Non-acoustic effects of "greenery" as input to economic analyses

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HOSANNA: Holistic and sustainable abatement of noise by optimized combinations of natural and artificial means

Trees, bushes and shrubs, surface treatments, roughened surfaces, repeating structures, low barriers, facade design, green walls, berms, porous materials, recycling. Sound indicators suitable for quiet areas.

November 2009 – 2012: Led by Chalmers: Jens Forssén. Approx 5 mill €.

Opportunities for '*surface treatments*' include

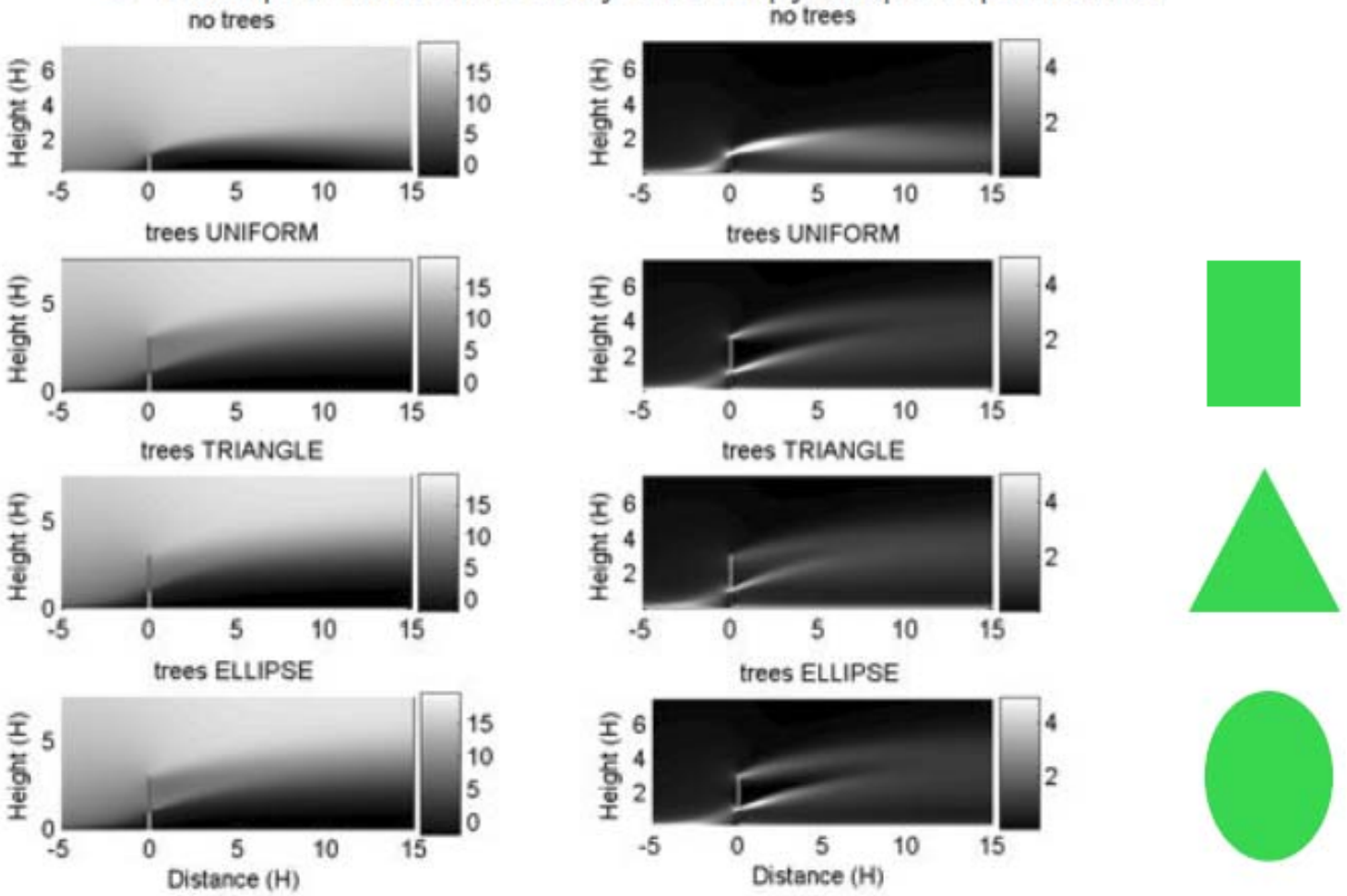
- Embankments
- Roadside verges and central reservations
- Plantings
- Open spaces
- Façades and Roof tops

- *hard surface treatments*
  - random roughness; bumps and/or depressions
  - periodic ridges and/or grooves - diffraction gratings
  - parallel low walls
  - buried resonant arrays, sonic crystals
  - buried resonators
  - addition of porous materials

- *soft surface treatments* (cultivation and planting)

- *optimised combinations of these treatments*
  - 'tuned' ground effect.

- **Improving microclimatology by vegetation (3.3)**
  - Example : numerical study on canopy shape : optimisation



Numerical evaluation of tree canopy shape near noise barriers to improve downwind shielding, T. Van Renterghem, D. Botteldooren

Soundscape improvement policies

- **Deployment of sound- or urbscaping elements (roofs, walls, barriers, greenery) can be analysed either alone or as part of a ”package” using CBA**
- **When are benefits larger than the costs?**

BRADFORD CONTRIBUTION

Confining economic analysis to acoustic benefits is limiting:

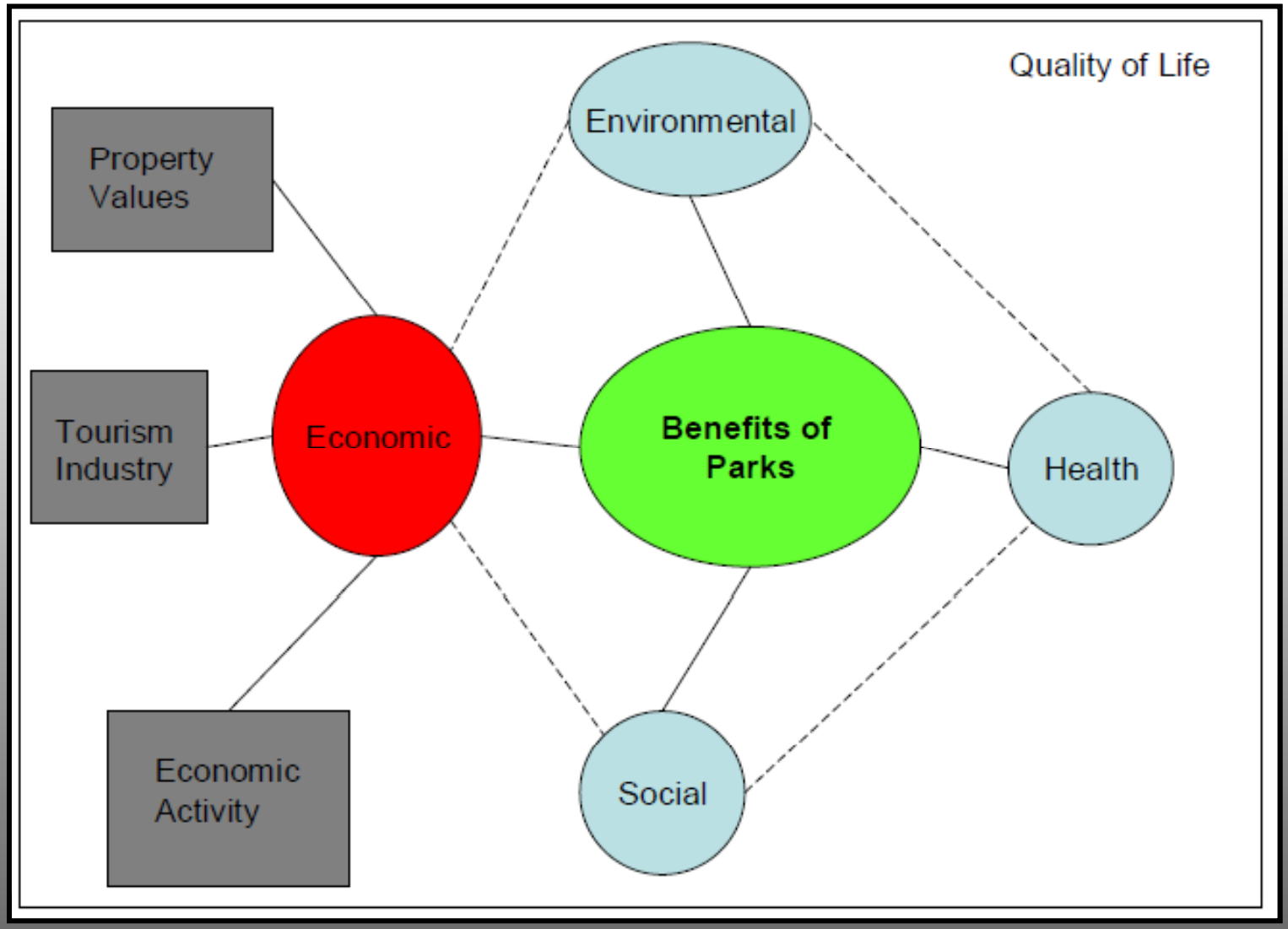
- Additional effects that need to be explored:

- Aesthetic
- Recreational
- Recuperative
- Thermal comfort
- Air pollution
- GHG sequestering, GHG uptake
- Urban heat islands
- Insulation/Energy usage
- Water run-off
- Biodiversity

Economic unit values of urban greenery

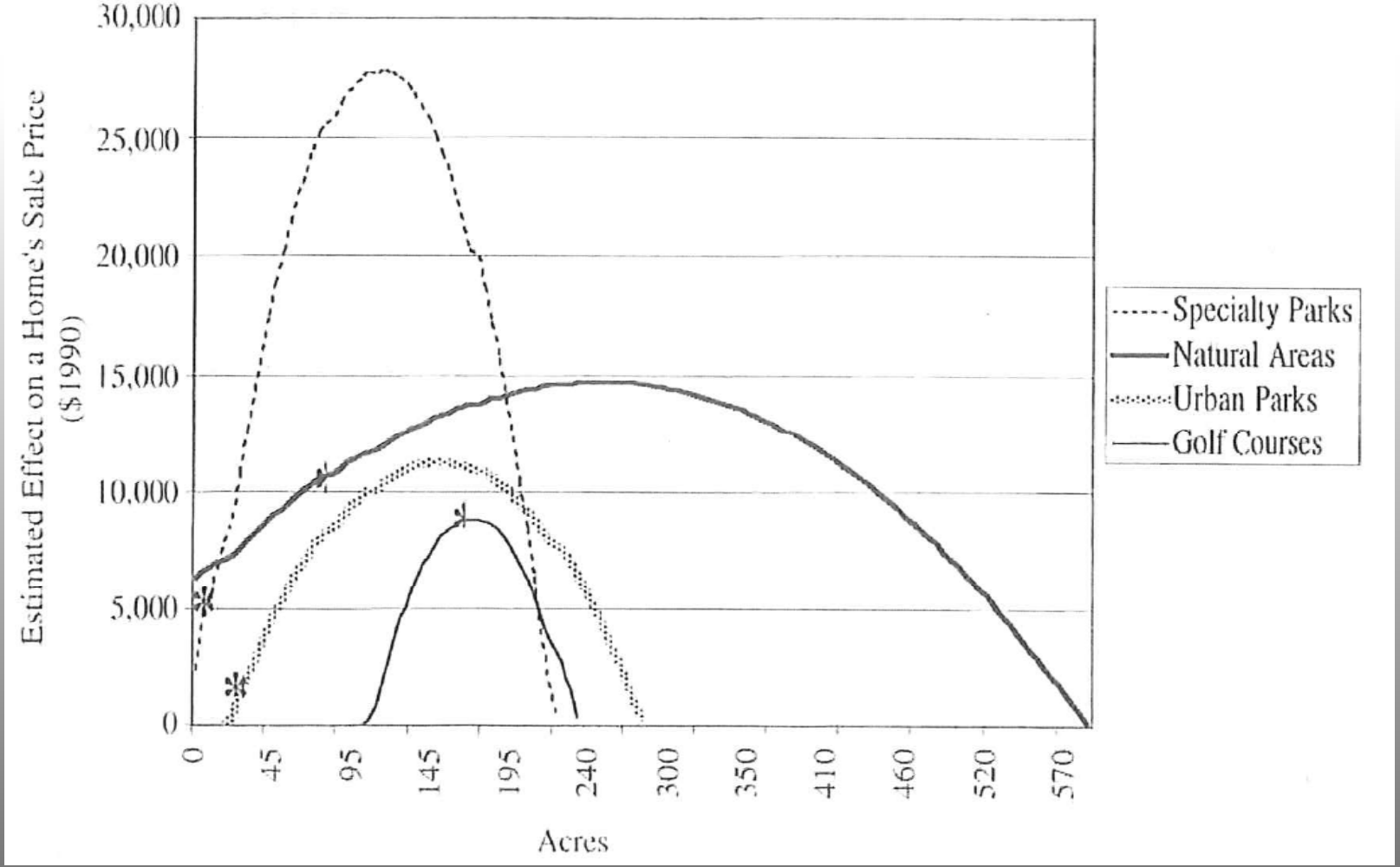
- Aesthetic and recreational and recuparative/restoration values not available as unit values
- Many case-based valuations of urban greenery exist, primarily hedonic pricing studies for the effect on property values
- TOI is making a literature survey, collating value estimates for green roofs/walls, trees, parks, and attempting to convert these into coarse unit values

