CIEEM 2017
Mainstreaming Biodiversity into Future Cities

Landscape, Biodiversity and Ecosystem Services at the Heart of Sustainable Architecture and Urban Masterplanning?

Dr. Mike Wells FCIEEM CEnv CSci CBiol CWEM

Founding Director, Biodiversity by Design Ltd

Built Environment Expert UK Design Council

Visiting Research Fellow Bath School of Architecture and Civil Engineering

HOW TO MAINSTREAM BIODIVERSITY INTO THE FUTURE CITY?

SYNOPSIS:

- *Understand the need*
- *Know the benefits and evidence base…*
- *…but do not wait for perfect knowledge!*
- *Know the policy frameworks and use them*
- *Know the key guidance*
- *Know and learn from case studies and exemplars*
- *Understand third party incentives*
- *Respond to third party concerns*
- *Strive for optimisation*

THE PRESSING NEED FOR BIODIVERSITY MAINSTREAMING IN CITY DESIGN

We’re an urban species now…

Image of dense urban Shanghai

Cartoon of countryside abandonment for an undesirable city

Climate Change

Image of the Stern report

Image of mass extinctions over time including the anthropocene

Mass extinctions

- current mass extinction rate is man-induced at 1000 to 10,000 x background rate
- conservative estimate 3 species per hour
- predicted 20% to 50% extinction of global biodiversity

UNDERSTAND THE BENEFITS AND THE EVIDENCE BASE

Ecosystem Services diagram from the Millennium Ecosystem Assessement

...1997...

Globally ecosystem goods and services are worth ca. £22 trillion/year

(range £10-£36 trillion)

or 2 x GLOBAL GDP

Robert Costanza

Biodiversity underpins all ecosystem services

‘Ecosystem functions are more stable through time in experimental ecosystems with relatively high levels of biodiversity; and there are comparable effects in natural ecosystems. Taken together, this evidence shows that, in general terms, the level and stability of ecosystem services tend to improve with increasing biodiversity.’

UK National Ecosystem Assessment Technical Report

UK National Ecosystem Assessment (2011)

Front cover image

Front cover image of UK NEA follow on report on economic valuation of ESS

…but nothing on urban eco-psychology and productivity…

Delving deeper - biophilia

Front cover image of the Biophilia Hypothesis

Biophilia.. is the innately emotional affiliation of human beings to other living organisms. Innate means hereditary and hence part of ultimate human nature.

Edward Wilson - Harvard

Biophilia is a weak genetic tendency whose full and functional development depends on sufficient experience, learning an cultural support. Biophilic sensibilities can atrophy, and society plays and important role in recognising and nurturing them.

Stephen Kellert - Yale

Image of biophilic elements
and a for sale sign

Images relating to drug taking and the effects of natural views

biology letters

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Psychological benefits of greenspace increase with biodiversity

Richard A Fuller[1,*], Katherine N Irvine[2], Patrick Devine-Wright[2,†], Philip H Warren[1] and Kevin J Gaston[1]

+ Author Affiliations

*Author for correspondence (r.a.fuller@dunelm.org.uk)

'Psychological benefits of greenspace increase with biodiversity'

Fuller *et al.* 2007

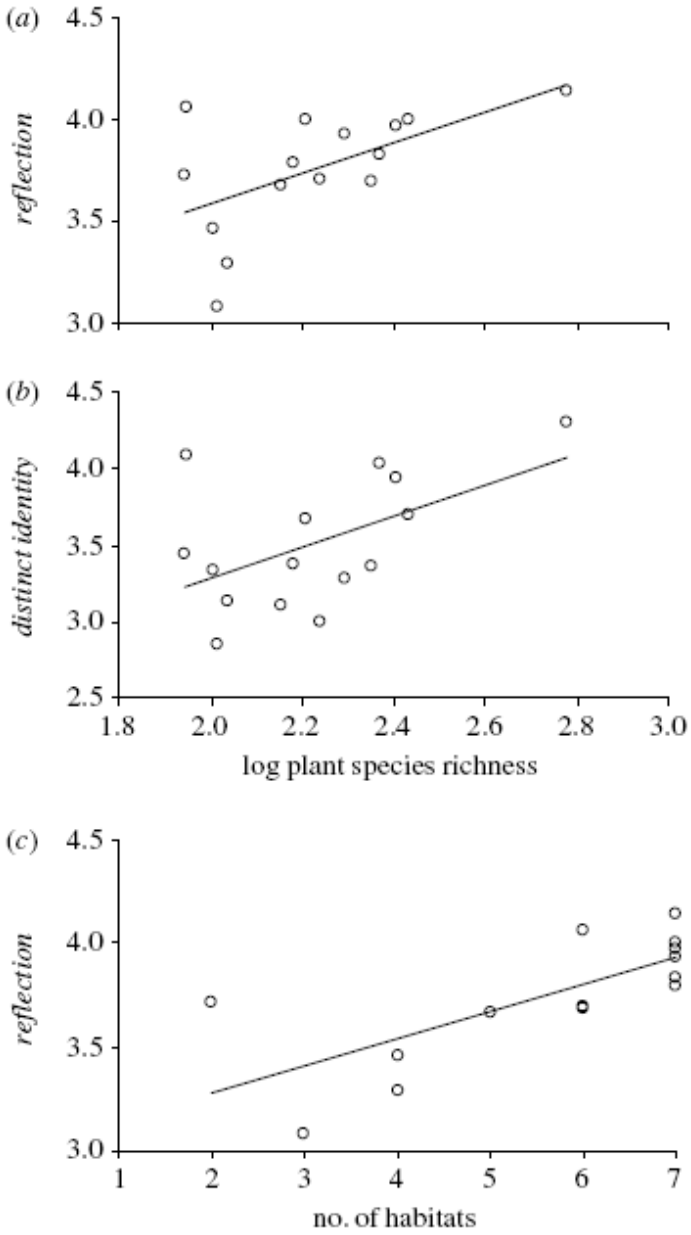


Figure 1. Relationship between log plant species richness and (*a*) *reflection*, (*b*) *distinct identity* and (*c*) the relationship between number of habitat types present in a greenspace and *reflection*. See text and table 1 for explanation of units.

ENVIRONMENT AND CRIME IN THE INNER CITY
Does Vegetation Reduce Crime?

