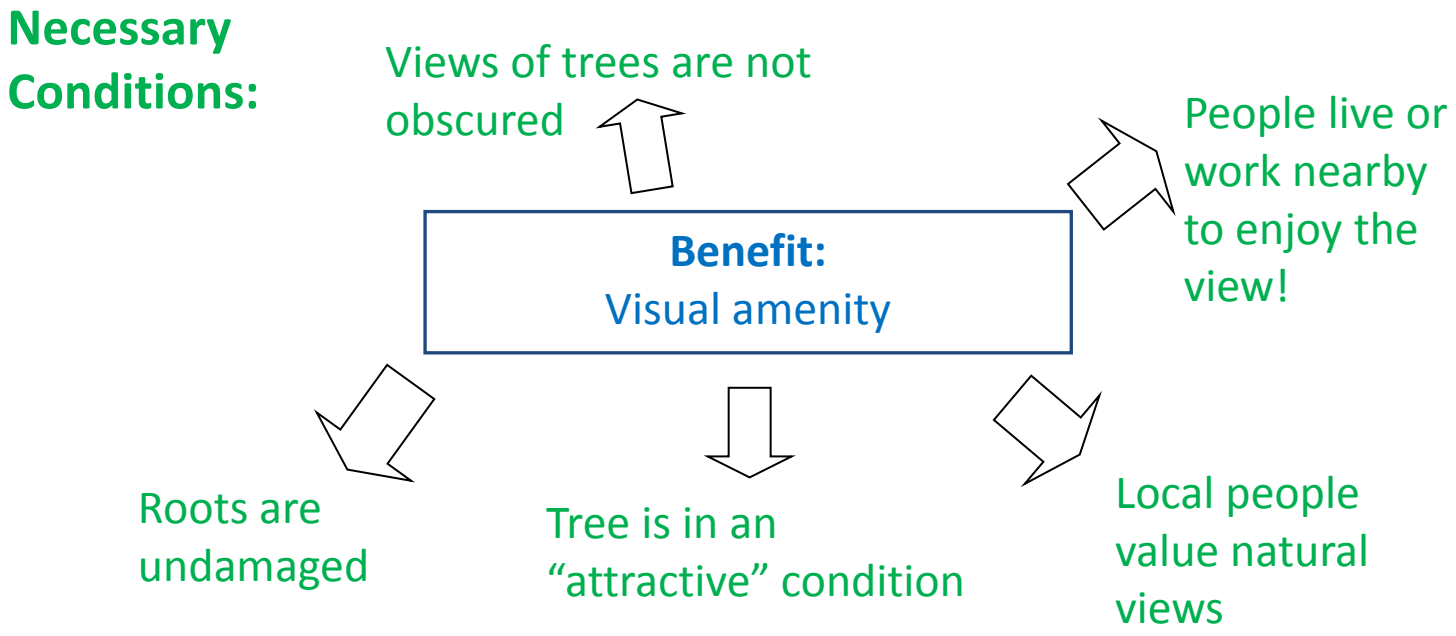
Solutions and their (potential) benefits

- Many **solutions** have numerous potential **benefits**
- Clearly identifying these is key
- Focussing on protecting the solution (in this case a tree) is insufficient
- The benefits it delivers also have to be resilient to urban changes



Benefits and their (necessary) conditions

- Whether each **benefit** will be delivered depends on a set of **conditions**
- Explicitly recognising these is important
- In this case, whether the tree delivers visual amenity is dependant on its visibility and health as well as on the values of local communities.



The urban Futures Methodology

1. Clearly define the sustainability solution
2. Identify each of the intended benefits
3. For each benefit, identify the conditions that need to be in place for the benefit to be delivered
4. Test whether these conditions likely to be supported in the future

Methodology for a single benefit

1. Solution- Plant a line of street trees
2. Intended benefit- Visual amenity
3. Necessary Conditions - Views of trees not obscured
   Local people value natural views
   Trees are attractive
   Trees are healthy
   People live or work nearby

Necessary conditions for multiple benefits

By repeating this for multiple benefits, synergies and tensions become clearer e.g.