Parks and Open Spaces



Mapping the Benefits of Parks (Edwards, K. M., 2007)

Proximity to different types of open spaces



Open Space Acerage and Home Sale Price (Lutzenhiser et al. 2001)

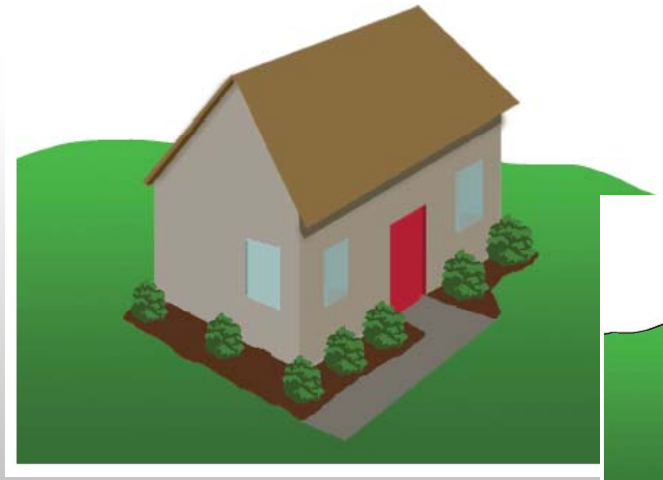
Landscape Plants and Design Matter

Importance rank	Landscape aspect	% of value added to home
1	Design sophistication	42
2	Plant size	36
3	Diversity of plant material type	22

Survey results with the ranking of landscape aspects and the percent value that these aspects added to the home value (Niemiera and Horticulturist, 2009)

Landscape Plants and Design Matter

Design sophistication



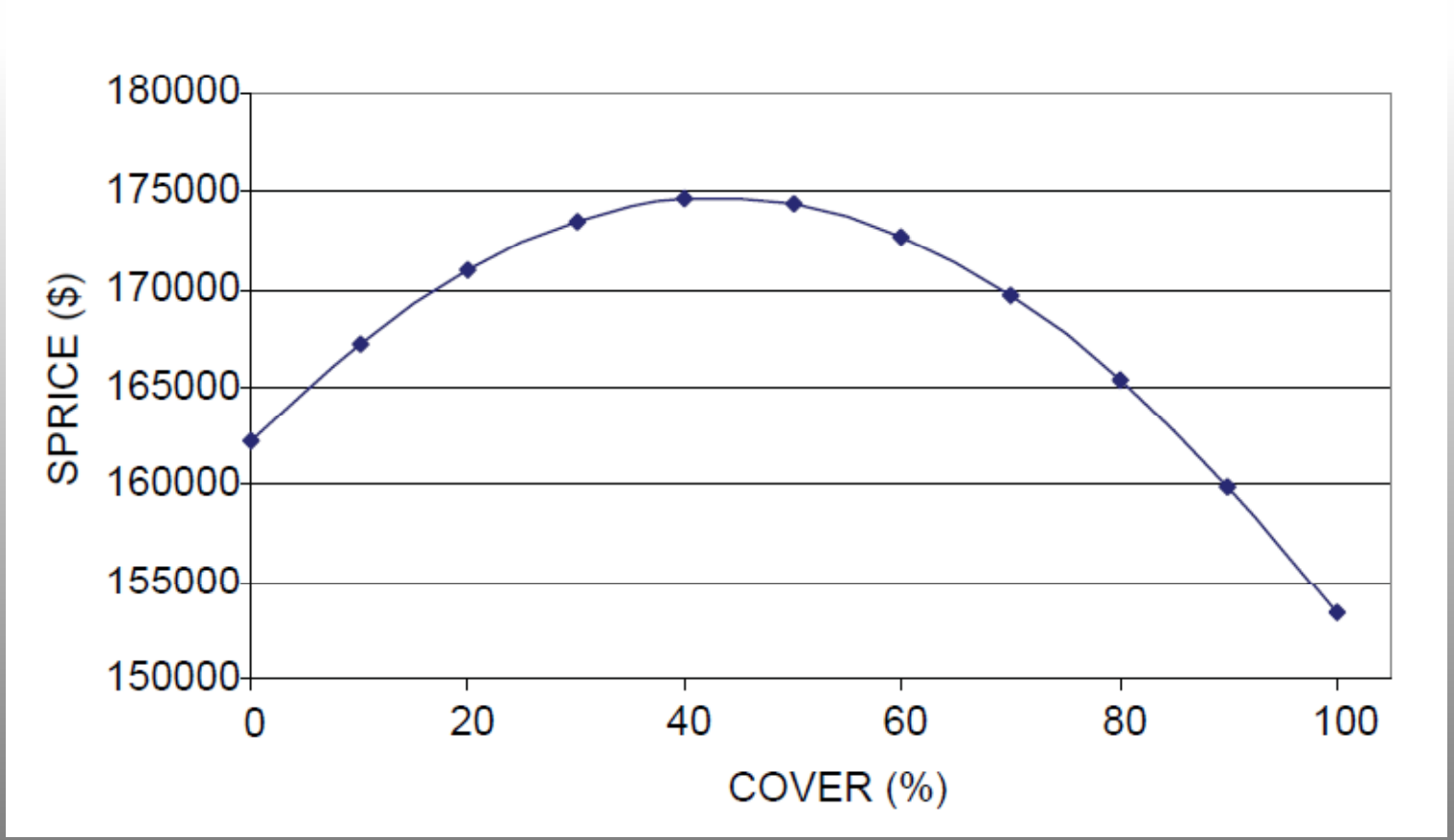
Foundation planting only.

Foundation planting with one large, oblong island planting and one or two single specimen or shade trees in the lawn

Design Sophistication Level 3: a foundation planting with adjoining beds and two or three large island plantings, all incorporating curved bedlines.

Relatively large landscape expenditures significantly increased perceived home value and will result in a higher selling price than homes with a minimal landscape.

A graph of the quadratic relation between house price and tree cover is shown in Fig. 1 for the *average Melonie Park house with 2,681 square feet, a single* story, two exterior features, 85 days on the market, and a landscape evaluation score of good.