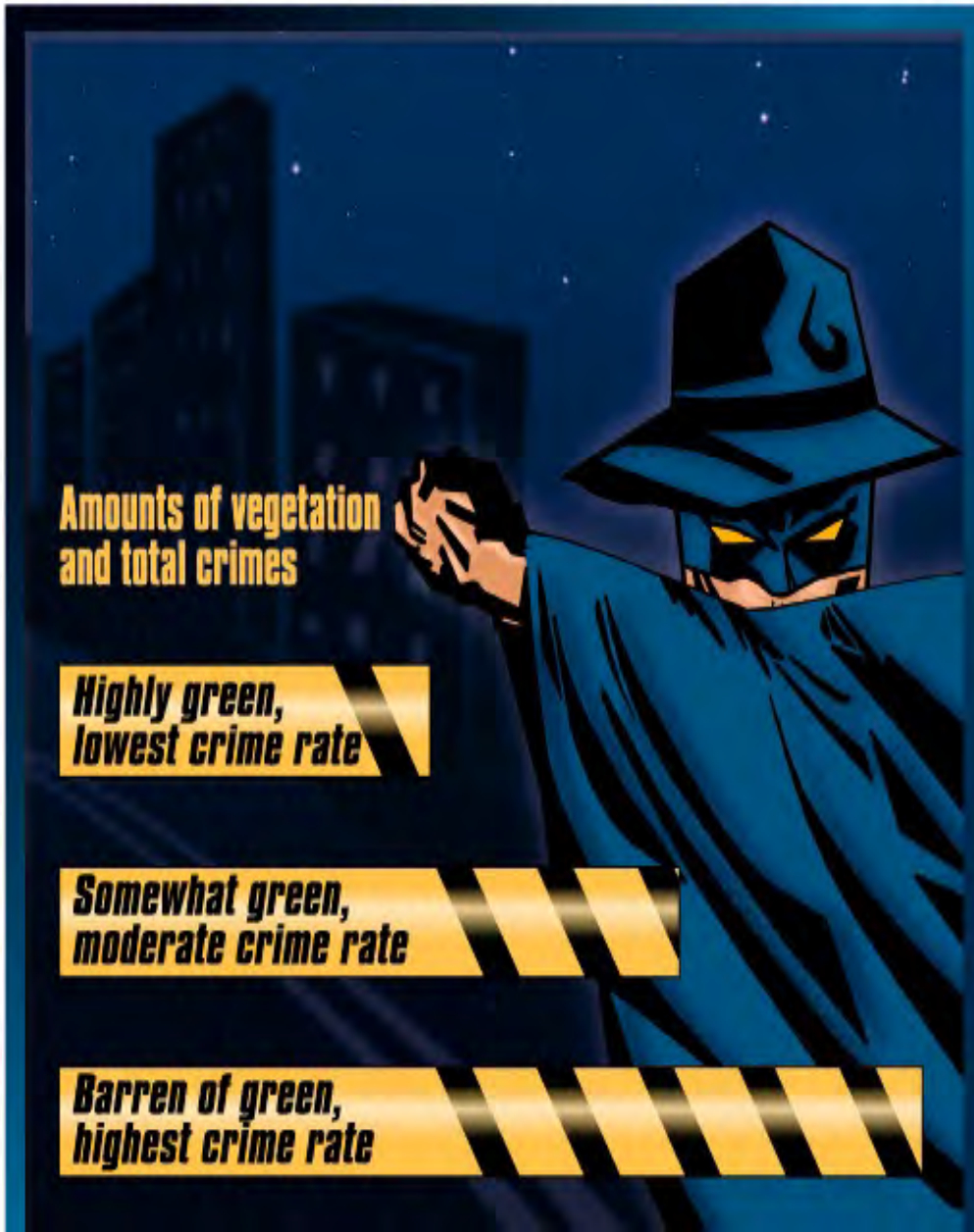
FRANCES E. KUO *is an assistant professor and codirector of the Human-Environment Research Laboratory at the University of Illinois, Urbana-Champaign. Her research focuses on attention, defensible space, and novice-friendly information.*

WILLIAM C. SULLIVAN *is an associate professor and codirector of the Human-Environment Research Laboratory at the University of Illinois, Urbana-Champaign. His research focuses on the psychological and social benefits of urban nature and citizen participation in environmental decision making.*

ABSTRACT: Although vegetation has been positively linked to fear of crime and crime in a number of settings, recent findings in urban residential areas have hinted at a possible negative relationship: Residents living in "greener" surroundings report lower levels of fear, fewer incivilities, and less aggressive and violent behavior. This study used police crime reports to examine the relationship between vegetation and crime in an inner-city neighborhood. Crime rates for 98 apartment buildings with varying levels of nearby vegetation were compared. Results indicate that although residents were randomly assigned to different levels of nearby vegetation, the greener a building's surroundings were, the fewer crimes reported. Furthermore, this pattern held for both property crimes and violent crimes. The relationship of vegetation to crime held after the number of apartments per building, building height, vacancy rate, and number of occupied units per building were accounted for.

Green Streets, Not Mean Streets

In an inner city neighborhood, the greener the residence, the lower the crime rate



Jubilee Campus, Nottingham University:

Images of the campus buildings and landscape and students

Effects in the workplace

Exposure to high quality urban nature

- *Improved mood*
- *Reduced tension*
- *Reduced anger*
- *Reduced depression*
- *Reduced confusion*
- *Reduced fatigue*
- *Increased vigour*

- *Improved test performance*
- *Improved cognitive skills*
- *Increased creativity*
- *Increased productivity*

- *Improved cognitive skills and test performance*
- *Increased creativity*
- *Increased productivity*
- *Reduced costs*
- *Increased profits*

A fast-growing evidence base

- Great complexity, dynamic pathways of effect, variation in spatial, demographic and individual factors – can lead to contradiction and variation
- BUT…2800 scientific papers on ecosystems and health since the 1990s to 2010
- Consistent strong evidence for positive influence on psychological AFFECT and EMOTIONS
- Positive effect on reducing occurrence of disease
- Ever-increasing sophistication of metrics and biomonitors
- Smaller effects on different aspects of our mental and physical health and behaviour add up may synergise to give larger effects

Institute for European Environmental Policy
2016

Front cover image of the Health and Social Benefits of Biodiversity Protection

Green the cities NOW!

Environment International 99 (2017) 343–350

Contents lists available at ScienceDirect

Environment International

journal homepage: www.elsevier.com/locate/envint

No time to lose – Green the cities now

Matilda van den Bosch [a,b,*], Mark Nieuwenhuijsen [c]

[a] School of Population and Public Health, The University of British Columbia, 314 – 2206 East Mall, Vancouver, BC V6T 1Z3, Canada
[b] Department of Forest and Conservation Sciences, The University of British Columbia, 3041-2424 Main Mall, Vancouver, BC V6T 1Z4, Canada
[c] ISGlobal CREAL, Barcelona Biomedical Research Park (PRBB), Doctor Aiguader 88, 08003 Barcelona, Spain

Capsule:

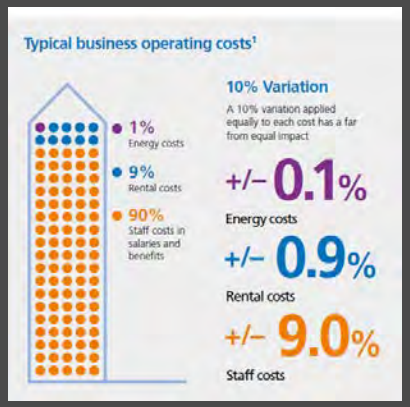
We do not need to wait, and must not wait for statistically rigorous control-laden science to act in putting biodiversity at the heart of the future city

Designing for Biodiversity Productivity and Profit British Council for Offices (2011)