- Many benefits depend on large, mature trees
- Some benefits require proximity to busy roads whilst others require the opposite!

	Necessary conditions																										
Desired benefits	Tree is retained	Tree access to light maintained	Low stress from soil pollution	Low stress from air pollution	Root growth not substantially impeded	Water supply sufficient for healthy growth1	No limitation on water supply to tree	Species is native	Species is low VOC emitter	Tree roots do not spread excessively laterally	Species is evergreen	Tree is large and mature	High canopy2	Large-scale tree-cover across urban area	Tree part of spatially-connected network	Tree forms part of a densely-vegetated barrier5	Tree does not overhang road or pavement	Tree is growing in a pervious surface	Tree blocks solar access to building	Trees are maintained for amenity3	Trees are maintained for wildlife4	People are present nearby	Tree is visually accessible to public	Tree is physically accessible to public	No artificial lighting	No persistent noise	Surrounding area built to high density	Tree not in street canyon with busy road
Reduce population exposure to NO_2, O_3, PM	X	X	X	X	X	X	?[a]		X		?[b]	X		?[c]								X					X[gg]
Assimilate CO_2	X	X	X	X	X	X						X		X[ii]						!d							
Provide feeding resource for native birds/bats	X	?[e]	?[e]	?[e]	?[e]	?[e]		X[z]				X		X	X			?[f]		!g	X	!h		!h	X	X	!!	X
Cool buildings (shade)	X	X	X	X	X	X					?[a][c]	X							X									!!
Warm buildings (wind shelter)	X	X	X	X	X	X					X	X	!e			X			!q								!k	
Reduce air temperature	X	X	X	X	X	X	X[ff]					X		X			!!		X[l]									!!
Attenuate noise	X	X	X	X	X	X					X[b]	X	!e			X		?[g][g]		!m								
Reduce stormwater runoff rate/volume	X	X	X	X	X	X					?[n]	?[o]		X				X										
Create desirable environments for recreation	X	X	X	X	X	X				X		?[p]	X		X					X	!a	X	X	X				
Improve urban aesthetics	X	X	X	X	X	X				X		?[p]								X	!a	X	X					
Reduce psychological stress	X	X	X	X	X	X						?[p]	X[b]									X	X	?[h]				