House sales price and tree cover percentage (Stigarll and Elam, 2009)

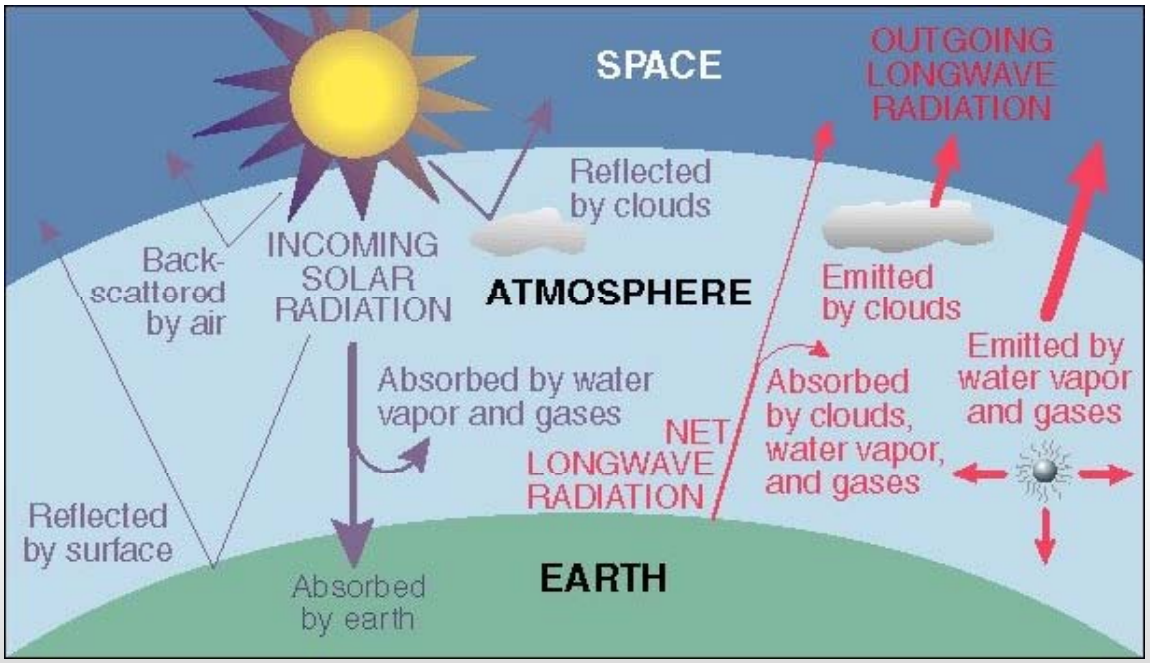
Economic unit values of urban greenery

- Unit value estimates can ...
  - be applied in exploratory CBA of vegetation measures, and
  - potentially serve as point of departure for meta-analysis of economic valuation of urban greenery (green roofs/walls, trees, parks)

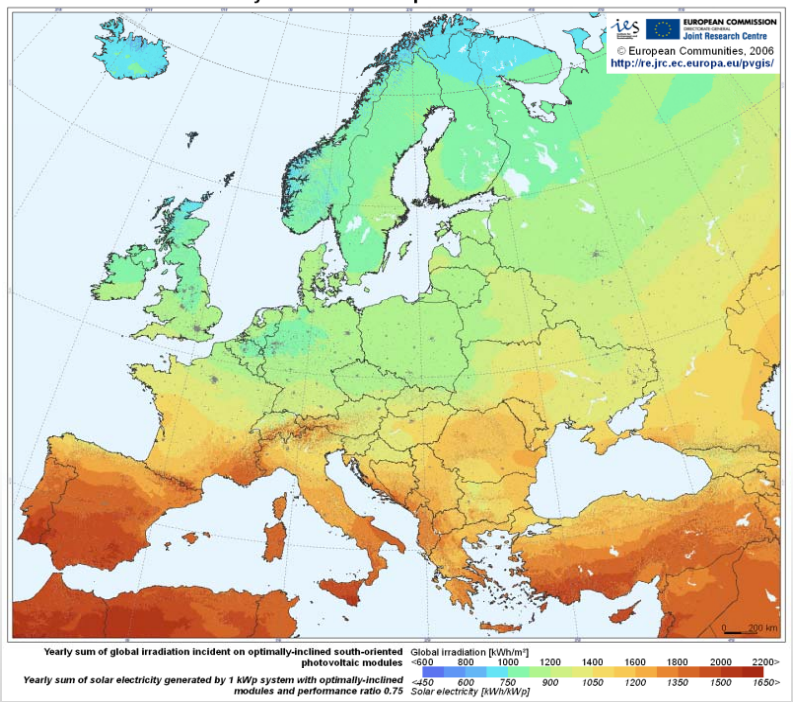
Restoration – qualitative research

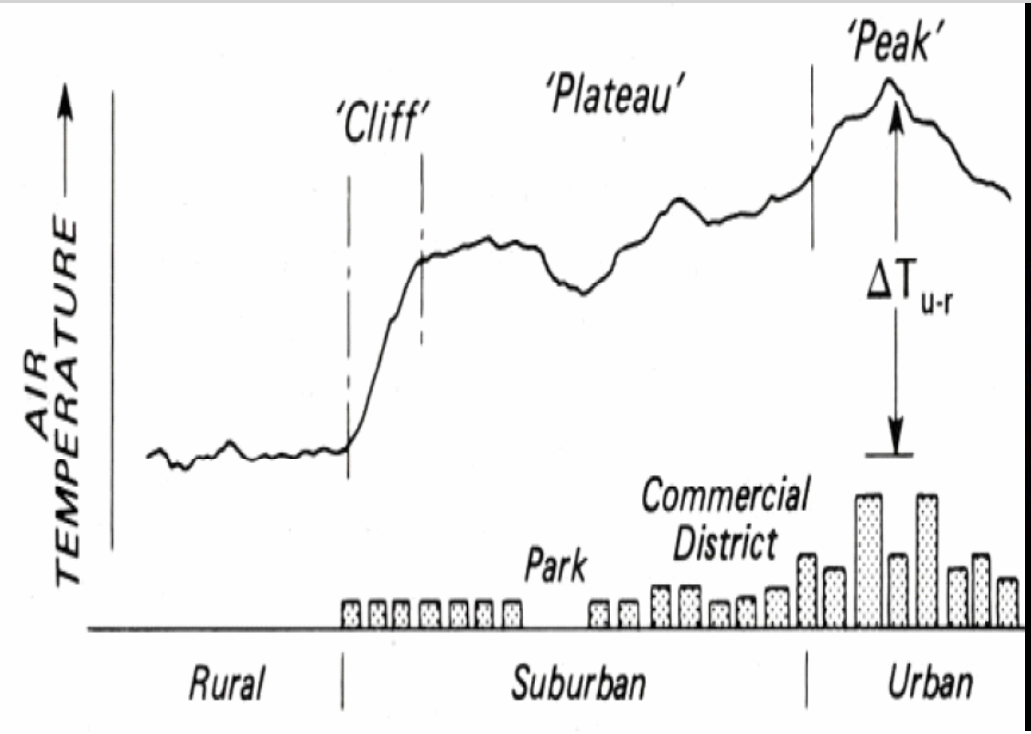
More generally, our study contributes to the now far-reaching discussion of therapeutic landscapes. As Williams (2007, p. 9) observed in her anthology on the topic, "there is a growing interest in studying sites that provide respite from the quick-paced, stressful lifestyle characteristics of the Western world". Such studies can benefit from a reading of restorative environments theory, which can help to characterize such sites not only negatively (e.g., not quick-paced), but also in positive terms (e.g., fascinating) (Hartig, 2007). Beyond providing psychological grounds for such classical themes as the therapeutic value of nature experiences for urban residents (e.g., Gesler, 1992), the restorative environments literature supports a discussion of how people use particular places to maintain their psychological well-being (e.g., Korpela et al., 2008)

