An aerial photograph of a city, likely Lahti, showing a dense urban area with a mix of residential and commercial buildings. In the background, several industrial smokestacks are visible, with thick white smoke rising into the sky, suggesting air pollution. The overall scene is somewhat hazy, with a greyish-blue sky.

Green city – what does it actually mean?"

Heikki Setälä

Department of Environmental Sciences

Lahti Environmental Campus

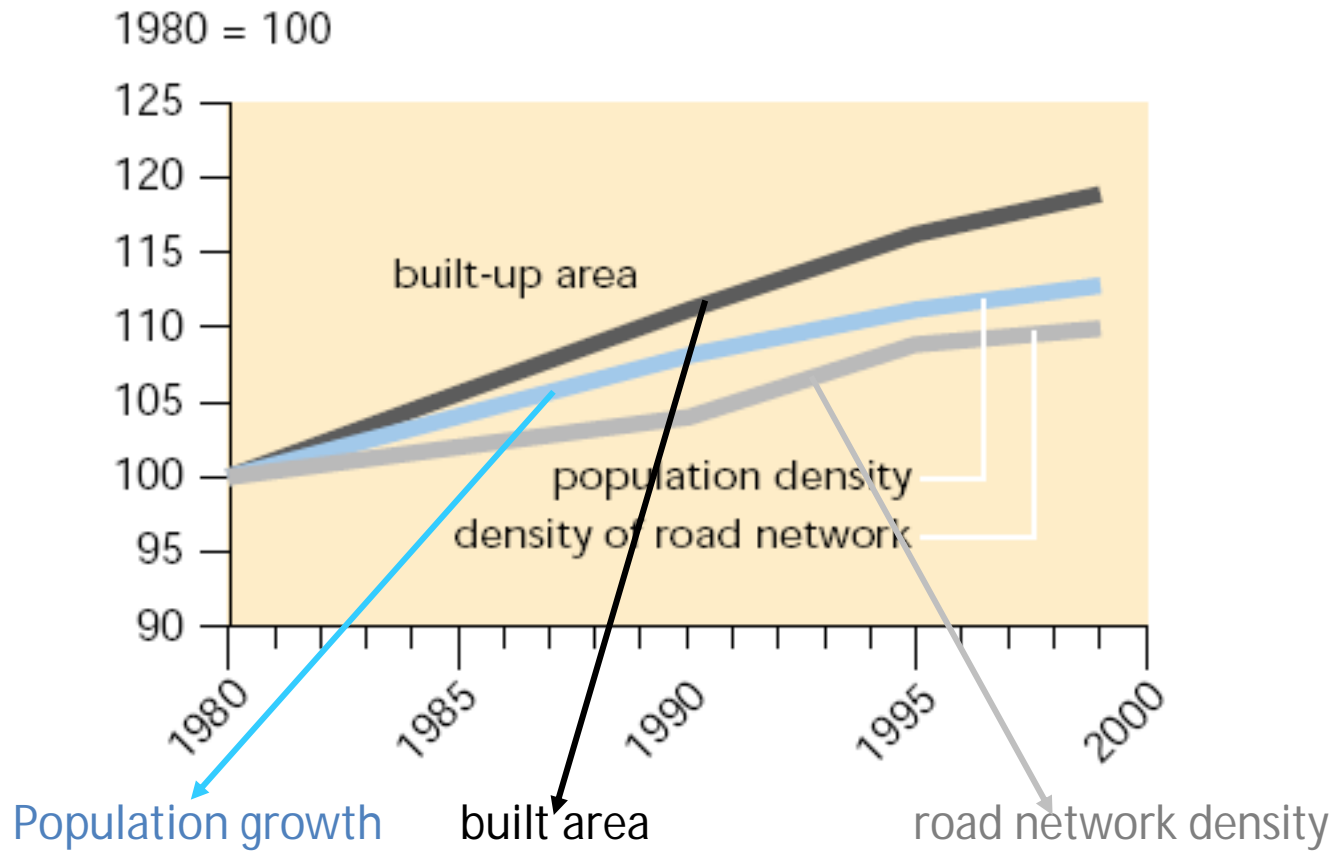
Some facts about urbanization ...

2 figures is enough ...