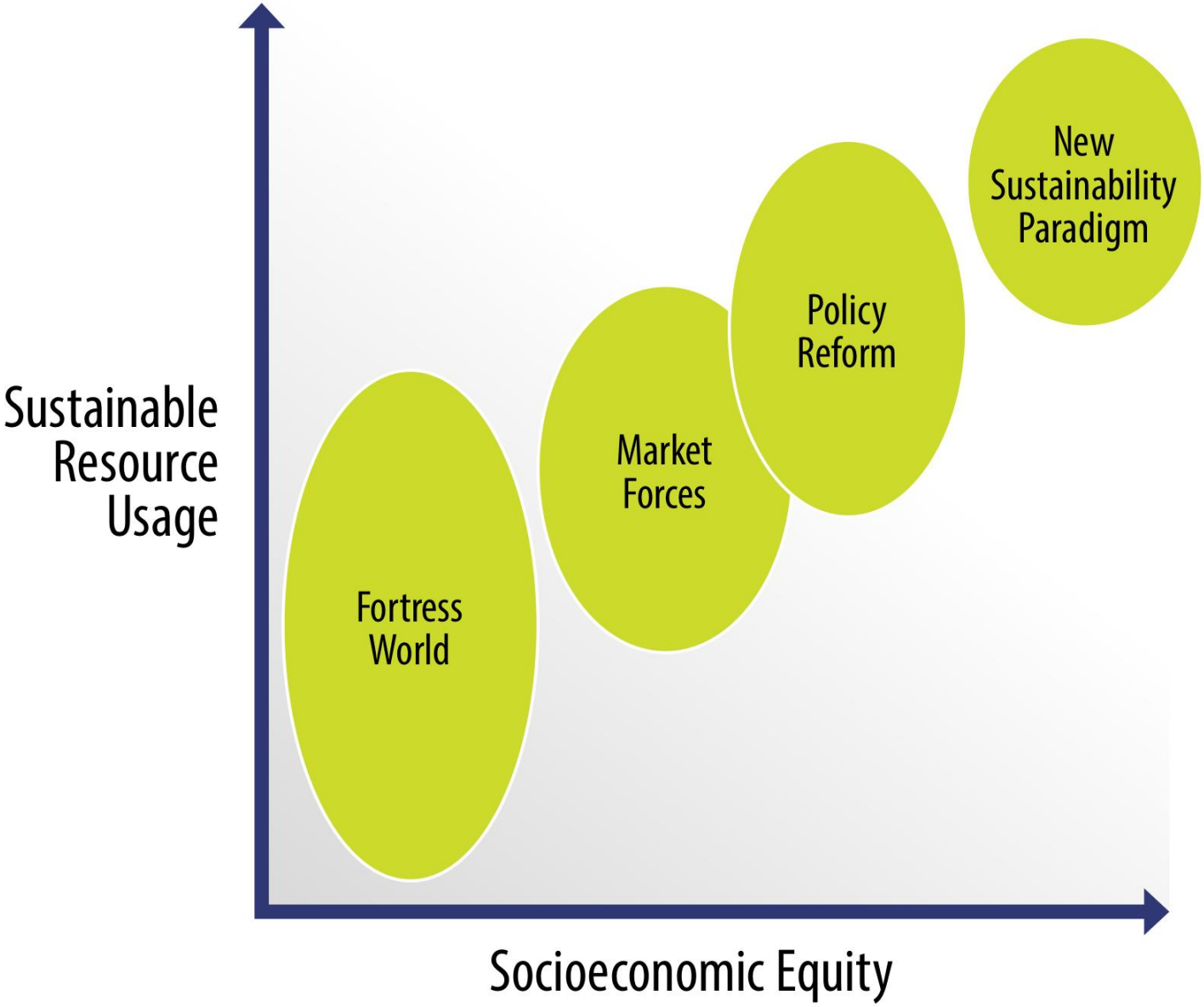
Step 4 – Resilience of benefits to urban change

- The benefits urban trees deliver can change over time.
- As their context changes, conditions vital for their performance may be lost.
- Are these conditions likely to be supported in the future, and if not, why not?

But how can we explore the future of our cities?

- The UF method **does not predict** the future... it is **not trend analysis.** All such predictions will be wrong!
- Instead, UF uses **future scenarios** that are**:**
  - *well-cited within academic literature;*
  - *sufficiently distinct from each other;*
  - *wide ranging (from probable to plausible)*

... allowing for creative thinking, less constrained by thoughts about current practice or the form and function of today's cities.


Sustainable Resource Usage
Fortress World
Market Forces
Policy Reform
New Sustainability Paradigm
Socioeconomic Equity

Market Forces

New Sustainability Paradigm

Fortress World

Policy Reform

Market Forces

Competitive, open and integrated global **markets drive world development**

- ***Social*** *and* ***environmental*** *concerns are* ***secondary***
- ***Consumerism, materialism*** *and* ***individualism*** *spread as core human values*
- ***Income disparity***

New Sustainability Paradigm

A more humane and equitable society, driven by **shift in social values**.

- ***Equity*** *and* ***sustainability*** *define development*
- *Greater* ***environmental awareness*** and support
- *A new spirit of* ***community*** *identification and* ***participation***

Fortress World

Highly divided society, with **resource and personal security** as driving values.

- *Alliances protect the privileges of* ***rich and powerful elites***
- *The* ***poor majority are isolated*** *from all but essential services*

Policy Reform

Improved social equity and environmental protection through **vigorous policy initiatives.**

- ***Social*** *goals prioritised over* ***environmental***
- ***Consumerism*** *and* ***individualism*** *are still ubiquitous*
- *Income* ***disparity is reduced***

Market Forces

New Sustainability Paradigm

Would the street trees we plant today sill be functioning within these futures?

