



University of Helsinki

URBAN ECOLOGY: Why is it an increasingly important topic?

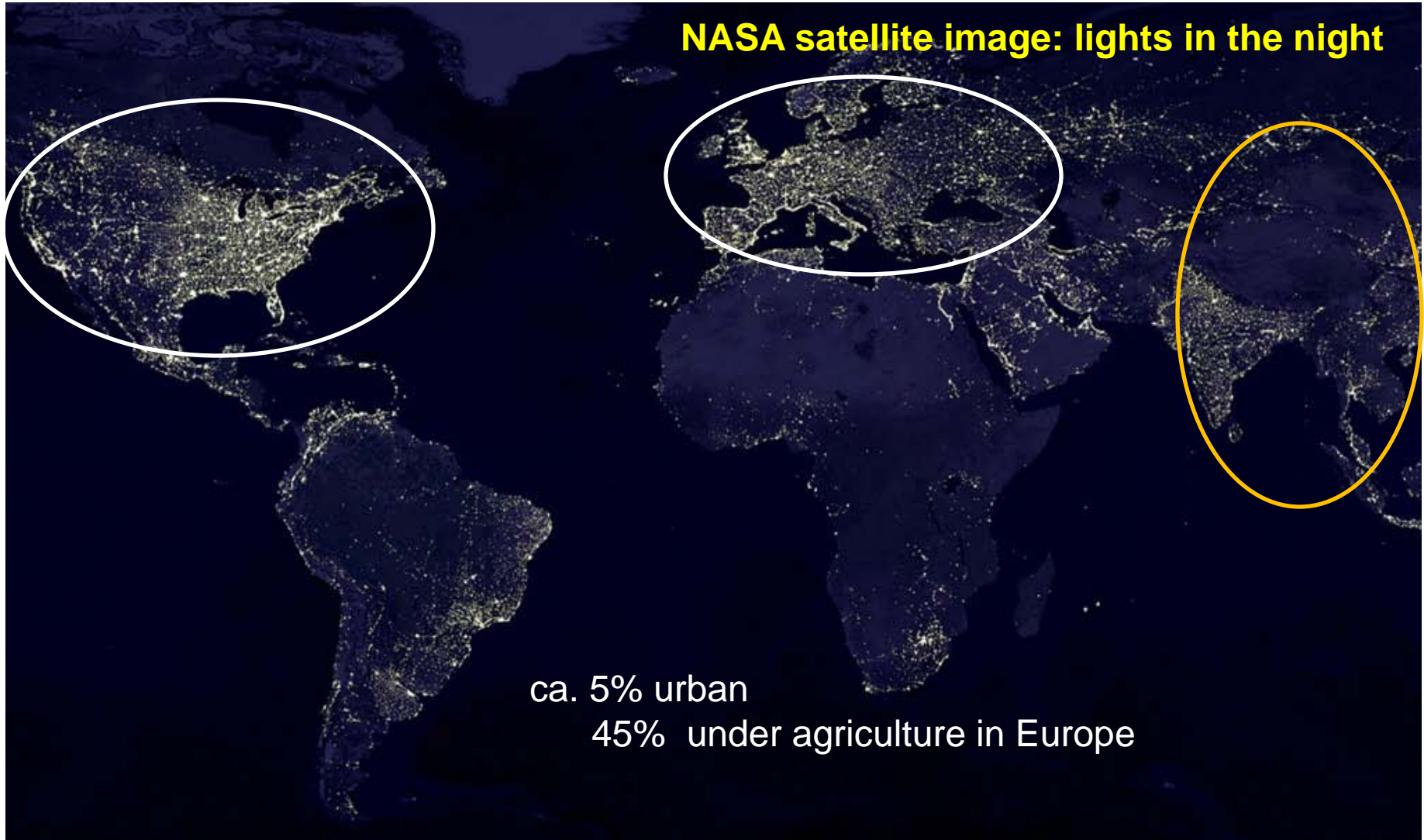


Heikki Setälä
University of Helsinki
**Department of Ecological and Environmental
Sciences**
Finland

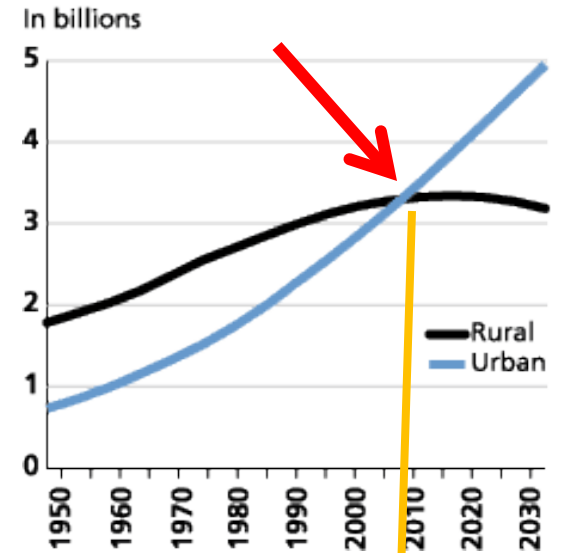
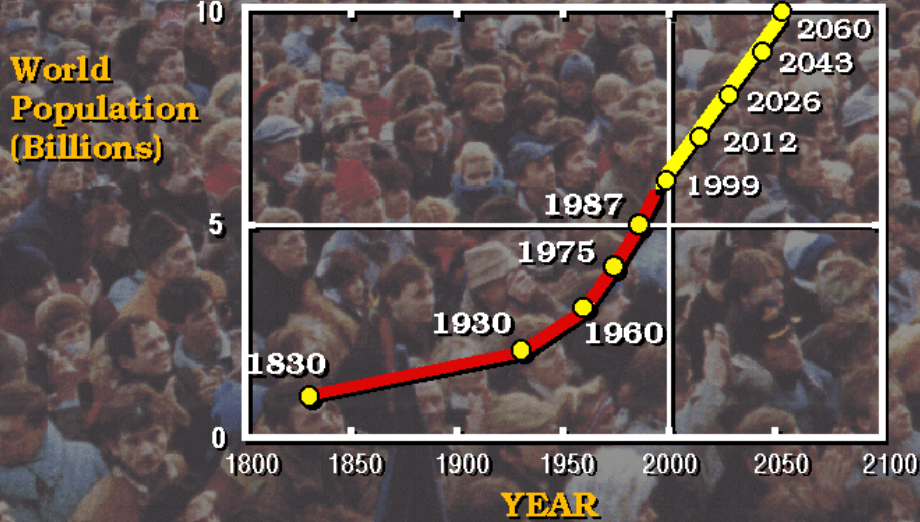
OUTLINE