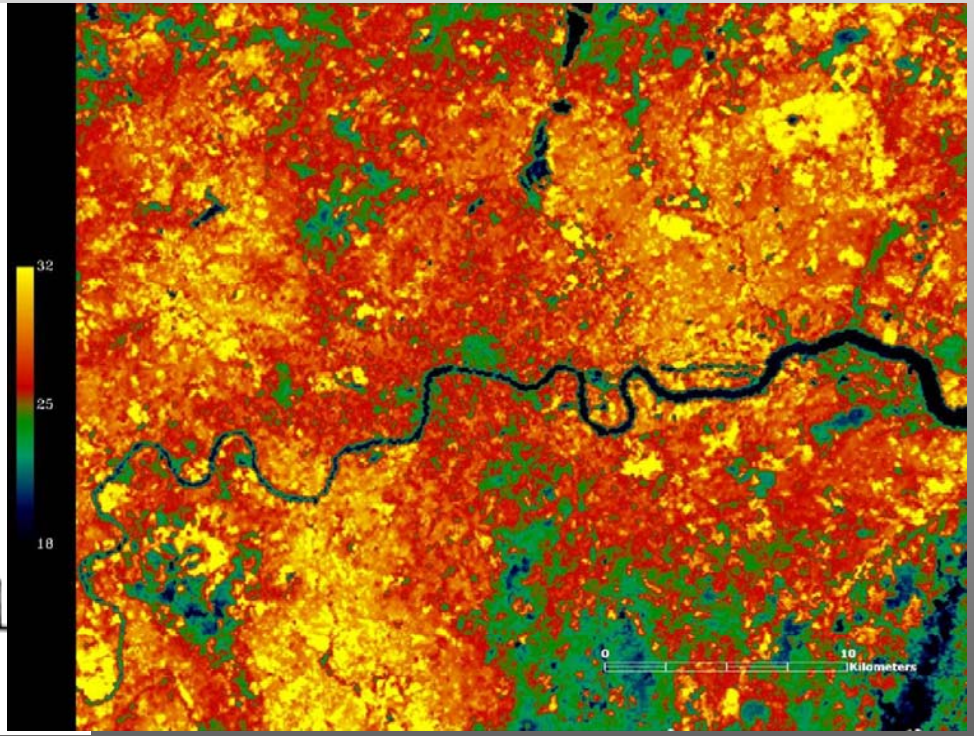
Hug S & al.2009 on restorative places

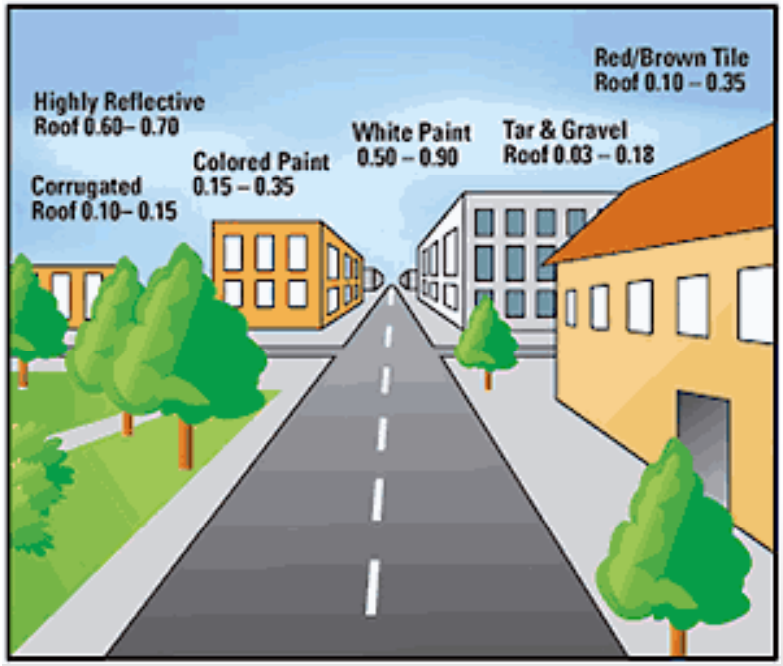


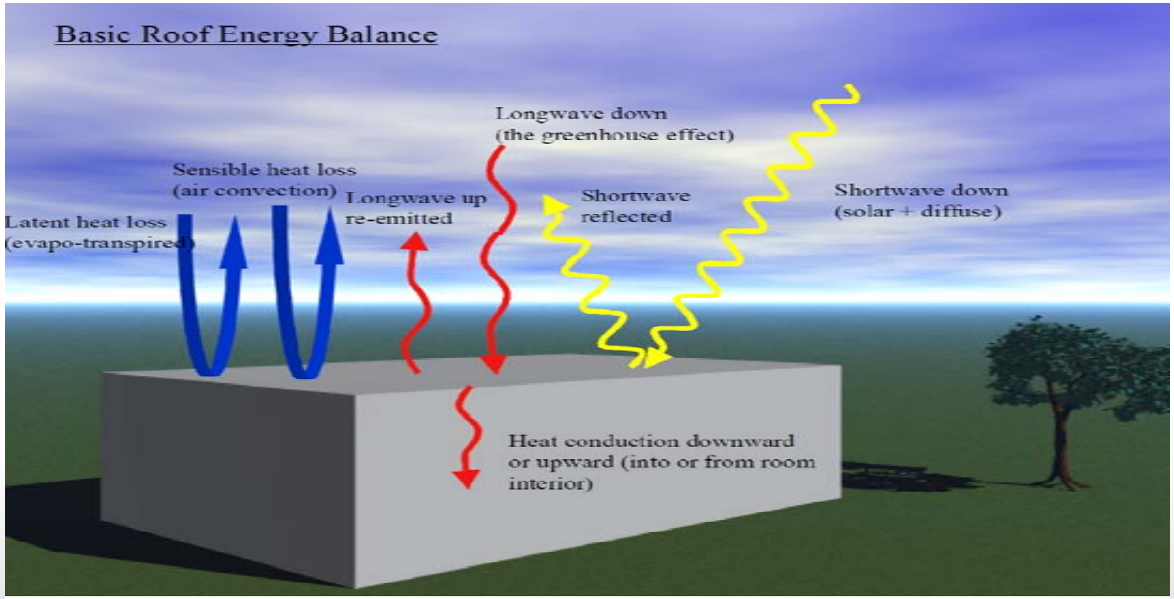
Photovoltaic Solar Electricity Potential in European Countries