Fortress World

Policy Reform

UK City scenario characteristics

Theme	Indicator	Baseline (UK)	Characteristic of UK – New Sustainability Paradigm	Characteristic of UK – Policy Reform	Characteristic of UK – Market Forces	Characteristic of UK – Fortress World
Planning and land use	Land use	1.38 ha, or 5.7% of total UK	Built up area reduces by 17% 	No change in built up area 	Increase of 17% in built up area 	Increase of 50% in built up area unevenly distributed between rich and poor 
Demography	Urban population density	40.3 persons/ha	Increase of 22% largely driven by reduced built up areas 	Increase of 14% in existing built up areas 	Decrease of 3% due to sprawl 	Decrease of 20%, although this will be different in rich and poor areas 
Society	Attitudes towards consumerism		Sufficiency becomes the preferred lifestyle, replacing ostentatious consumerism. Societal values change to stress well-being, solidarity, and environmental concerns.	Resource intensive consumption reflects the search for individualism and status, and undermines support for policies that prioritise long-range environmental and	Materialism and consumerism spread as core human values, particularly in the young 	High consumption lifestyles are available to the rich. The rapidly growing population in the poor regions aspires to the same lifestyle, but has restricted access to goods

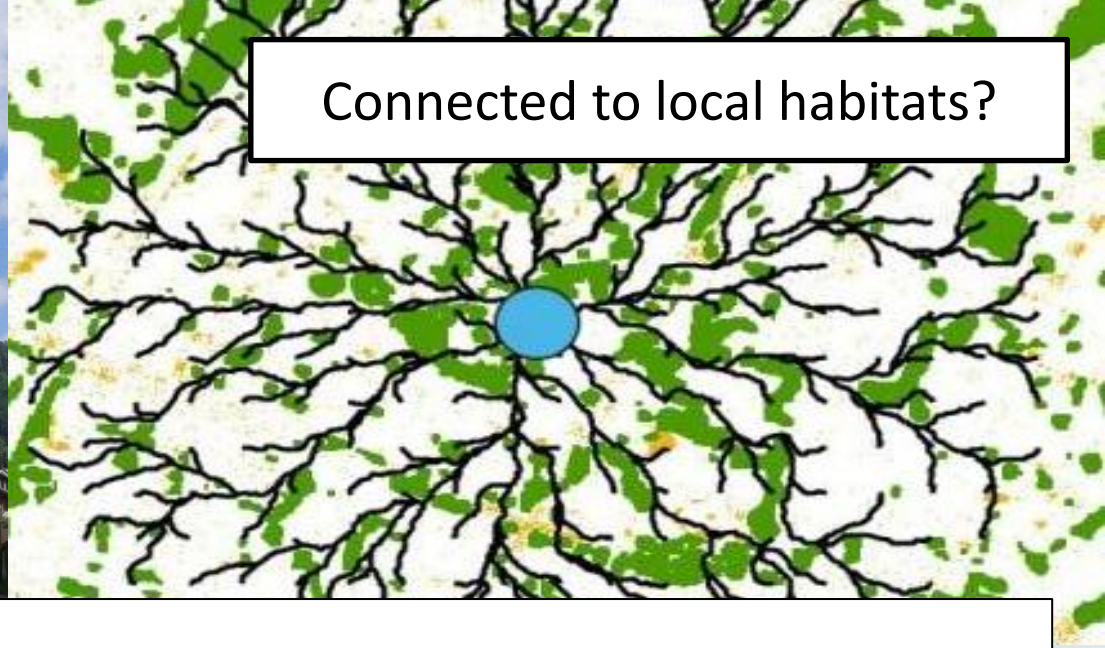
- Interrogate scenarios from the perspective of our necessary conditions
- Highlight particular threats and their causes
  e.g. for the necessary condition – “Trees are tall and mature”

New Sust’bility Paradigm	Policy Reform	Market Forces	Fortress World
Benefits of large mature trees are recognised and conditions protected within city systems management	Threats in urban centres from densification policy. Less space, light and access to surface water. Threats along transport corridors - regeneration for low carbon mass transit	High risk of removal in areas where buried utilities are abundant. Removal in locations where public or property are threatened (litigation risk). Vulnerable in areas with high land value	Particularly vulnerable in socially deprived locations. Maintenance budgets lost. Damaged for fuel/timber.