- 1) Background of urbanisation - briefly
- 2) What is urban ecology- briefly
- 3) A holistic, **ecosystem** approach in urban ecology
- 4) Urbanisation and soils
- 5) Restoring ecosystem services in cities – empirical studies

1: URBANISATION – some background



World Population Growth Past and Future



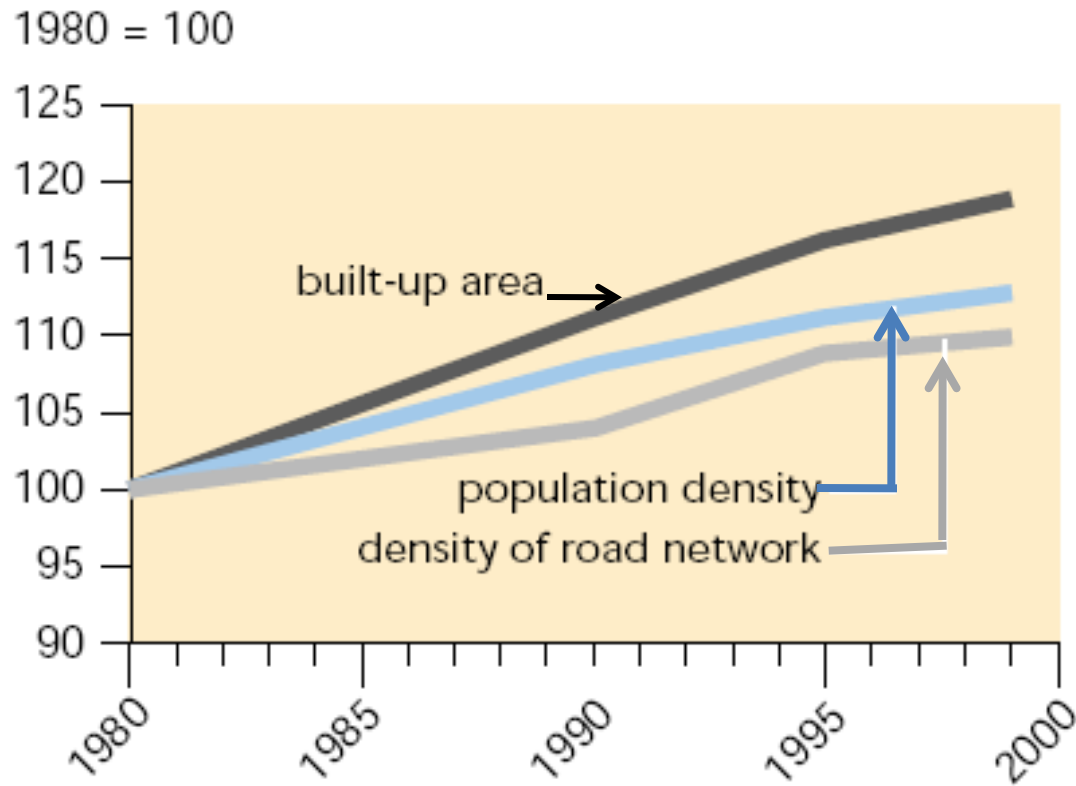
fti.neep.wisc.edu/neep602/lecture24.htm



Problems of over-population

CONSEQUENCES OF URBANISATION

Built-up area, road network and population increases, selected EEA countries

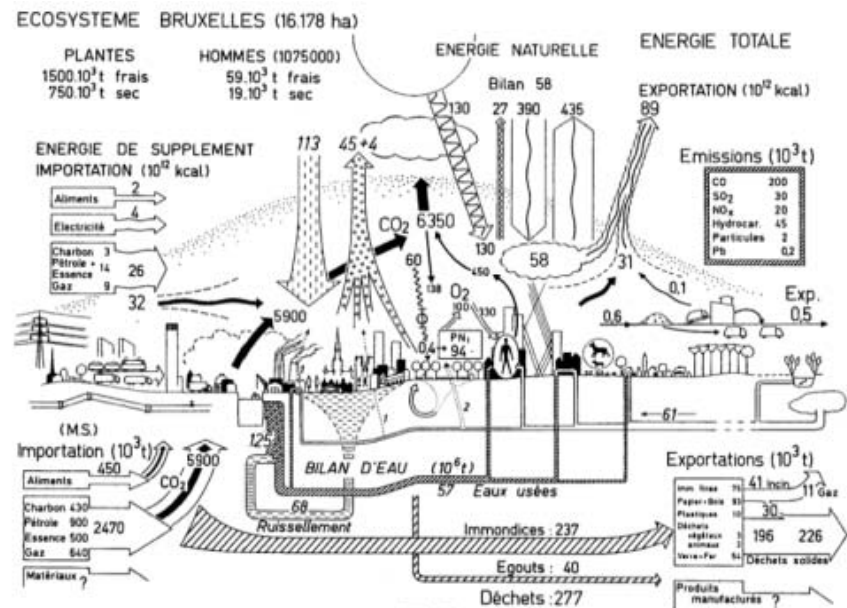


Built-up area increases faster than population growth!!!!
(has this happened unnoticed by ecogists??)