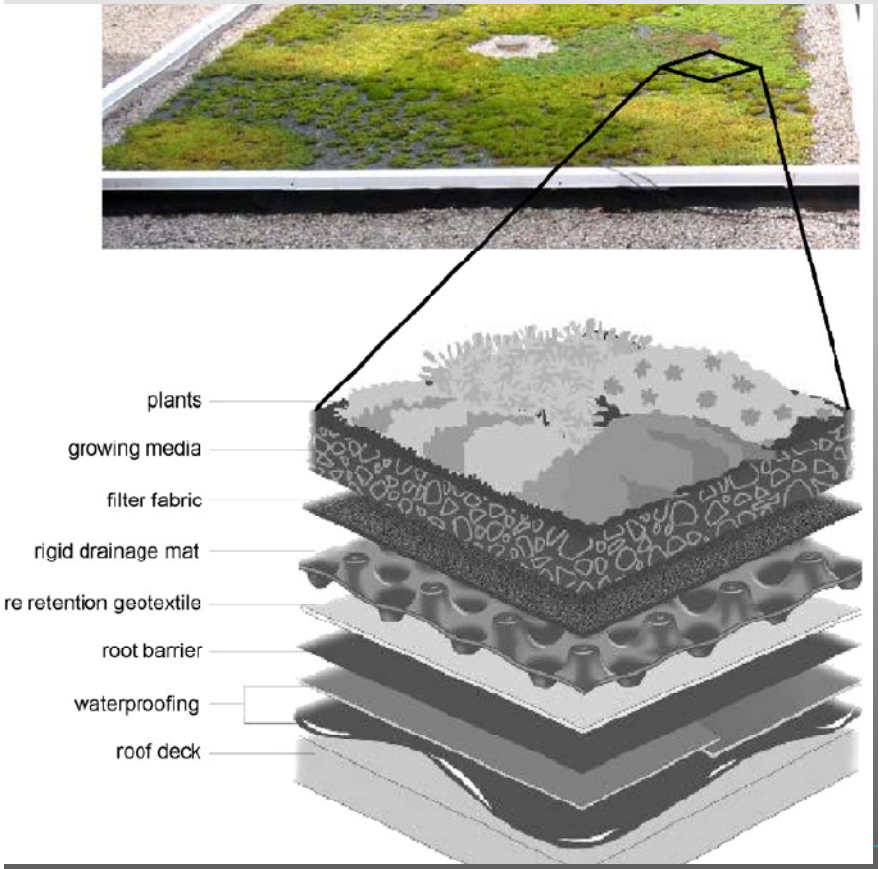


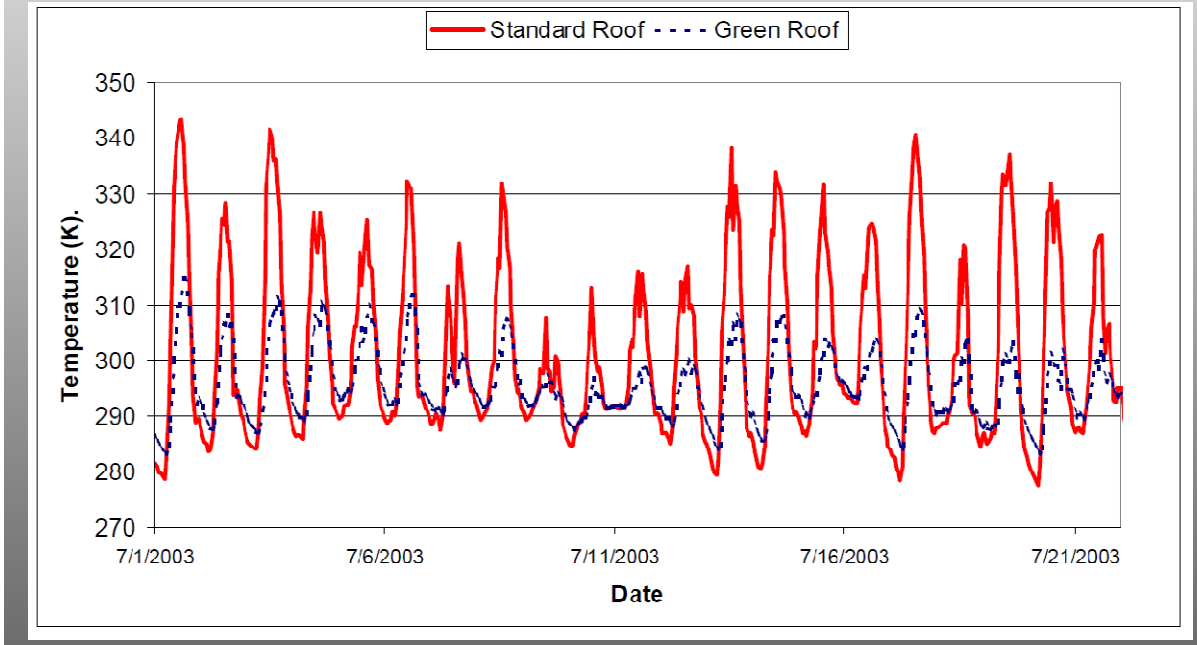






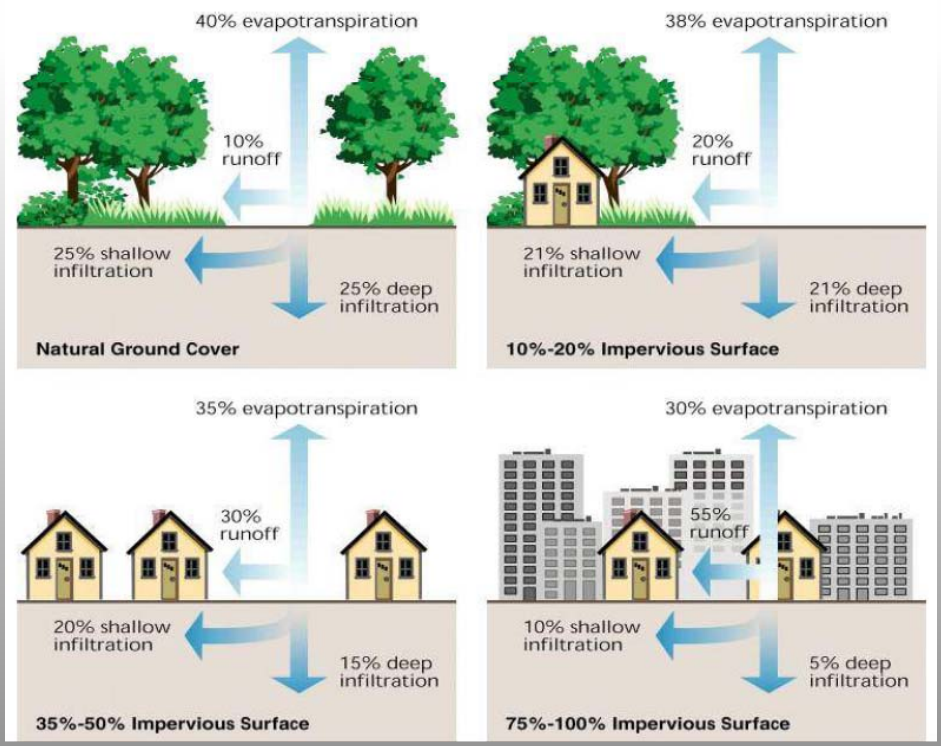