Discussion

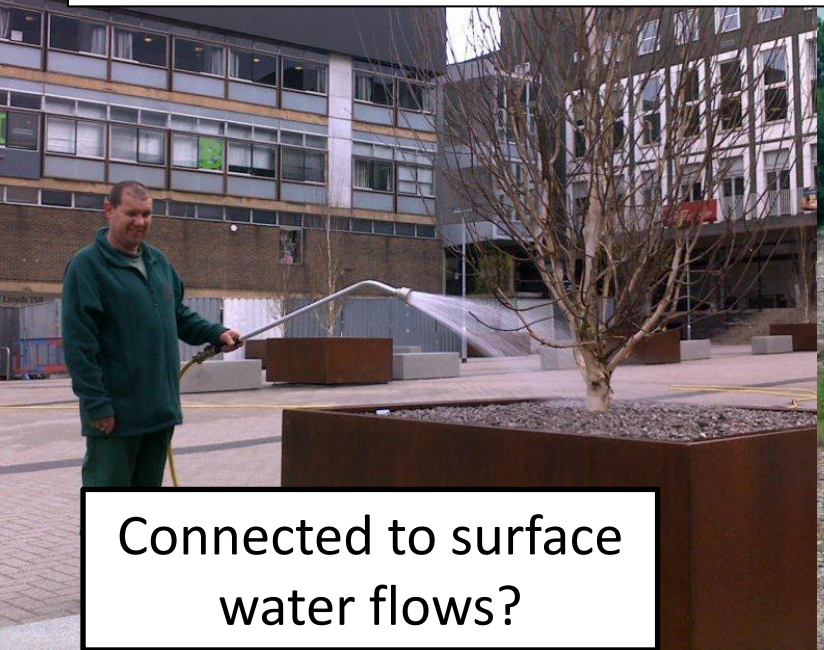
- Are we installing street trees in areas where risk of removal/loss is high?
- If they survive, will they still deliver the benefits we desire?
- Many barriers exist to newly planted trees reaching maturity, and some locations appear to be particularly risky.
- But we already know that large urban trees are vulnerable!
- However, the UF approach helps us:
    - Question what our tree planting is trying to achieve
    - Make explicit our assumptions about their protection in the future
    - Highlight vulnerabilities and their causes in a structured way
- This example raises questions about whether new models for ownership and management of urban street trees are needed to make them more resilient.
- Perhaps urban trees and soils need to be adopted and valued as standard components of surface water management infrastructure?
- Could the preservation of green viewsheds become normal practice for urban designers and managers?
- Should the conditions necessary for delivery of key benefits be valued and managed as if they were actually part of the tree itself?

Visible to residents?



Connected to local habitats?

How valuable will future urban trees be if they are not...



Connected to surface water flows?

Accessible to the public?

Conclusion

“Sustainability solutions” are not intrinsically sustainable - their performance depends greatly on their **context** and whether key **conditions are retained over time.**

Urban tree planting campaigns need to be challenged to demonstrate that the **longeivity** of these trees has been considered, and questioned as to whether the expected **benefits are future proof**.

Clearly we need to protect urban trees over large time scales, but this is not sufficient. We also need to **identify and protect the broader systems** that allow these trees to deliver their potential benefits into the future.

Urban Futures info

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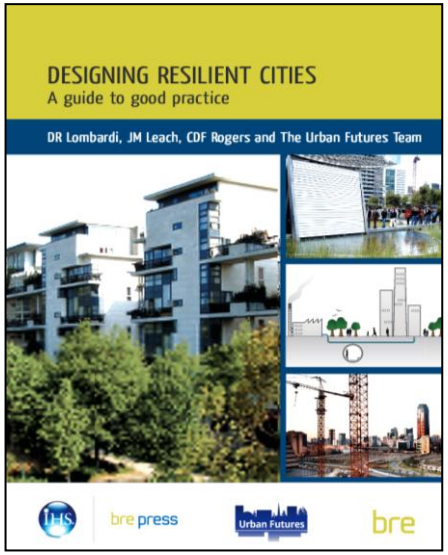
- Guidance and worked examples



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