2) WHAT IS Urban ecology?

Urban Ecology splits into two "technical" parts:

- 1) Ecology **IN** cities
- 2) Ecology **OF** cities



- Ecology **IN** cities = population - community ecology
- adaptation of life in cities
- biodiversity issues important

- Ecology **OF** cities = ecosystem ecology, urban metabolism, how cities function as a unit, ecosystem services under study ...

Session III topic:

”Biodiversity and sustainable development”

Ecology IN cities:

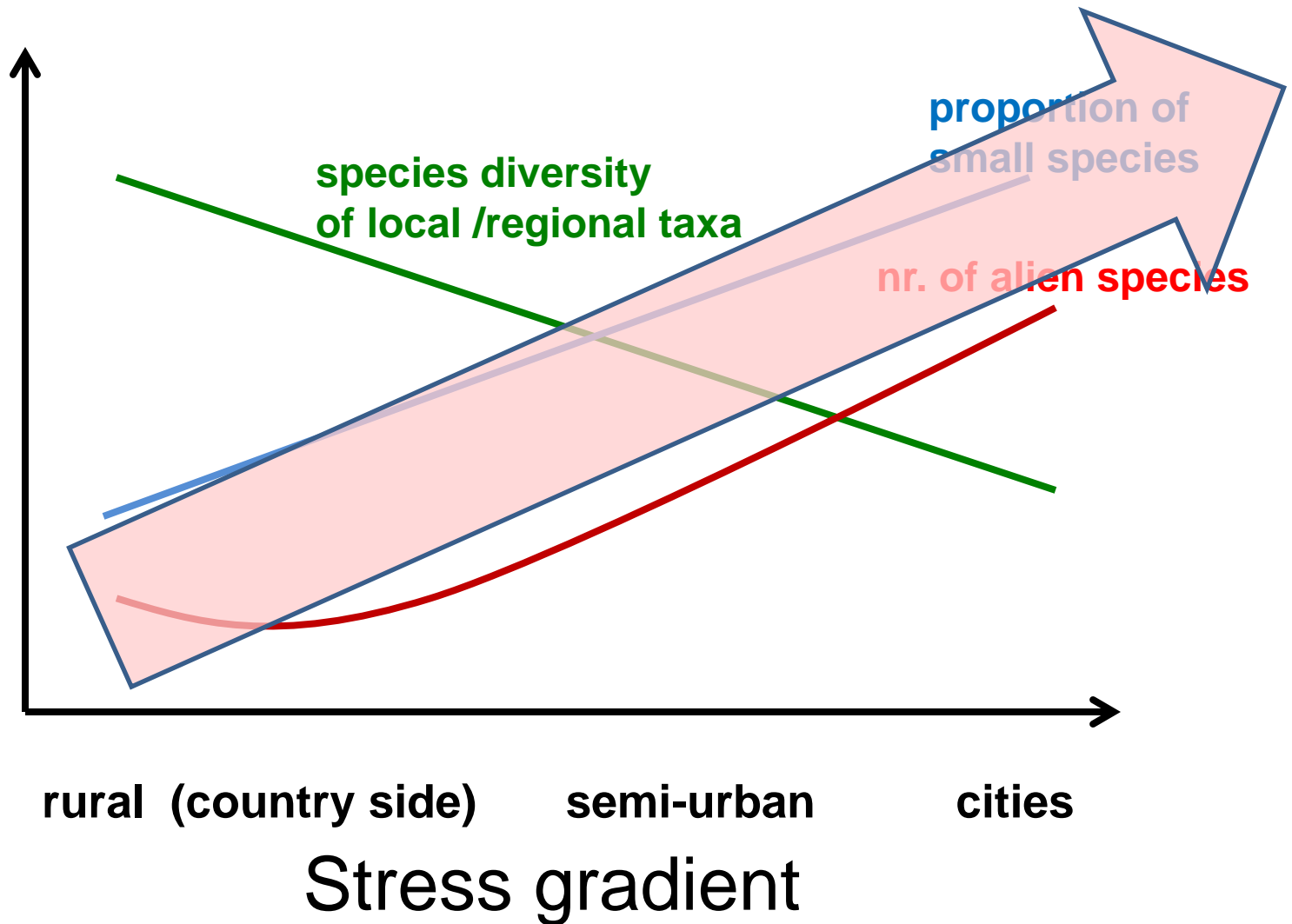
Urban biodiversity – some facts.....

Cities are not isolated from ”pristine” nature



Today 25% of the world’s protected areas are within 17 km of an urban area

Biodiversity and urbanisation: general trends



National Urban Park Stockholm, Sweden



No other area in Sweden (of same size) have similar high species richness:

- >1.000 sp. of butterflies,
- 1.500 beetles,
- 250 bird species
- 112 red-listed species

Urban ecosystems and biodiversity

- Urban areas are heterogenous → biodiversity may be high, especially in alien species

but does this mean that high species number helps in making cities better places to live? More sustainable?

Are there some other values than **biodiversity** that we should think about in e.g. in city planning?

Perhaps a more **HOLISTIC** view ...?