Mike Wells and Ken Yeang

Biophilia included in *Health, wellbeing and productivity in offices*

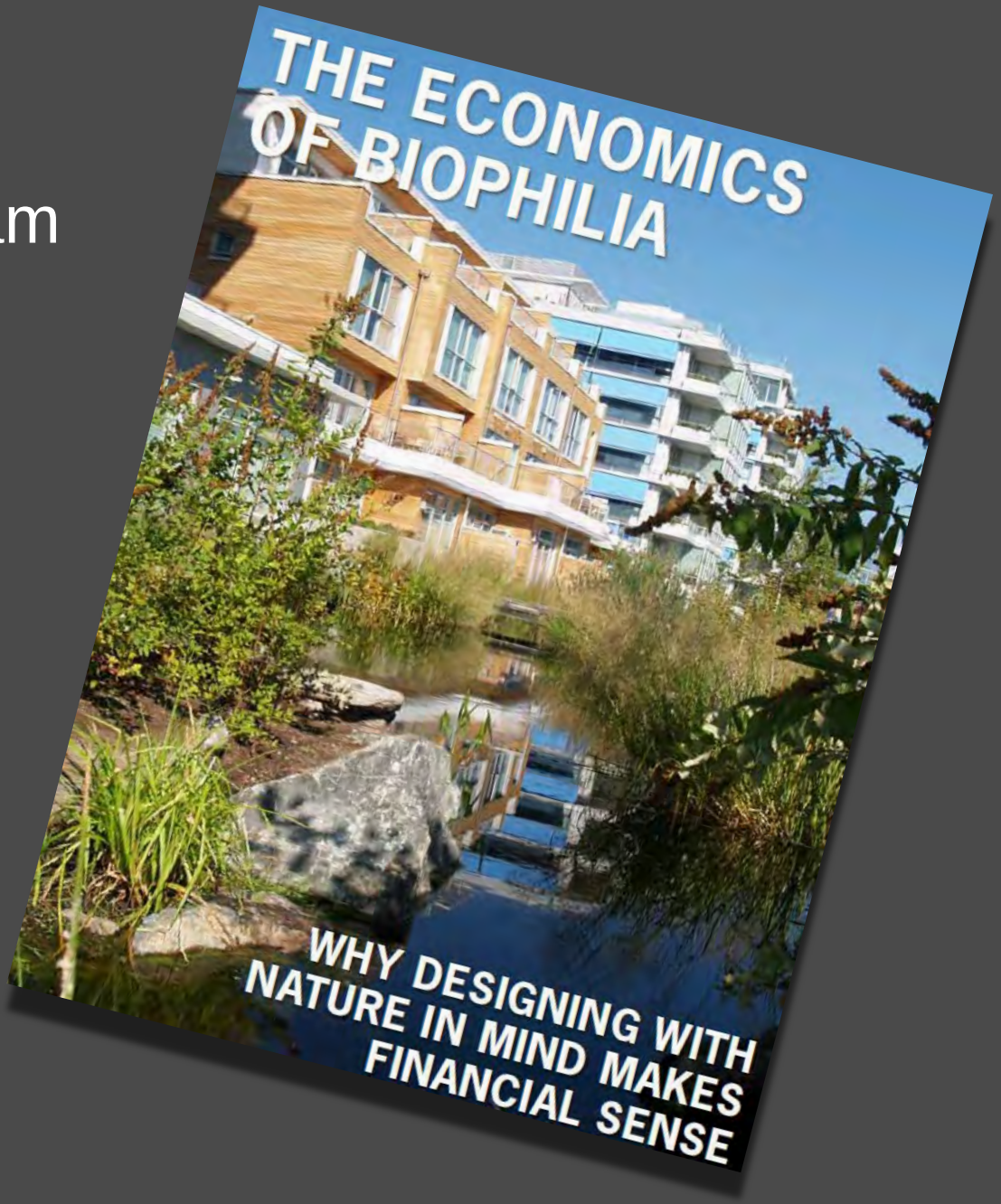
World Green Building Council 2014



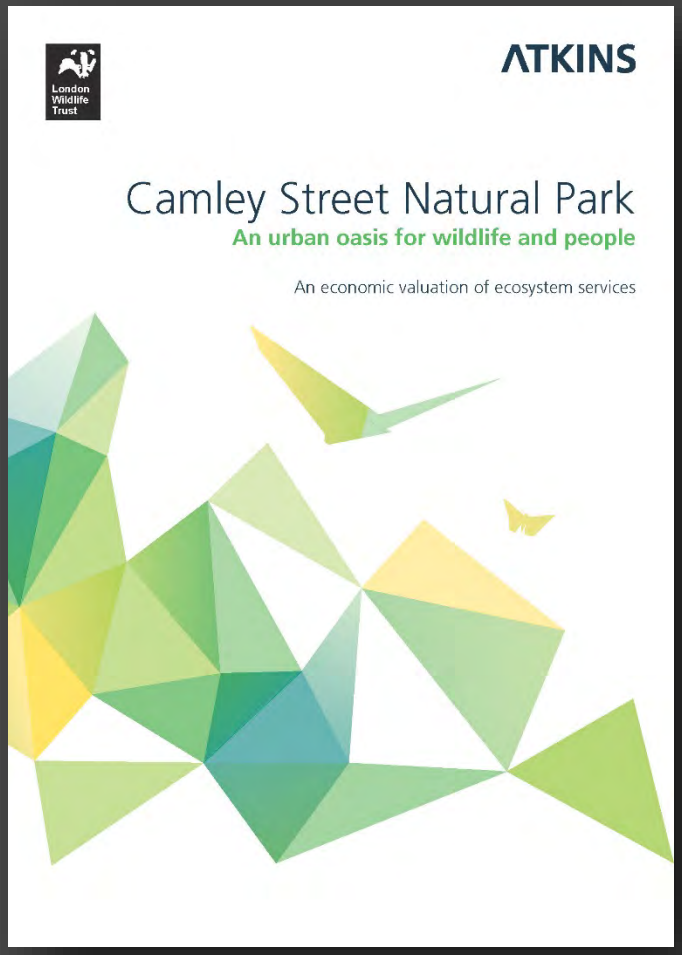
'There is overwhelming evidence which demonstrates that the design of an office impacts the health, wellbeing and productivity of its occupants.'

Biophilia becoming mainstream in the USA

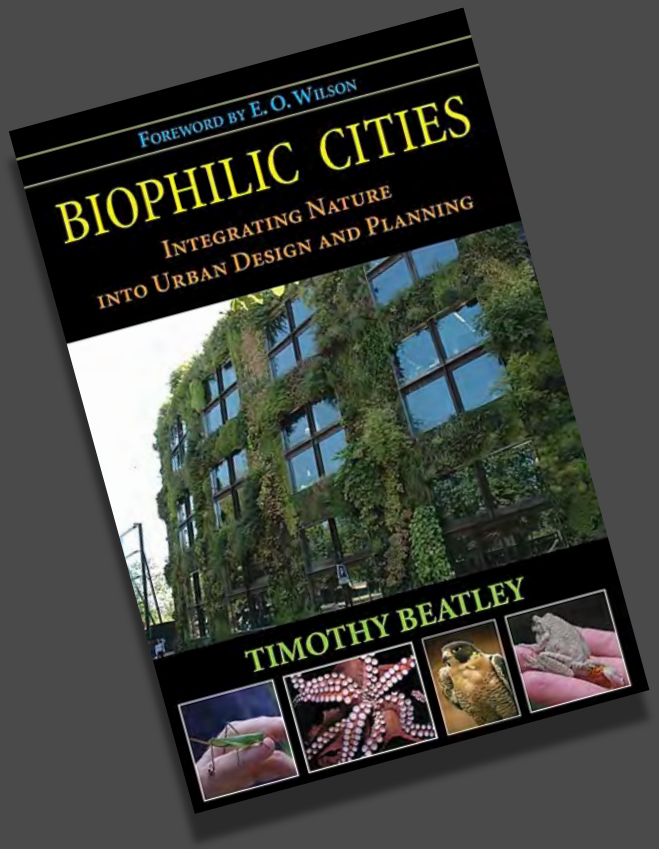
Terrapin Bright Green
(2011)