The World by night: NASA satellite image



LAND-USE IN EUROPEAN CITIES



URBAN SPRAWL

- 1) Non-controlled growth spreading from the urban core to the surroundings
- 2) Increases the total area of the city → longer commuting dist.
 - more consumption of fossil fuels (increased CO₂ emissions)
 - climate warming

 Actions to mitigate sprawl needed

COMMON PRACTISE → CONSOLIDATION OF CITIES

Common beliefs of consolidation ...

- 1) reduces traffic and cuts CO₂ emission
- 2) prevents/reduces the use of agricultural or natural sites → maintains scenery, biodiversity ..

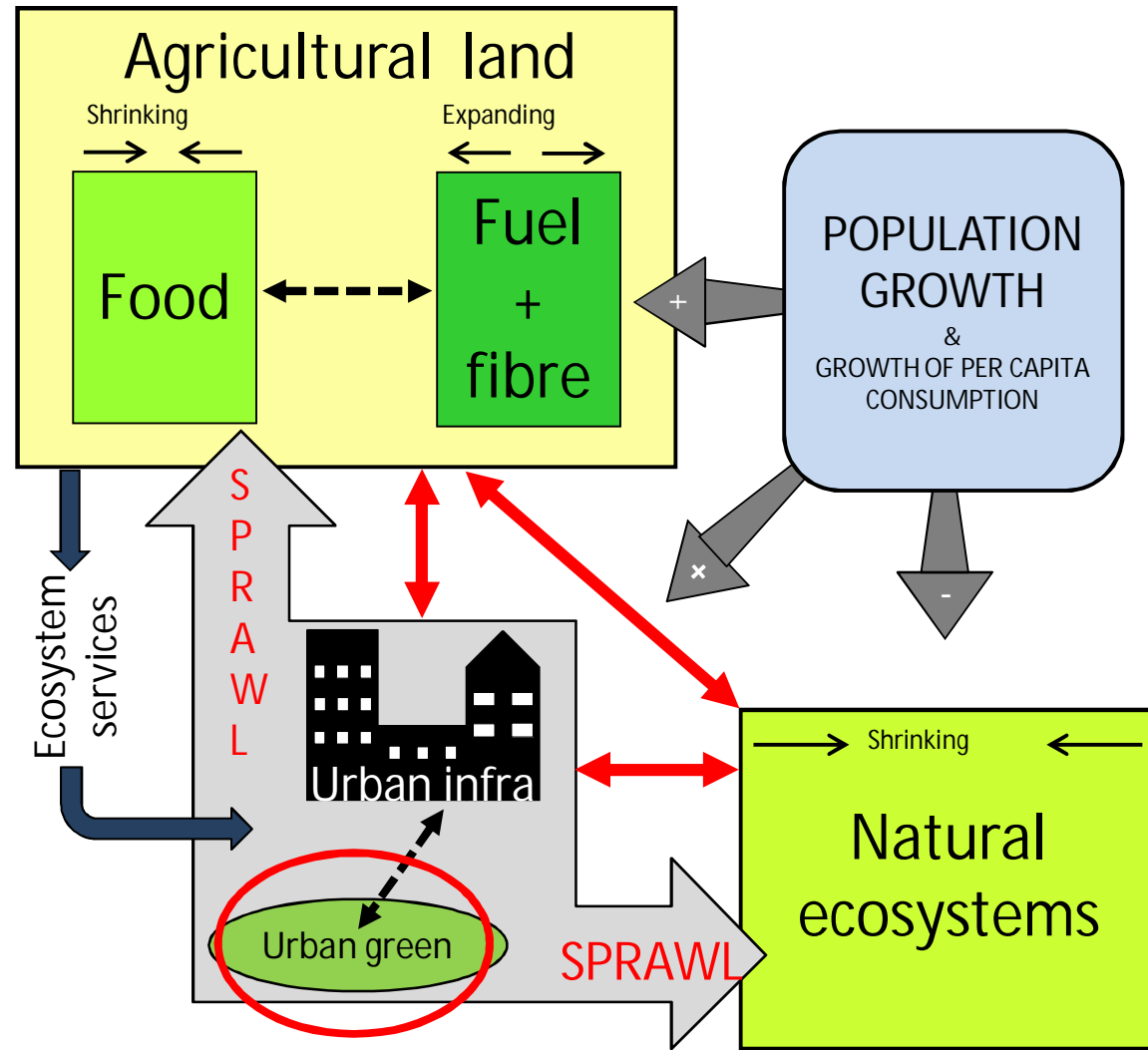
HOWEVER... problems?