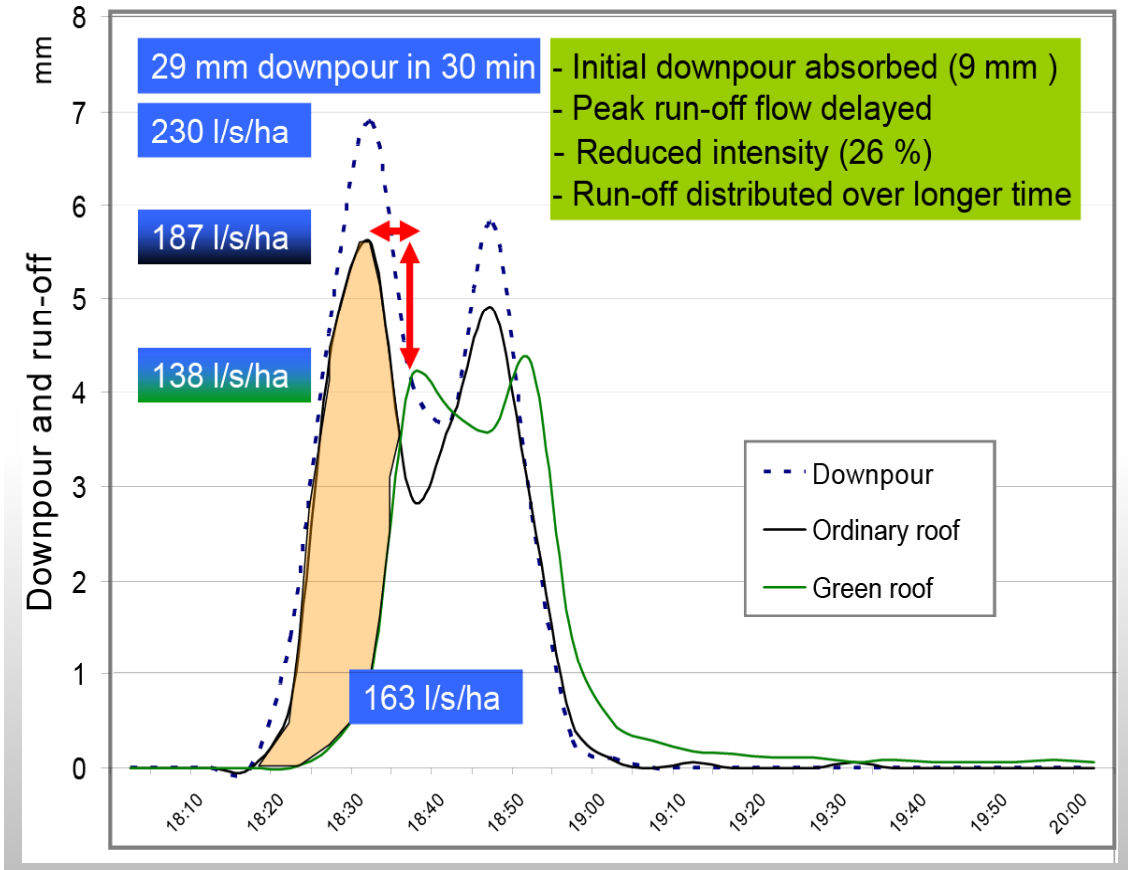


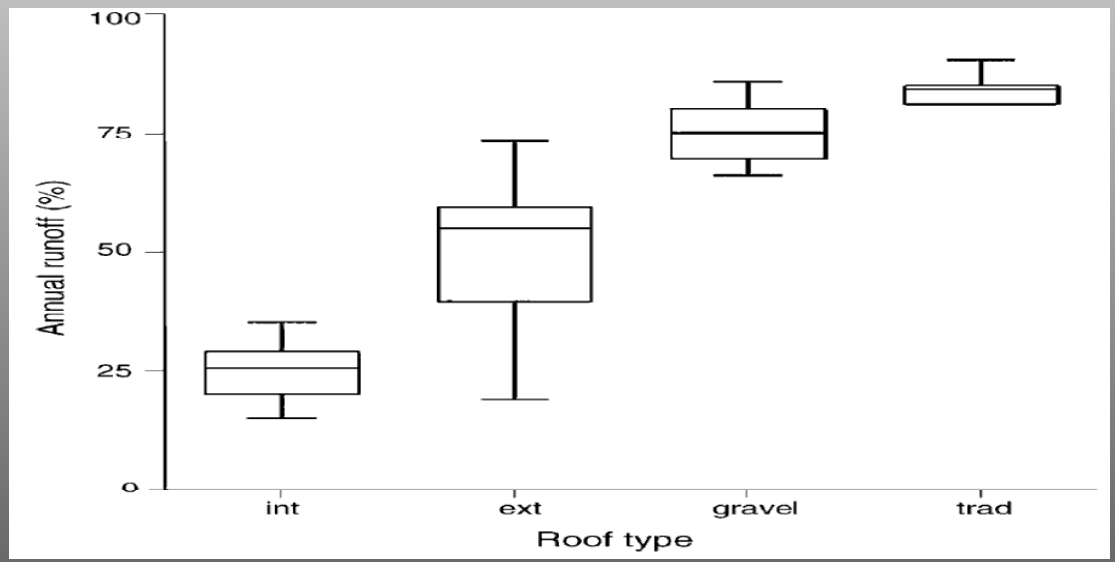


(Mentens, Raes et al. 2006)