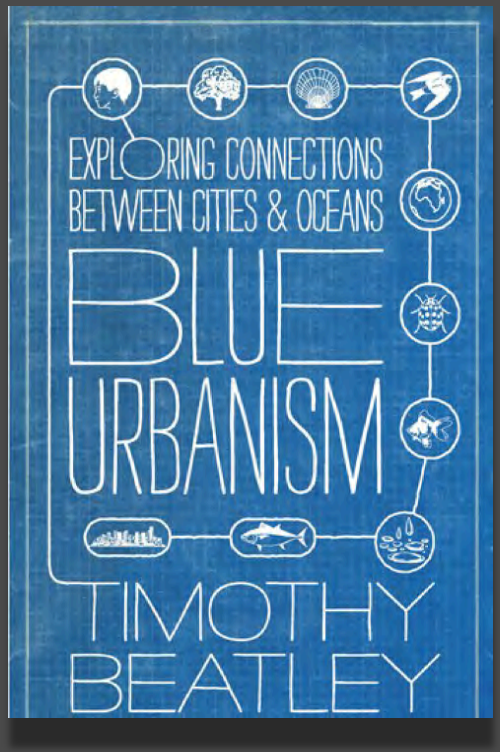


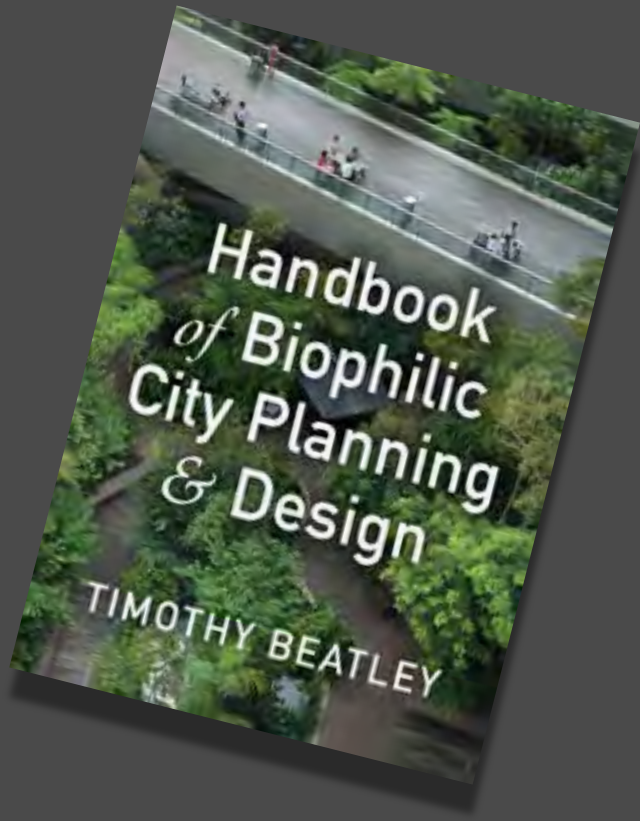
Use Urban Ecosystem Service assessment methods that properly reflect the *ecopsychological effects*; e.g. value transfer analysis



Biophilic Cities







‘A biophilic city is a city abundant with nature, a city that looks for opportunities to repair and restore and creatively insert nature wherever it can. It is an outdoor city, a physically active city, in which residents spend time enjoying the biological magic and wonder around them. In biophilic cities, residents care about nature and work on its behalf locally and globally’.

Timothy Beatley – Biophilic Cities

KNOW & QUOTE THE POLICY FRAMEWORKS

England’s Biodiversity Strategy (2011)

Environment White Paper (England) (2011)

‘A healthy, properly functioning natural environment is the foundation of sustained economic growth, prospering communities and personal wellbeing.’

Once again an emphasis on urban ecosystem services

- Provisioning
- Regulating
- Cultural
- Supporting

8 The Natural Choice

Spot the ecosystem services

Ecosystem Services are the products of natural systems from which people derive benefits, including goods and services, some of which can be valued economically, and others which have a non-economic value.

- **Provisioning services:** We obtain products from ecosystems, such as: food (crops, meat and dairy products, fish and honey); water (from rivers and also groundwater); fibre (timber and wool); and fuel (wood and biofuels).
- **Regulating services:** We benefit from ecosystem processes, such as: pollination (of wild plants and cultivated crops and flowers); water purification (in wetlands and sustainable urban drainage schemes); climate regulation (through local cooling and carbon capture by trees); noise and air pollution reduction (by urban and surrounding vegetation); and flood hazard reduction (by floodplains and sustainable urban drainage).
- **Cultural services:** We gain non-material benefits from ecosystems, for example: through spiritual or religious enrichment, cultural heritage, recreation or aesthetic experience. Accessible green spaces provide recreation, and enhance health and social cohesion.
- **Supporting services:** These are ecosystem functions that are necessary for the production of all other ecosystem services, for example: soil formation (for example, in woodlands or in well managed allotments) and nutrient cycling (for example, soils breaking down animal waste).

All of these roles are underpinned by biodiversity; the level and stability of ecosystem services generally improve with increasing levels of biodiversity.

UN Biodiversity Summit 2010 & AICHI targets

Agreed we must address the *underlying causes of biodiversity loss*

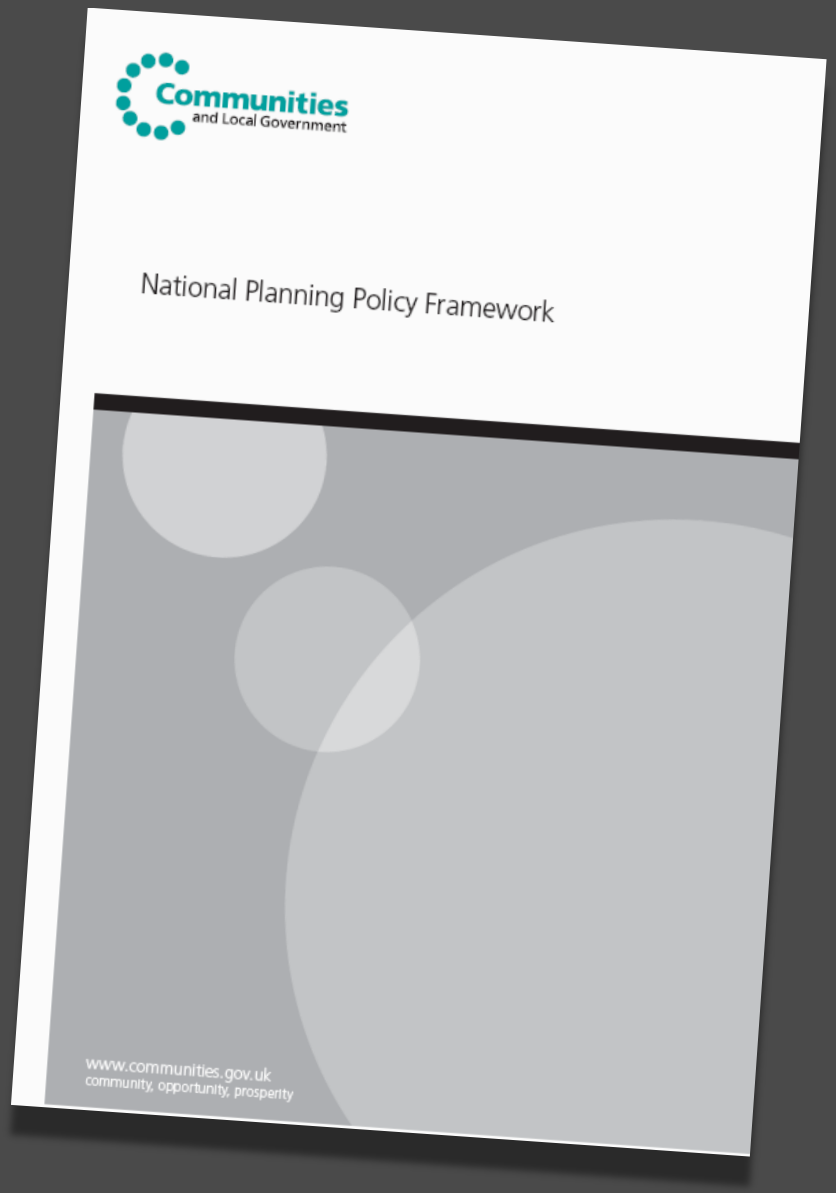
Strategic Goal D:

'*Enhance the benefits to all from biodiversity and ecosystem services*.'