Land/lots become utmost valuable → price tagging \$\$\$

Competition between urban green space and traditional urban land use → prognosis of the outcome not very "green"

→ Conflicts of interest between land use types

Conflicts (i) between \longleftrightarrow and (ii) within \longleftrightarrow land uses



Why to concern about **urban green**?

Setälä et al. 2011 (submitted)

Why to concern about urban green?

Answer: ECOSYSTEM SERVICES

Ecosystem services are goods and services that humans, either directly or indirectly, get from the living nature to sustain their life. Often irreplaceable.

- Food
- Fresh air and water
- Nutrient cycling
- Detoxification of harmful substances
- Pollination
- Flood control
- etc.

Services provided by
-vegetation
- pervious soils

URBAN AREAS?

ECOSYSTEM SERVICES IN URBAN SETTINGS

- Esthetics – traditional: the beauty of **urban green**
- Functional role (material cycles, purification processes)



Well-being of the citizens

An example:

Forests = lungs (oxygen production) and/or
kidneys and liver (purification/detoxification)

Urban green = esthetics + function →
sustainability of cities likely to link with the quality
and quantity of **urban green** →
urban **green space** is **valuable**

A tiny problem ...

Economists ... non-use value, no price tag for **green space**



Green space bound to loose in the
competition for land. "Money talks"



Or ... could the **urban green** be priced???

Valuing ecosystem services is not a novel idea:

The first rehearsal by Costanza 1997 (Nature, Vol. 387):
Ecosystem services on this planet equals 33 trillion US\$/y
(trillion = thousand billion = 1000 000 000 000)

Perhaps monetarizing urban green is not that bad idea?

Some attempts in USA and China ...

Giving a price to an ecosystem service is tedious

Some methods ...

(a) Replacement cost method:

for example replace the costly technology to purify air by letting trees to remove pollution

(b) Avoided cost method:

for e.g. costs avoided via alleviation of storm water -induced problems, based on calculating the costs of building conventional 'hard' structures for storm water management (underground pipeline network etc.).

(c) Hedonic pricing:

Most commonly applied to variations in housing prices that reflect the value of local environmental attributes.

(d) Willingness to pay:

peoples willingness to pay for a "price of access to a site" (such as a park).

Average value US\$/ha/y (2008) of services provided by green space in urban areas in USA and China

SERVICE	AVERAGE VALUE US\$/ha/y	RANGE #
Air quality regulation	602 (n=9)	56 - 1 958
Carbon sequestration	367 (n=5)	54 - 653
Carbon storage	2 906 (n=3)	1 783 - 4 815
Stormwater reduction	857 (n=6)	572 - 2 362
Energy savings	1 313 (n=34)	321 - 1 774
Recreation & amenity	5 882 (n=2)	1 984 - 9 780
Health effects	17 548 (n=1)	na

Elmqvist, Setälä, deGroot & Handel
(almost submitted)

Metrics and **monetary values** of some ecosystem services in two cities – Washington DC and Modesto, USA.

Yearly sums

	WASHINGTON DC		MODESTO Ca	
	/ ha urban green	/entire city	/ ha urban green	/ entire city
Pollution removal	118 kg (211\$)	2.5 mill.\$	210 kg (2551\$)	1.5 mill.\$
C sequestration	3,5 tn (766\$)	2.9 mill.\$	18,4 tn (763\$)	0.5 mill. \$
C storage	115 tn (2488\$)	9.7 mill.\$	-	-
Energy savings	6,2 MWh (676 \$)	8.5 mill.\$	16,8 MWh (1457\$)	0.91 mill.\$
Stormwater red.	-	-	390 m ³ (1033\$)	0.69 mill.\$

Elmqvist, Setälä, deGroot & Handel (to be submitted)

Note: savings due to health and money spent on recreation not included

City of Philadelphia, USA: Public parks worth of over 1 billion US\$/year

I: use of free parks for recreation (instead of having to purchase them) → 1 bill. US\$