- Behavior of the entire system

- ecosystem processes under study

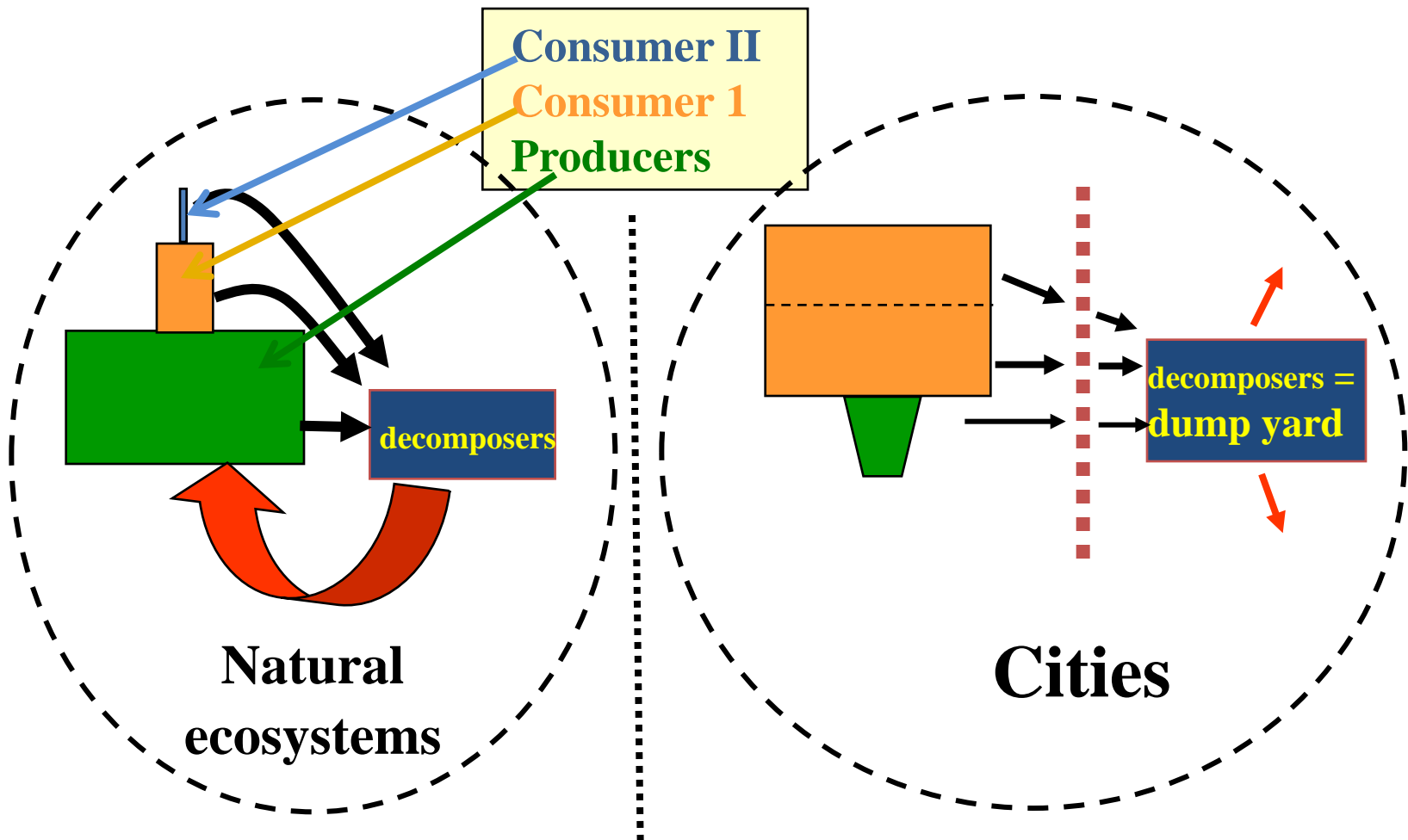


3) A holistic, ecosystem approach in urban ecology (ecology OF cities)



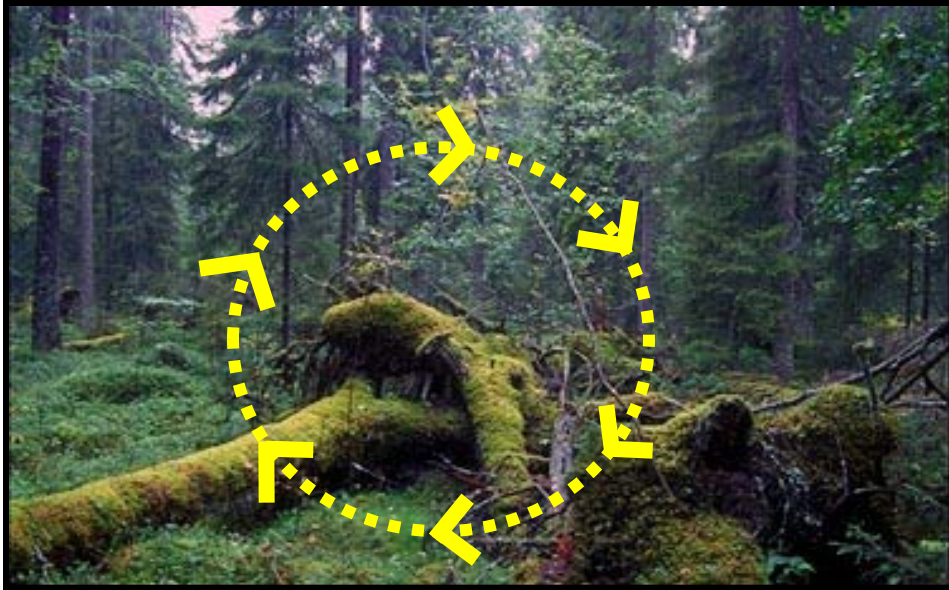
Peculiarities of urban "eco"systems:

A) Trophic pyramide upside-down in cities



Drivers of biogeochemical processes are under human control

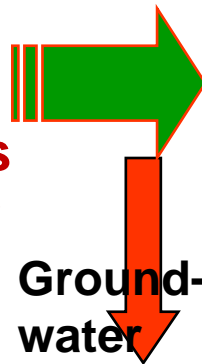
B) Loose material cycles in cities



Natural ecosystems

Conservative
A lot of recycling

→ retention of materials
within a system is poor



Ground-
water



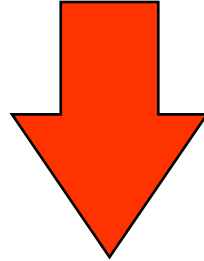
air

Dump

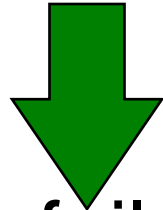
Surface
waters

Urban areas

Due to the converted trophic pyramide and loose material cycles urban systems are inefficient in processing matter



Urban systems do not **FUNCTION** properly



Urban systems fail to provide the humans with life-supporting

ECOSYSTEM SERVICES

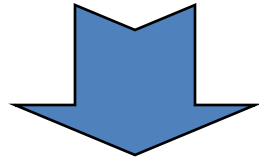
Ecosystem services are services provided by nature and that are irreplaceable for humans

CRUCIAL ECOSYSTEM SERVICES IN CITIES

1) Upon which ecosystem services are urban dwellers dependent on?

and

2) what are the eco-services urban ecosystems can/should provide?



Considered as important:

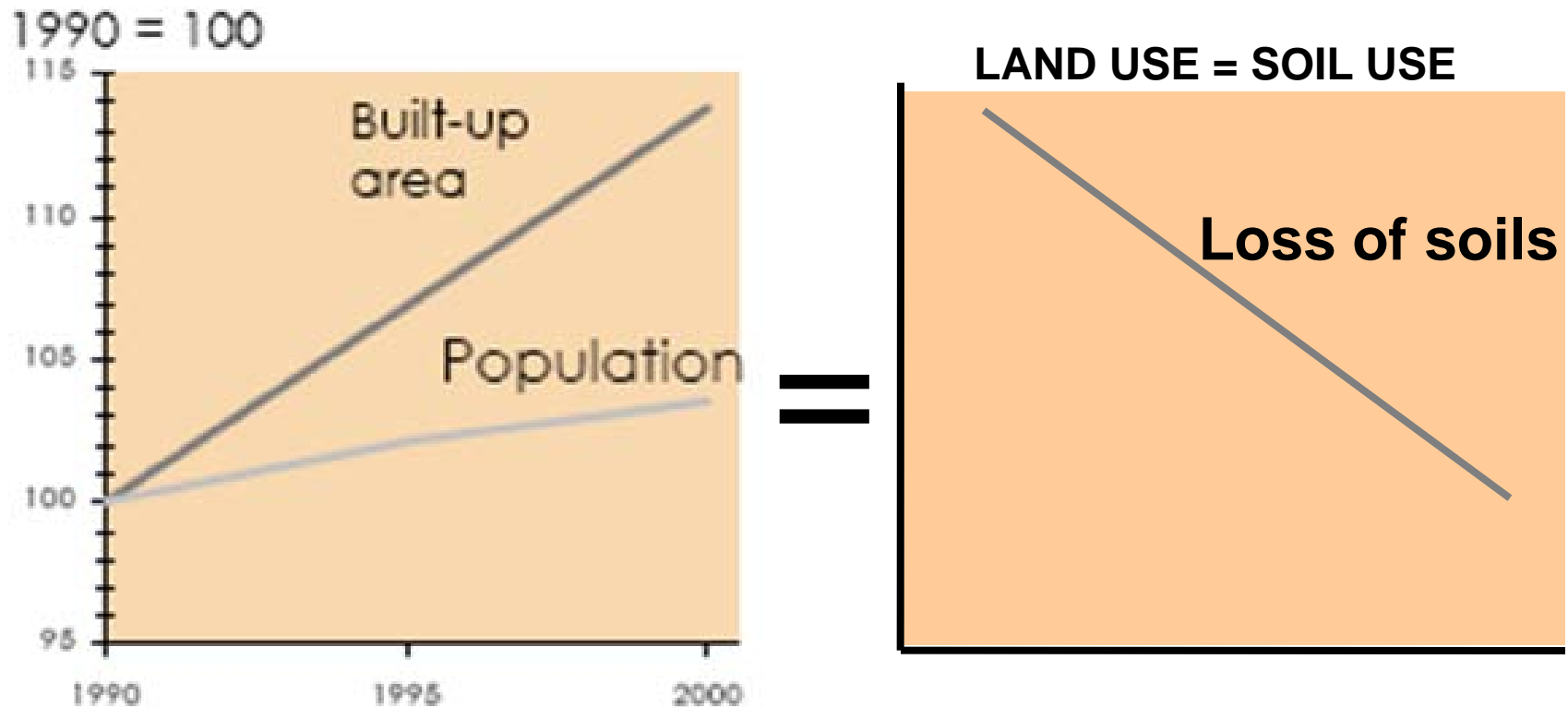
- 1) Hydrological services (rainwater drainage and purification)
- 2) Air filtering
- 3) Carbon sequestration
- 4) Recreational and cultural services



SOIL SERVICES

4: URBAN SOILS AND ECOSYSTEM SERVICES-

Remember this?