Image of people celebrating the signing of the protocol

England's National Planning Policy Framework 2012 (NPPF)

- Presumption in favour of sustainable development – but sustainable includes improving biodiversity and adapting to climate change
- Planning system should contribute to and enhance the natural environment, providing net gains to biodiversity where possible
- Need to work at landscape scale, improve ecological networks, recreate priority habitats and habitats of priority species
- *'opportunities to incorporate biodiversity in and around developments should be encouraged;'*



London Infrastructure Plan 2050

The report states that by 2050:

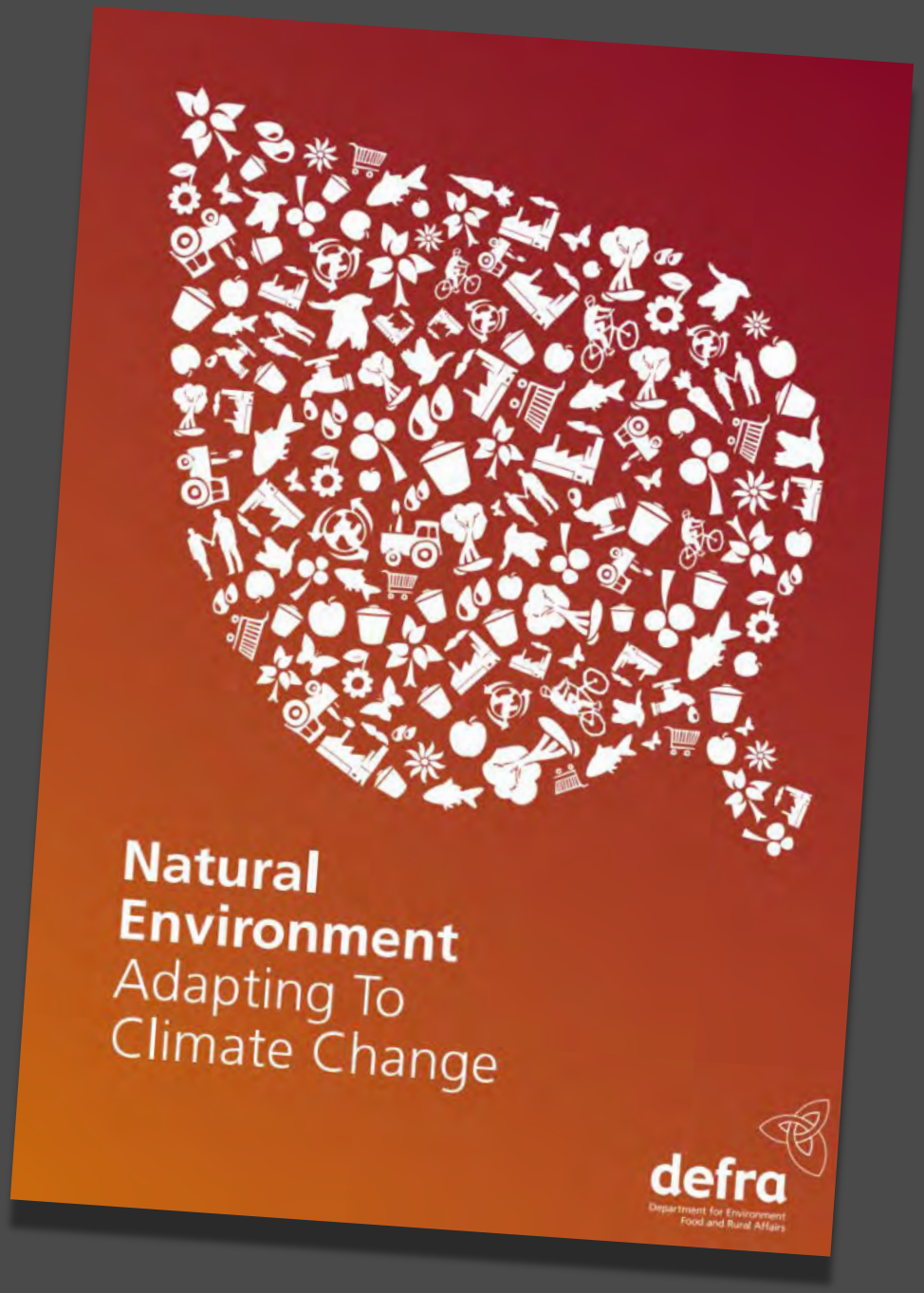
‘London will have a city-wide green infrastructure network that is planned, designed and managed to absorb floodwater, keep the city cool, encourage healthy lifestyles, and enhance biodiversity and ecological resilience.’

KNOW KEY ‘HOW TO’ GUIDANCE

TEEB
(2010)


The Economics
of Ecosystems
& Biodiversity
MAINSTREAMING THE ECONOMICS OF NATURE
A SYNTHESIS OF THE APPROACH, CONCLUSIONS
AND RECOMMENDATIONS OF TEEB

Climate Change Adaptation DEFRA (2010)



Urban Air Temperature Regulation by GI

Forestry Commission (2013)

Forestry Commission

Research Note

Air temperature regulation by urban trees and green infrastructure

Kieron Doick and Tony Hutchings

February 2013

A well-known effect of urbanisation is the warming of the local climate relative to surrounding rural areas, creating a phenomenon known as the 'urban heat island' (UHI). UHI intensity varies across a city and over time, but temperature differences may reach 9 °C in the UK. Factors that contribute to a UHI include the thermal properties, height and spacing of buildings, the production of waste heat, air pollution, and differences in land cover and albedo. The UHI effect is important as heat-related stress accounts for around 1100 premature deaths per year in the UK – increasing noticeably in exceptionally hot years. An estimated 8–11 extra deaths occur each day for each degree increase in air temperature during UK summer heatwaves. As the occurrence and intensity of extreme heat events is set to increase under the changing climate predicted for the UK, there are significant implications for the thermal comfort and health of city dwellers across many parts of the UK. UHI abatement is of significance to those engaged in the development and delivery of climate change adaptation plans, including urban planners, policy makers and health professionals. Urban planning, building design and landscaping can all provide strategies for mitigating the UHI. Vegetation has a key role to play in contributing to the overall temperature regulation of cities. Informed selection and strategic placement of trees and green infrastructure can reduce the UHI and cool the air by between 2 °C and 8 °C, reducing heat-related stress and premature human deaths during high-temperature events.

Biodiversity Planning Toolkit (2010)

Good Practice Guidance for GI and Biodiversity (2012)