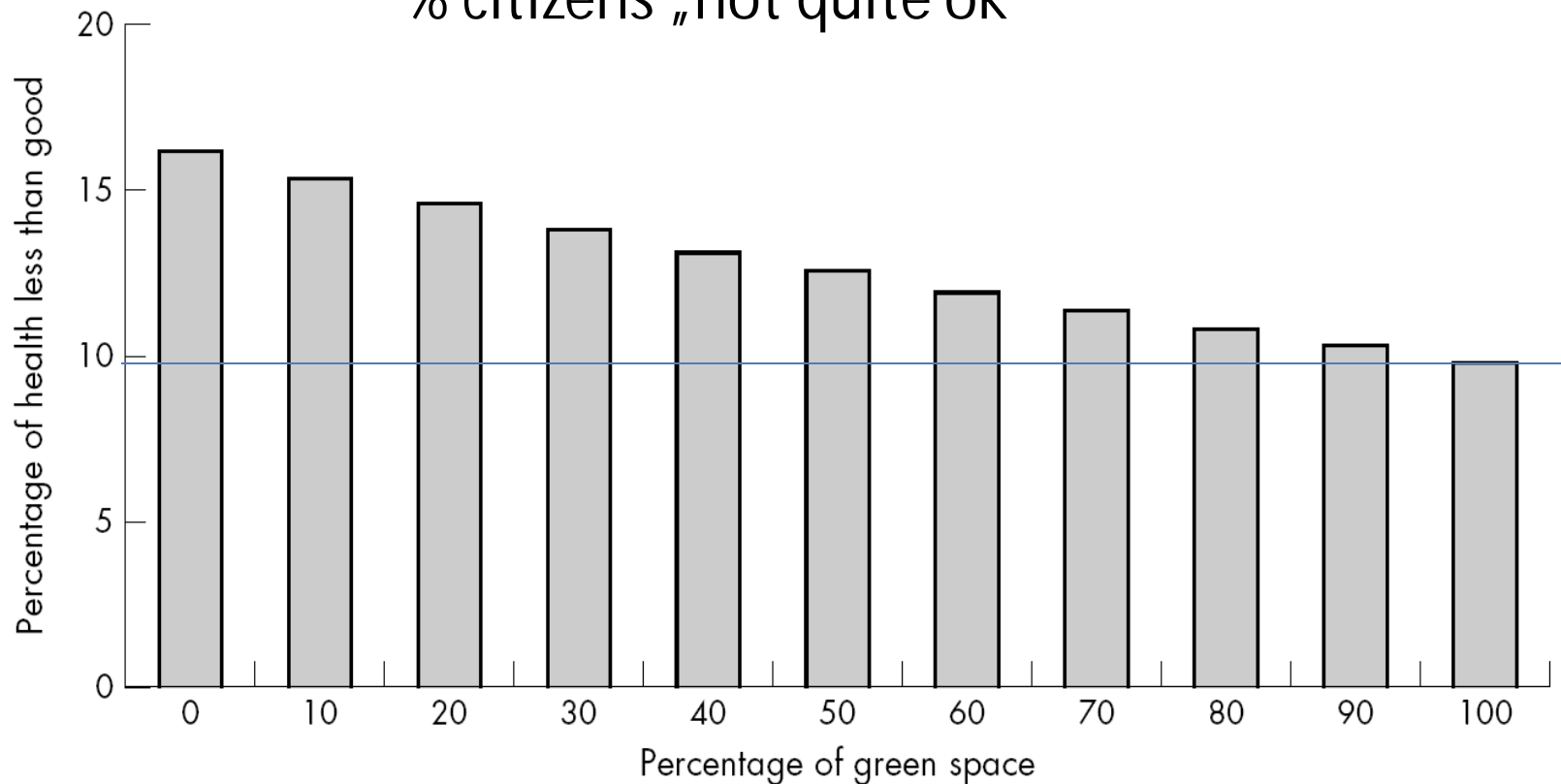
II: Health benefits; savings in medical costs
→ 69, 4 mill. US\$ (physical & psychological)

III: Savings due to "ecology":

- retention of rainfall (cutting cost of treating stormwater)
→ 5.9 million US\$
- removal of air pollutants → 1. 5 million US\$