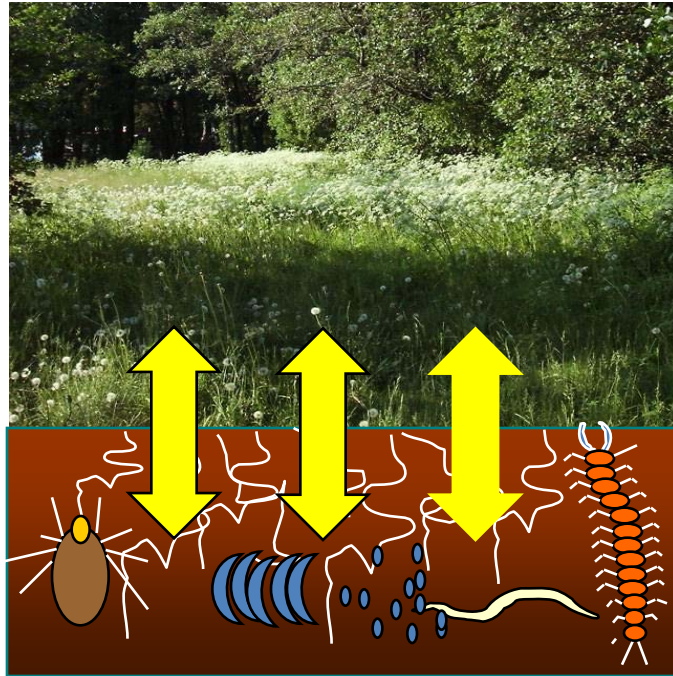


Soil is perhaps the most valuable resource on the planet.

Mark Twain: Buy *land/soil* - they've stopped making it!

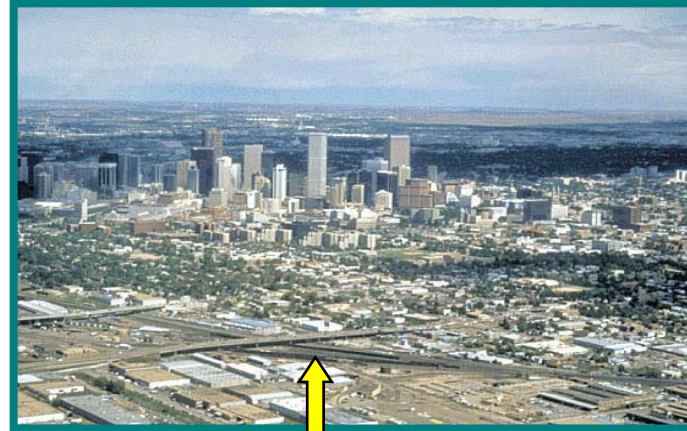
PIVOTAL role of SOILS

Natural

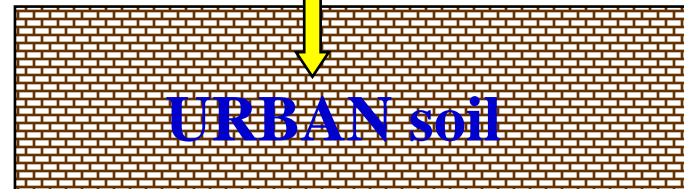


Rich in good-quality organic matter

Urban



Loose connection to "above"



Low and bad-quality organic matter

Mother earth?

WHAT ARE THE CRUCIAL SOIL SERVICES in CITIES??

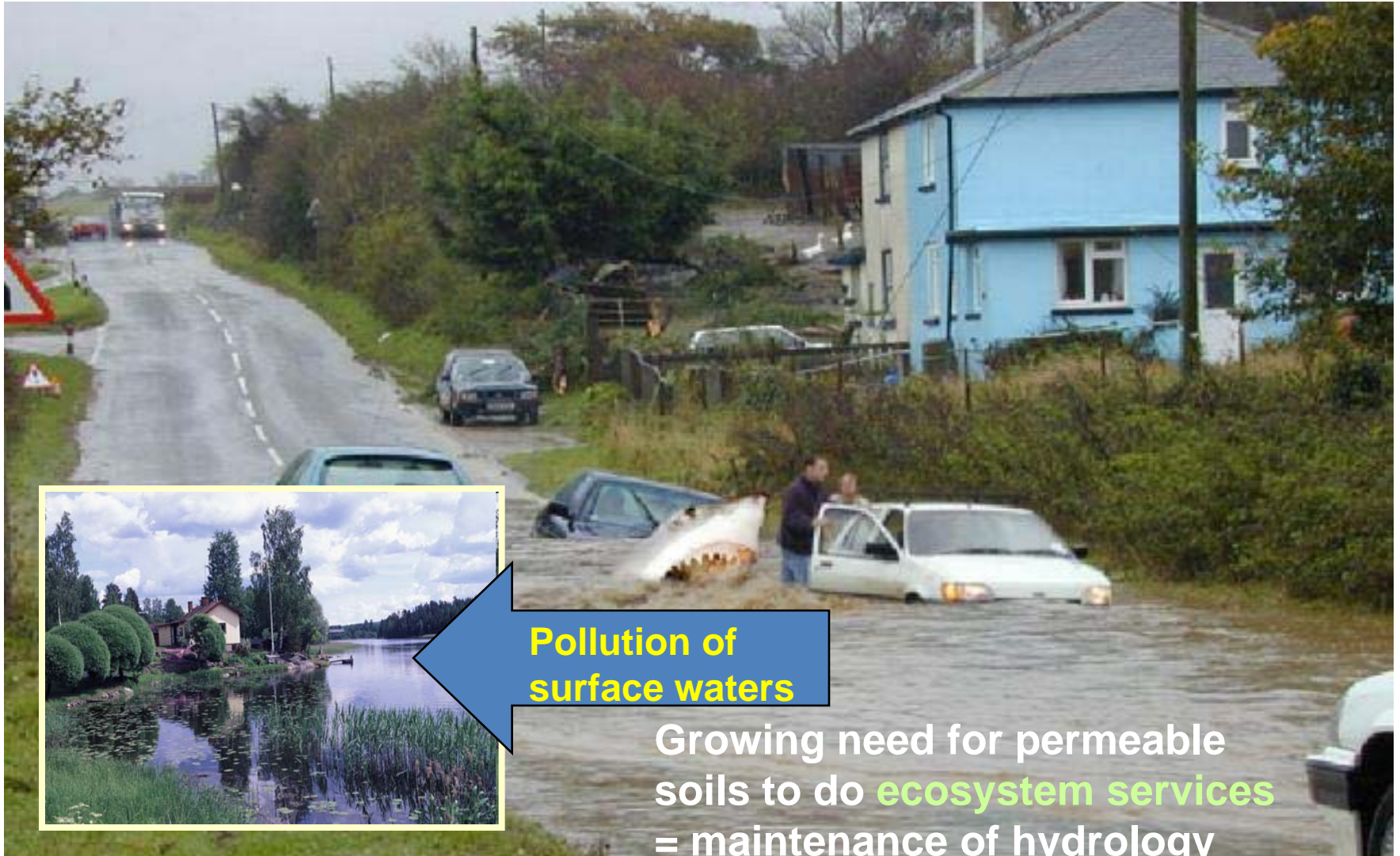
- Besides supporting **primary production** ...
- soils are important in **bioremediation** of pollutants:
ca. 75% (by weight) of the chemicals released into
the environment can be degraded by **soil biota**
- soils 1) **store** and 2) **purify water**