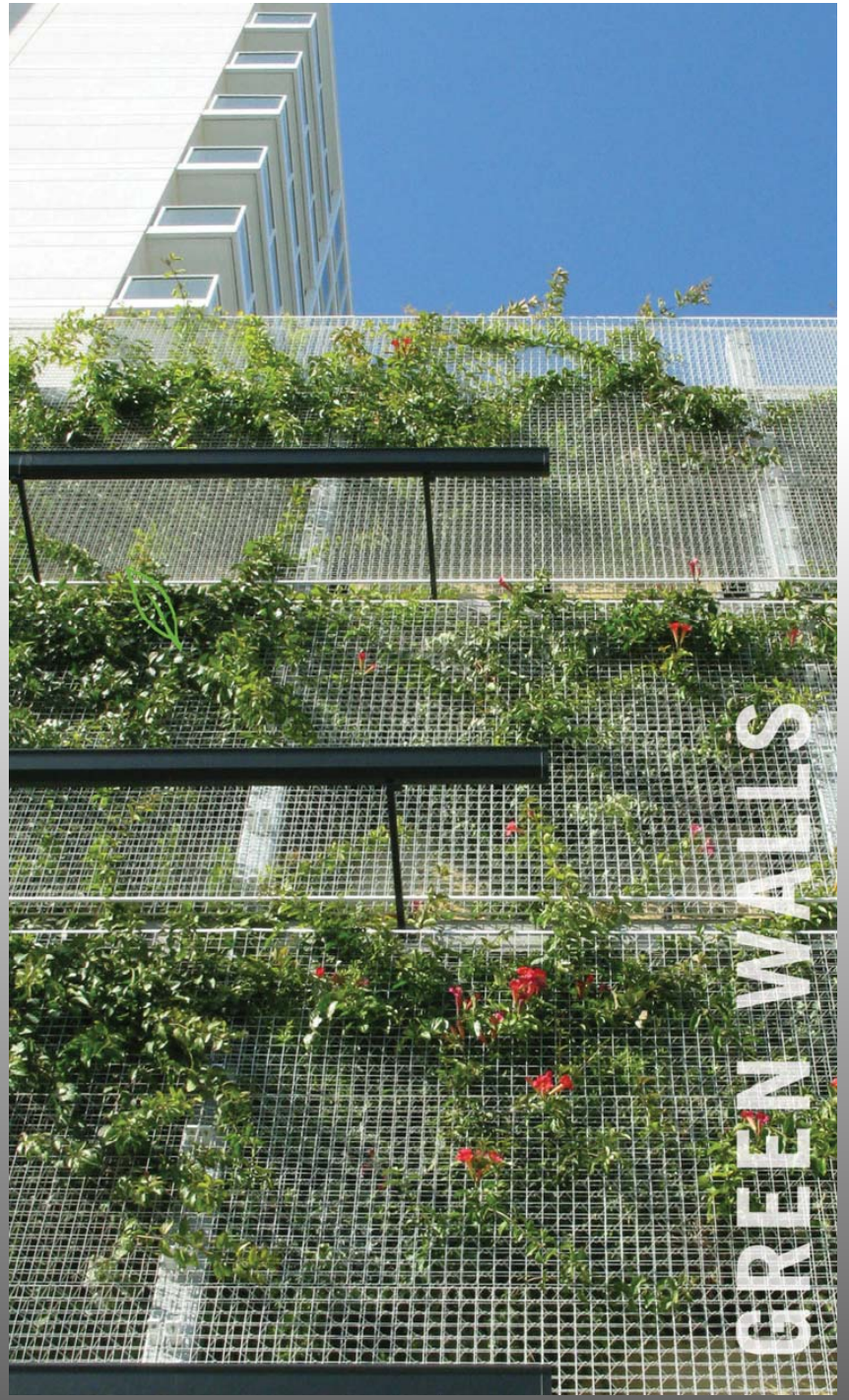
Water run offs





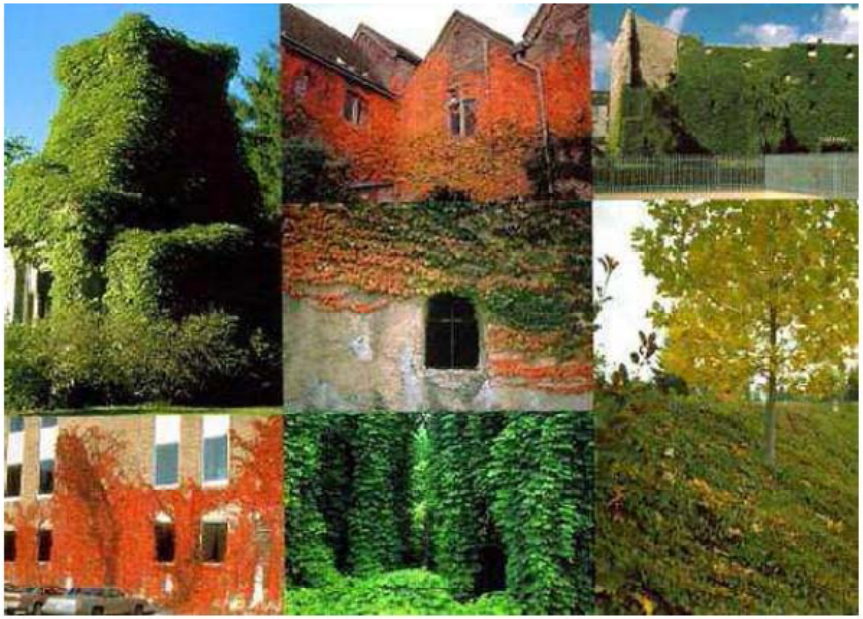


Green Walls



Above: Winter and Spring views of a living wall installation benefiting from a careful selection of plant varieties. Source: Randy Sharp

The following montage of photos shows a variety of green walls in different seasons, illustrating a wide range of color and texture.



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Appendix III. Relative Tree Effects

The urban forest in Chicago provides benefits that include carbon storage and sequestration, and air pollutant removal. To estimate a relative value of these benefits, tree benefits were compared to estimates of average carbon emissions in the city[20], average passenger automobile emissions[21], and average household emissions.[22]

General tree information:
Average tree diameter (d.b.h.) = 7.7 in.
Median tree diameter (d.b.h.) = 4.3 in.
Average number of trees per person = 1.3
Number of trees sampled = 1,697
Number of species sampled = 103

Average tree effects by tree diameter:

D.b.h.	Carbon storage			Carbon sequestration			Pollution removal	
Class (inch)	(lbs)	($)	(miles) [a]	(lbs/yr)	($/yr)	(miles)[a]	(lbs)	($)
1-3	6	0.06	20	1.8	0.02	6	0.05	0.17
3-6	37	0.38	130	5.5	0.06	20	0.2	0.60
6-9	127	1.32	470	10.9	0.11	40	0.4	1.56
9-12	304	3.15	1,110	17.6	0.18	65	0.7	2.65
12-15	538	5.56	1,970	23.8	0.25	87	1.1	3.99
15-18	859	8.89	3,150	32.4	0.34	119	1.2	4.48
18-21	1,286	13.31	4,710	42.8	0.44	157	1.7	5.95
21-24	1,709	17.68	6,260	48.3	0.50	177	1.5	5.50
24-27	2,258	23.36	8,270	60.0	0.62	220	1.8	6.48
27-30	3,116	32.24	11,410	72.0	0.75	264	2.7	9.81
30+	5,160	53.38	18,900	95.7	0.99	350	2.7	9.86

[a] miles = number of automobile miles driven that produces emissions equivalent to tree effect

Oslo: Quiet areas chosen along waterways that also are important to protect for biodiversity