Health benefits

relation between % of urban green space and
% citizens „not quite ok“

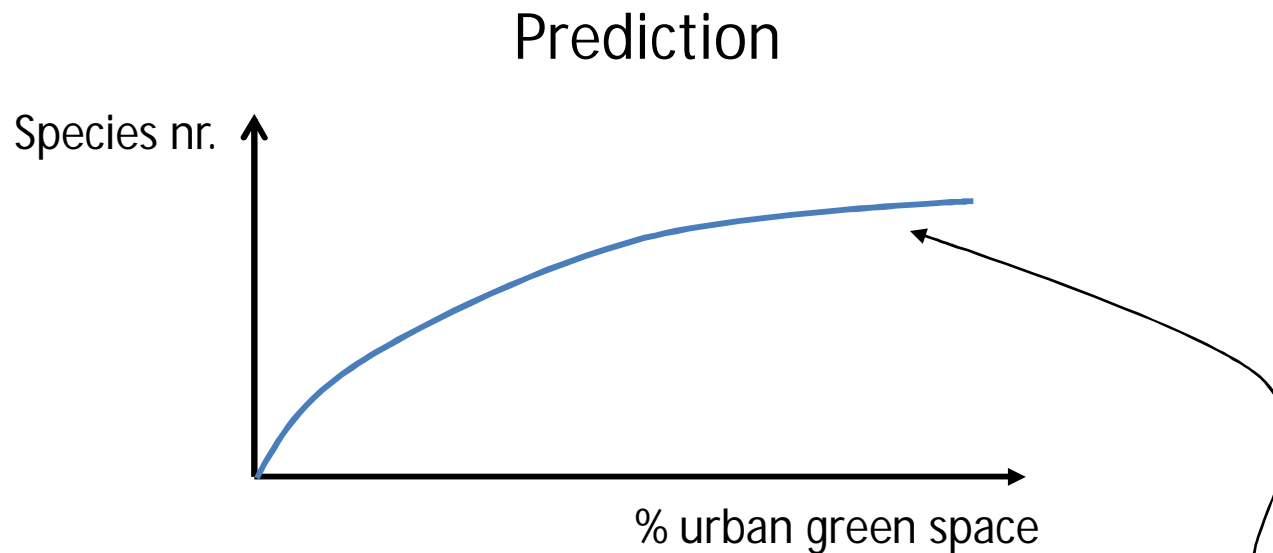


Maas et al. J Epidemiol Community Health 2006;60:587-592

- Recuperation rate faster in hospitals with **green scenery**
- Systolic blood pressure gets lower with increasing % **urban parks**

Something important missing?

What about biodiversity as a measure of the value of **urban green**?



What does **urban green** mean for biodiversity?

What does biodiversity mean for **urban green** and its functions?

SHOULD WE CARE ABOUT BIODIVERSITY IN CITIES?

When the value of urban **green space** is concerned biodiversity-related questions are tricky:

- **moral**
 - **esthetic**
 - **functional**
- Difficult to measure/convince a city planner
- Easier to give an operational value

but no scientific data to prove this...

Biodiversity perhaps not a relevant/wise/operational/ concept to be used as an argument to make cities greener???

(remember, a big proportion of urban biota is alien species)

SO... we have learnt that

"Green city" with its green spaces means a multitude of things.

Amplify of conflicts of interest with other (traditional) land uses.



Green things seem to be beneficial for humans as they provide ecosystem services, but are they important enough to be applied as a powerful tool in e.g. city planning?

"Green city – what does it actually mean?"

SCIENCE SOLVES"

Two multidisciplinary research projects launched:

- *“Enhancing Sustainable Urban Development through Ecosystem Services – ENSURE”* (funded by HENVI, in cooperation with Finnish Environment Institute, Finnish Meteorological Institute, Finnish Forest Research Institute)
- *“Well-being in urban environments: the use of ecosystem services as a tool towards sustainable urban planning”* (funded by the KATUMETRO consortium (four cities, two Ministeries, Universities and Applied universities))

MY ARENA:

*the ability of urban **green space** to remove air pollutants, sequester and store C, and mitigate the many problems associated with urban run-off water ... → calculate the “metrics” and “money”*

ENSURE: Green roofs ...

A dream come true ... sometime, somewhere



- Green roofs:**
- support refugia for endangered insects
 - hold and purify rain water (mitigate flooding)
 - filter polluted urban air
 - aesthetically pleasing

"Green city – what does it actually mean?"

CONCLUSION

- **Green city** actually means a new way of enhancing the sustainability of urbanized areas.
- **Ecosystem services** lie at the core of the concept
- If LIFE is valuable then **GREEN** is valuable
- Compaction of cities may compromise many of the above mentioned benefits
- Science solves