**WORTH OF TAKING CARE OF THIS
LIFE-SUPPORTING MACHINERY**

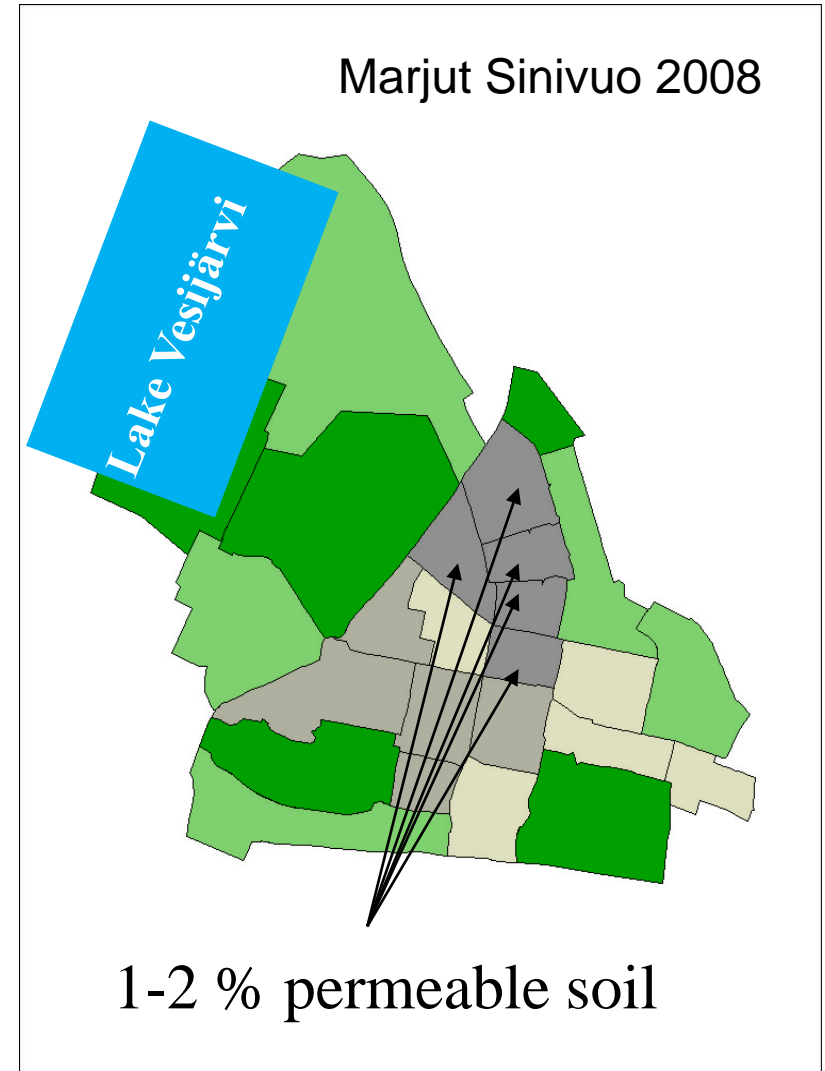
Consequences of urbanisation: sealed, impermeable surfaces