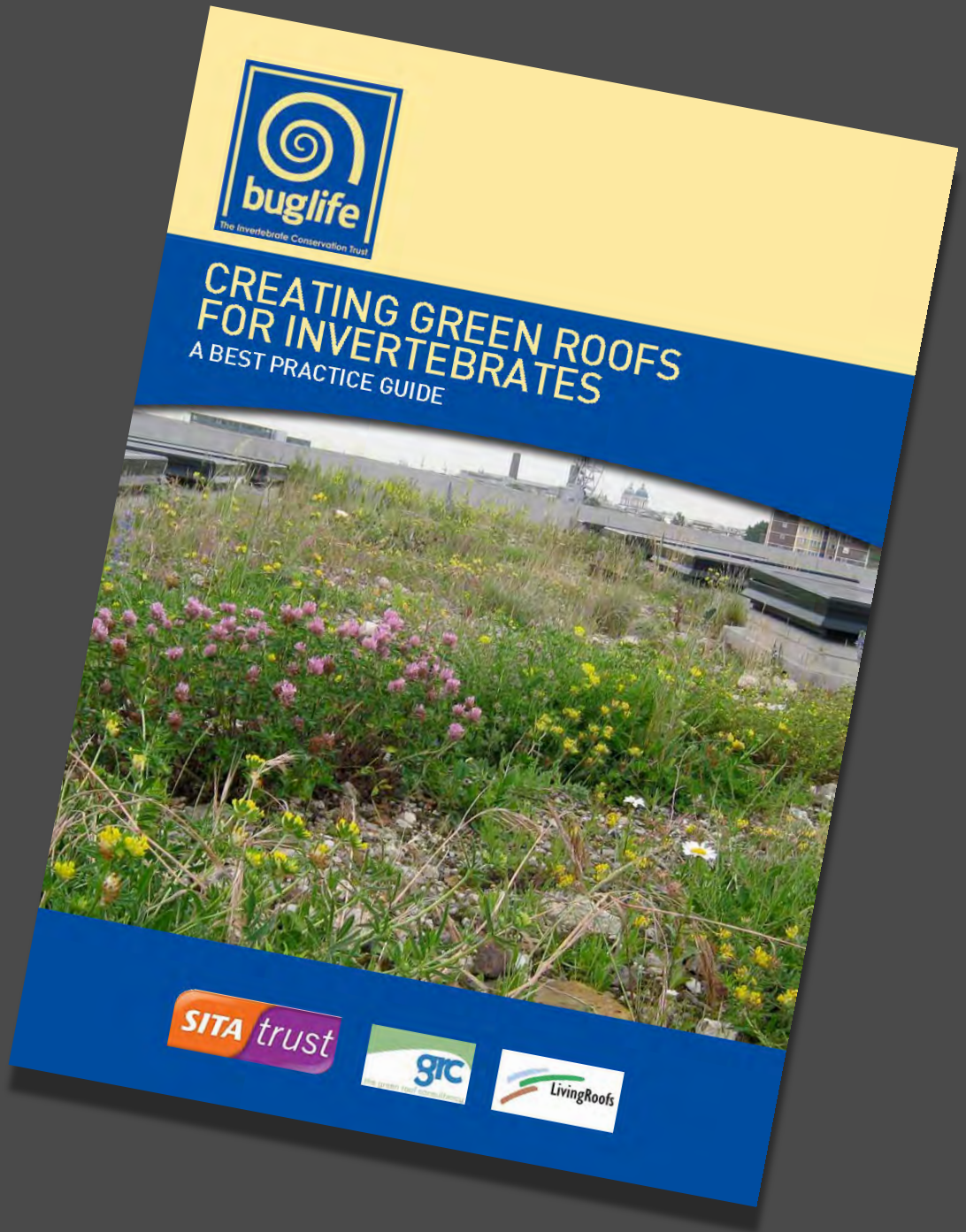
UK Green Roof Code (2014)

gro

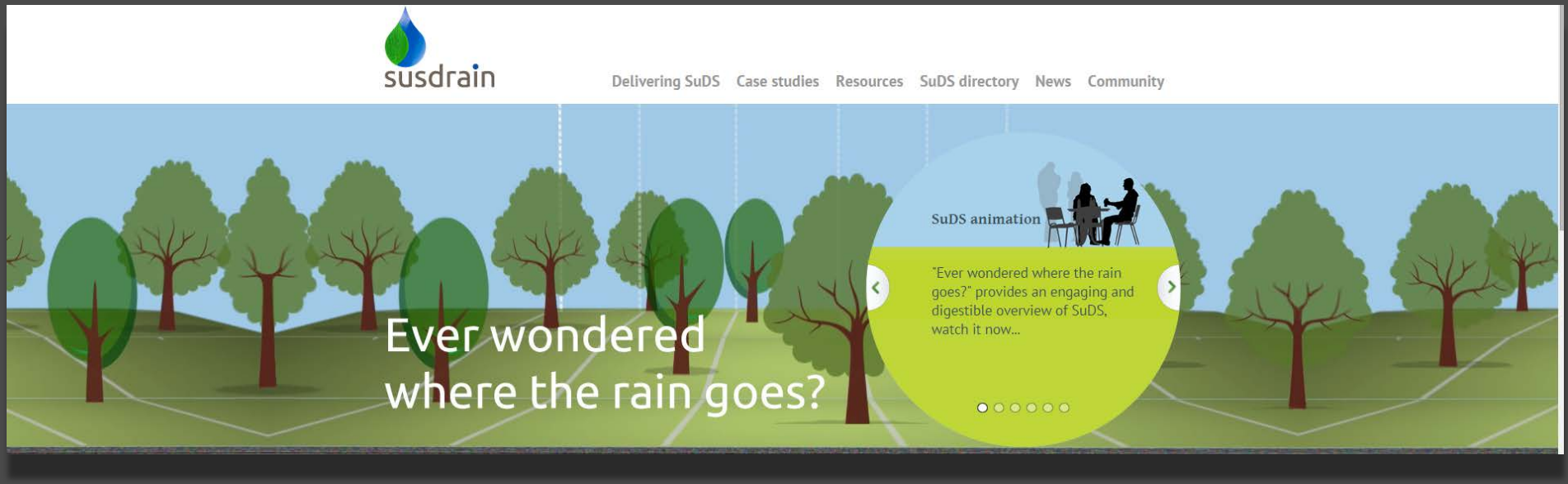
The GRO Green Roof Code

Green Roof Code of Best Practice for the UK 2014

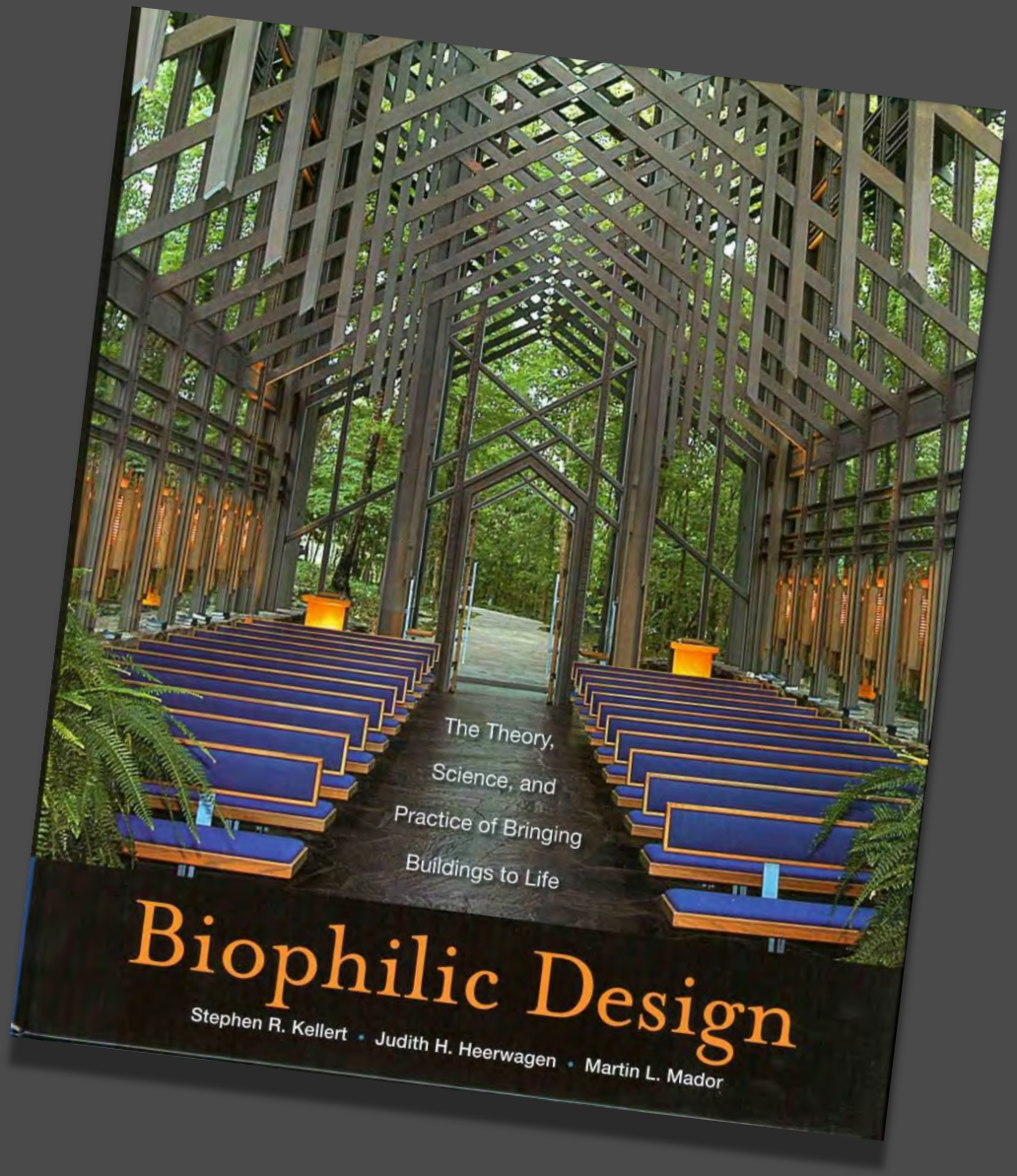
Designing for fauna…



Susdrain:
National Guidance on Sustainable Drainage (Constantly updated)



Biophilic Design



KNOW SOME BUILT EXAMPLARS

Design image of the academy

Scunthorpe Sports Academy, UK

Drivers:

- Design competition
- Enlightened Borough
- World-class design team

Bonnington Square Vauxhall, London, UK

Drivers

- Local galvanising resident and designer (Dan Pearson)
- Public pressure
- Enlightened Borough – Public-private partnership

Images of Bonnington Square

Rubens Hotel, Victoria, London, UK

21 metres
10, 000 plants

Drivers:

- Policy
- Flood risk management
- Individuality and single owner not decision by committee

Images of the living wall

Athletes' Village for the 2012 Olympic Games, Stratford, London, UK

Image of the AV from the air


SIGNORELLI
BEER

Drivers

- *Public Body*
- *National project with Review Board*
- *National spotlight*
- *International designers*
- *Code for Sustainable Homes & BREEAM*
- *Sitewide ecosystem services strategy*
- *Multifunctionality – hard to cut out*

'The London Olympics consciously set out to build nature into the overall design … the Olympic Village is fringed with wetland and wet woodlands, topped up with water from the roof-tops … the wetlands are a magnet for wildlife'

From: 'What Has Nature Ever Done For Us? How Money Really Does Grow On Trees' by Tony Juniper

Images of Bosco Verticale

Bosco Verticale Milan

2km of cantilevered balconies
Vertical square 0.7 km of forest
480 large and medium trees, 300 small trees, 11,000 perennial and covering plants and 5,000 shrubs. Many species

Drivers:

- Rebranding
- Brownfield regeneration
- Public health

The High Line, New York City, USA

Image of the High Line, NYC

Drivers:

- International advice –(☺)
- Multiple rationales for preservation
- Enlightened pressure group
- Inclusive economics arguments
- Persistence
- Monitoring

Image of the High Line, NYC

Images of the a green street with SuDS in Portland Oregon

City-wide SuDS, Portland, Oregon, USA

Drivers:

- Enlightened Local Authority - Policy
- Acceptance of inclusive economics arguments
- Global branding
- Public health

Brooklyn Grange Community Rooftop Farm, New York City, USA

Image of the Farm

Images of people cultivating the farm

Drivers:

- Grass routes group with knowledge
- Voluntary support
- Long-term sustainable economic model from outset
- Crowd and grant funding kickstart
- Leasehold
- > 20 tonnes of vegetables annually
- 17,000 children educated annually
- Global consultancy
- Profitable in year 3

Parkroyal Hotel on Pickering Avenue, Singapore
Woha Architects

Drivers:
• A celebratory response to national policy
• Unique selling point
• Platinum Green Mark

Images of the hotel facade

Images of the hotel

UNDERSTAND INCENTIVES AS SEEN BY OTHERS

Images of the supertrees

National branding and economics

e.g. Gardens by the Bay Singapore

- Attracting top talent (KPMG 2012)
- Tourism stimulus (Cianga & Popescu 2013)

Overall economic stimulation

e.g. Wild West End Initiative, London (2015)

Wild West End Logo

Focussed effects on trade footfall; e.g.

e.g. White City Green Wall, London, UK

Image of the green wall

RESPONSES?

- Further encourage the phenomenon & enthusiasm
- Push limits to create exemplars
- Monitor to learn

Developers of all kinds with an interest in securing planning consent

Image of Donald Trump

RESPONSES?

- *Traditional tools of legal agreements and conditions*
- *Remember that it does not require long-term buy in, belief or understanding*
- *So potentially reversible when the pressure is gone and authority no longer monitoring*
- *Work in association with long-term stakeholders to police the retention and maintenance of nature*

Public bodies with a societal duty of care and concern for public approbation

Image of a green street retrofit

RESPONSES?

- *Consultant and LA should 'rehearse' the policy base – mutual reinforcement*
- *Public involvement and education on inclusive benefits*
- *Think of public perception impact in all design for biodiversity, market research*
- *Work in association with long-term stakeholders*
- *Build electoral support*

Above: Paddington Green and Church Street GI retrofit, London, UK. Below. Jardins de Nantes, France

Image of playful topiary

ADDRESS OBJECTIONS & BARRIERS

Professional limitations

Architect

“ The consequence of all of this (emphasis on ecology and environment) has been that minimizing one's impact on the environment has replaced the traditional architectural aspiration to maximise one's impact…such is the current level of self-doubt in the West, that architects, traditionally renowned for making bold statements, are now marketing themselves on how small an impact they can make on the world…”

Ecologist

“We should focus on re-building real habitats in the countryside – fully functional ecosystems…why waste our time in cities?”

RESPONSES?

- Interdisciplinary education, learning and exchange!
- Syllabus change
- Speak from knowledge and passion

Cognitive Bias

If the knowledge around benefits and co-benefits of urban natural spaces is not part of the normative agenda, they may be perceived as containing merely aesthetical value which can be hard to define against more hard-core value like economic incentives or housing needs. This represents a cognitive bias in the sense that a common position has been shaped by a long-term neoliberalistic tradition …

Bosch and Nieuwenhuijsen (2017) revisiting Kahneman et al. 1991“

RESPONSES?

- Syllabus changes
- Institutional enlightenment
- Interdisciplinary events and outreach
- More examples and exemplars
- Study tours

Profit requirements

Developer interest
to maximise GFA and
traditional investor return (20-30%) with complaints of overpriced land & saturated markets!

RESPONSES?

- Public private partnerships and cost/uplift sharing
- Accessible vegetated architecture to increase accessible greenspace over footprint; not ‘out of sight, out of mind’
- Policy changes to require inclusive accounting (EsS)
- Incentives from local or central government (!)
- Client conversion to true belief in value uplift of GI (challenge normative cognitive bias)

Budgetary Constraints (LA and Developer)

RESPONSES?

- Public-private partnerships and cost/uplift sharing
- Long-term finance: e.g. Professionally built Private Rental Sector
- Overseas investment if properly controlled
- Changes to central government policy emphasis (!)
- True inclusive accounting of Urban Ecosystem Services
- Cost-efficiency on health and crime reduction
- New management models and incentives for public involvement
- Revisiting Community Infrastructure Levy
- Ring-fenced funding by Local Authorities: Duty to Maintain?
- Involve charities e.g, Land Trust, Trust for Urban Ecology etc.
- Leverage landscape citizen science, crowd funding
- Bio-products e.g. Croyden biofuels give financial return

Private owner's mistrust of public involvement

RESPONSES?

- Go to see good examples and potential scale of benefit e.g. London Wetland Centre
- Build industry for guidance/galvanising groups
- Use environmental charities and their expertise

Biophobia!

Image of *Segestria florentina*

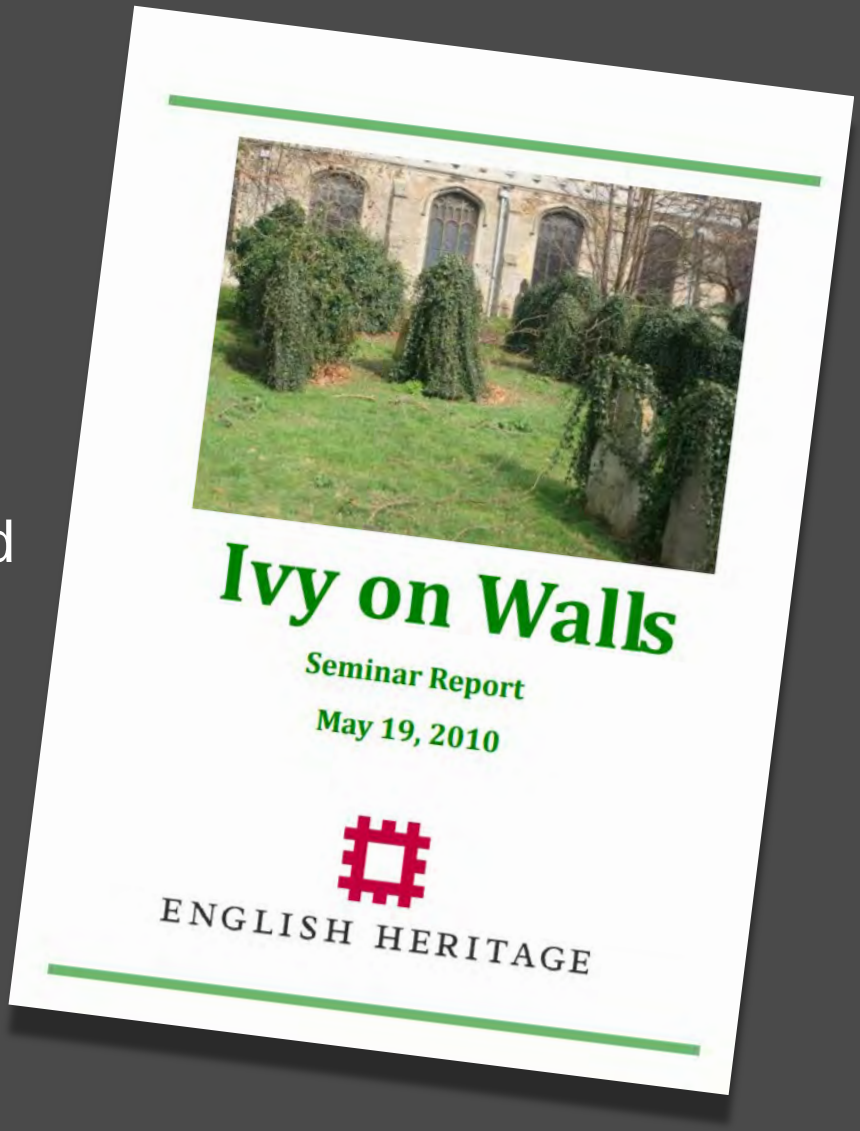
RESPONSES?

- Realistic assessment of risk
- Knowledge of biodiversity effects on single pest plague risk
- Wonder, fun and iconography to replace fear
- Note that *biophobia* is actually supporting evidence for *biophilia,* not a challenge to it (Ulrich)

Fears of damage to property

RESPONSES?

- All to be properly informed and up to date - balanced view including the latest protective technologies
- Sound advice early in the design process to avoid conflicts



Health and safety and privacy fears

Image of School

RESPONSES?

Sharrow School Sheffield

- *Ecologist to understand real statistical risk levels*
- *Comparisons with nearby natural hazards & urban conditions*
- *Tours… to see best practice working examples*
- *Accreditation e.g. BREEAM and government targets (dropped)*
- *Shared liabilities*
- *Management & monitoring*
- *Persistence! e.g. Sharrow School Sheffield*

Risks to wildlife

RESPONSES?

- *Latest technologies*
- *Early advice and input to cost plan*
- *Government subsidy or regulation*

THE FUTURE: OPTIMISATION

Green Design from Theory to Practice (2011)

- *Holistic approaches & definitions of urban nature*
- *Setting targets and metrics and monitoring*
- *Galvanise and involve the public at a time of reducing finance*

European Commission Horizon 2020 Nature Based Solutions NBS (2015)

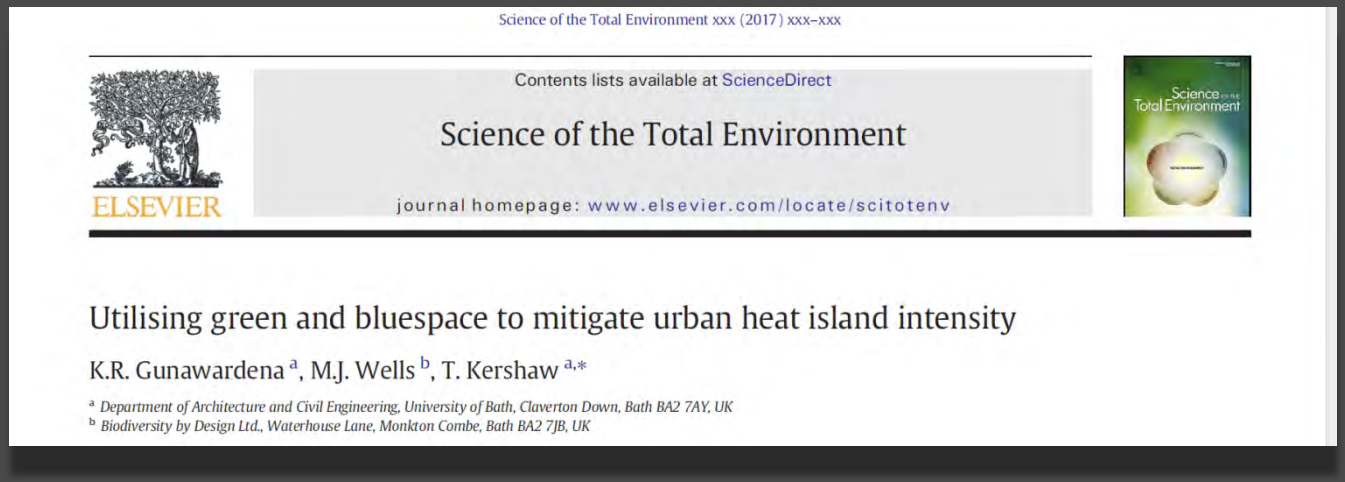
Key areas for future optimisation

- NBS and regeneration
- NBS and health and wellbeing
- NBS based insurance value
- Water sensitive design
- Thermoregulation
- Bio-products
- Coastal resilience
- Carbon sequestration

Optimising ecosystem services and trade-offs

We need to:

- *Better define our ECOLOGICAL goals in MULTIDISCIPLINARY words e.g. 'NET-POSITIVE, OPTIMISED, HOLISTIC, MULTIFUNCTIONAL, INCLUSIVE ECOLOGICAL DESIGN?'*
- *Go beyond single effect analyses to multi-variate modelling to inform masterplans, buildings etc.*
- *Include qualitative of semi-quantitative proxies for biophilic effects alongside traditionally measured physical and biotic variables*
- *Keep up to date and be open to counter-intuitive findings*



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Utilising green and bluespace to mitigate urban heat island intensity

K.R. Gunawardena [a], M.J. Wells [b], T. Kershaw [a,*]

[a] Department of Architecture and Civil Engineering, University of Bath, Claverton Down, Bath BA2 7AY, UK
[b] Biodiversity by Design Ltd., Waterhouse Lane, Monkton Combe, Bath BA2 7JB, UK

When we have mainstreamed biodiversity into future biophilic cities we should be able to MEASURE:

- *How much we care about GLOBAL NATURE and are prepared to fight for its preservation*
- *How HAPPY AND HEALTHY we are living in compact high density environments*
- *What is the distribution of species including innately important /UNCOMMON SPECIES*
- *How has the mainstreaming affected, URBAN METABOLISM e.g. flood risk, Urban Heat Island etc.*
- *And so much more!*

See THE NATURE OF CITIES website