Predicted climate change → **rainfall** to increase by
15 – 20 %

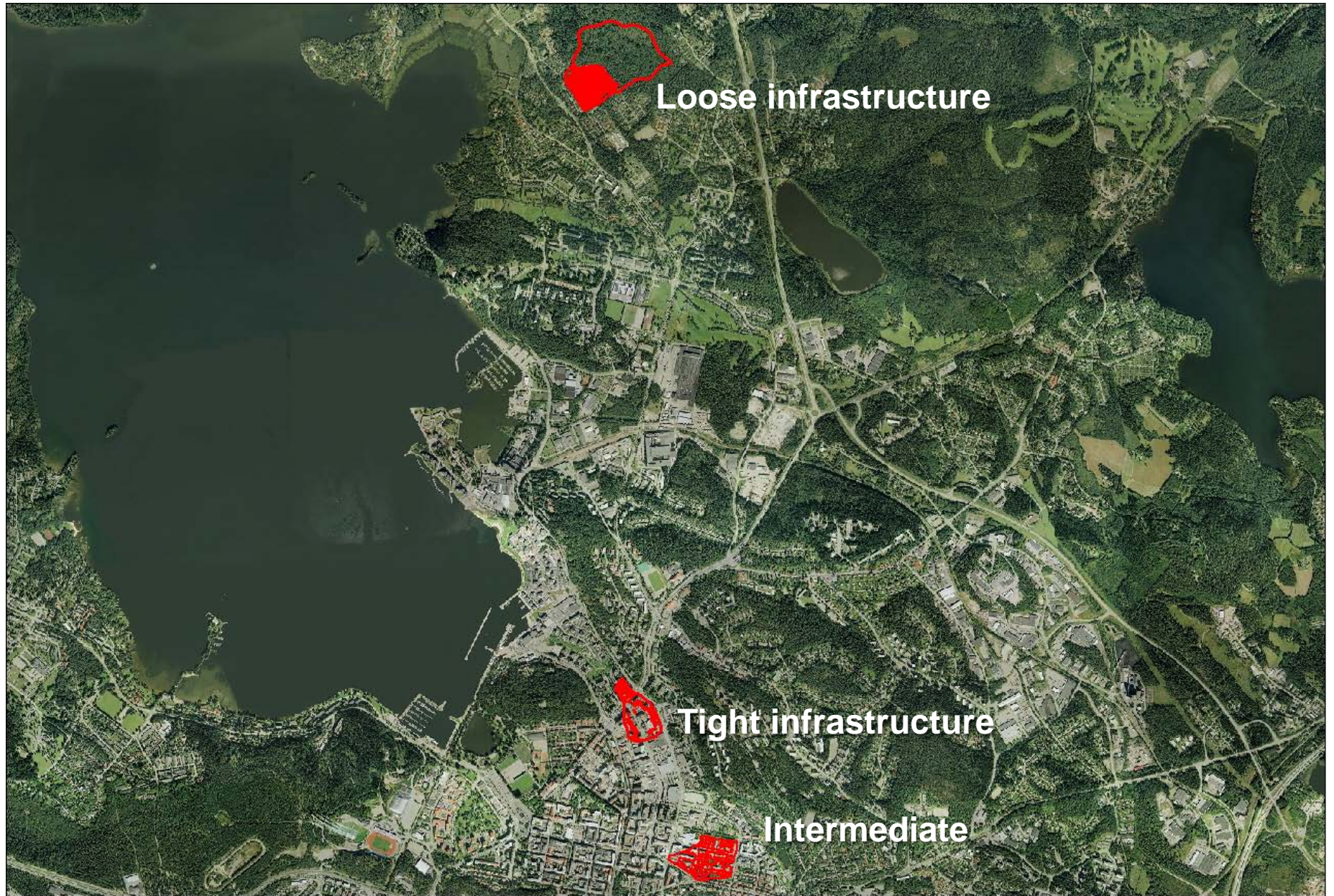


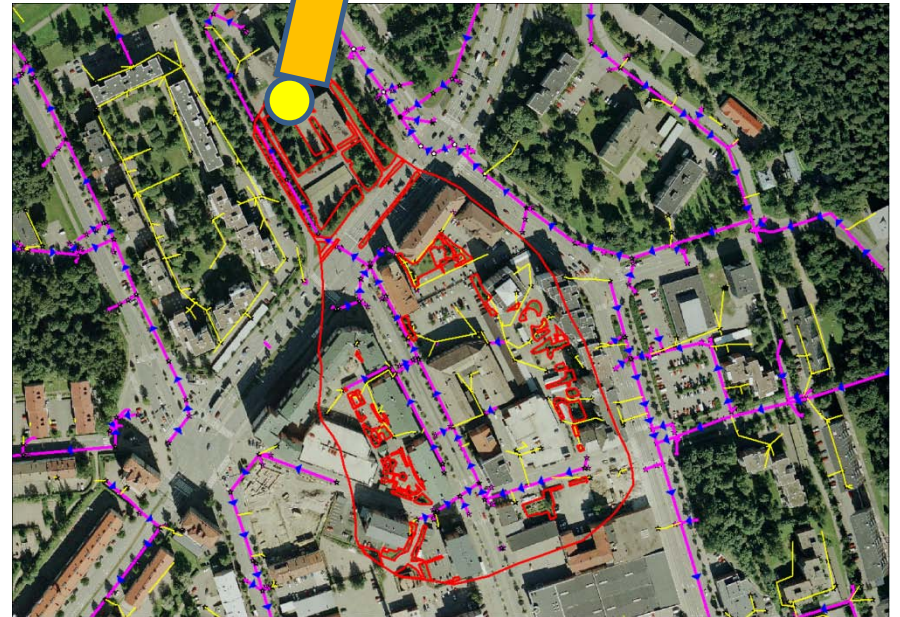
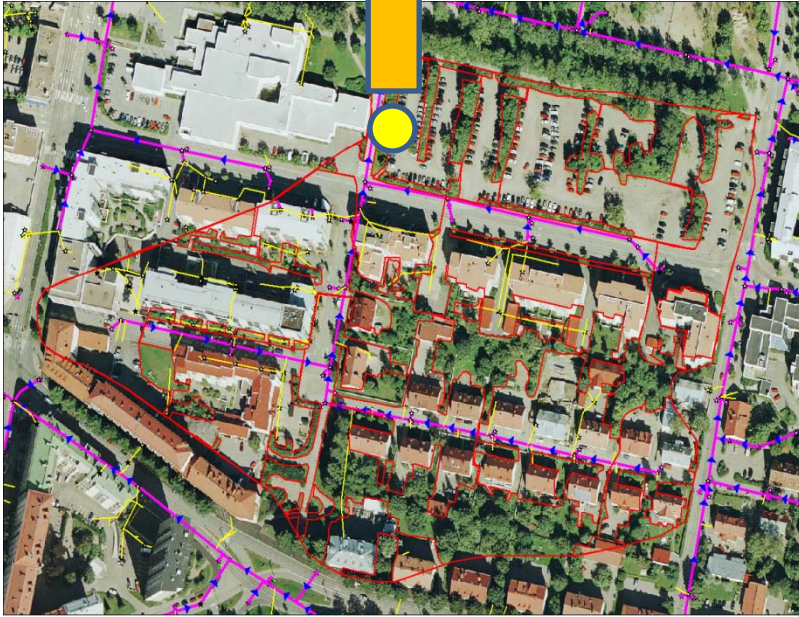
Permeability of soil surface

City of Lahti - core area



Catchment areas in the city of Lahti



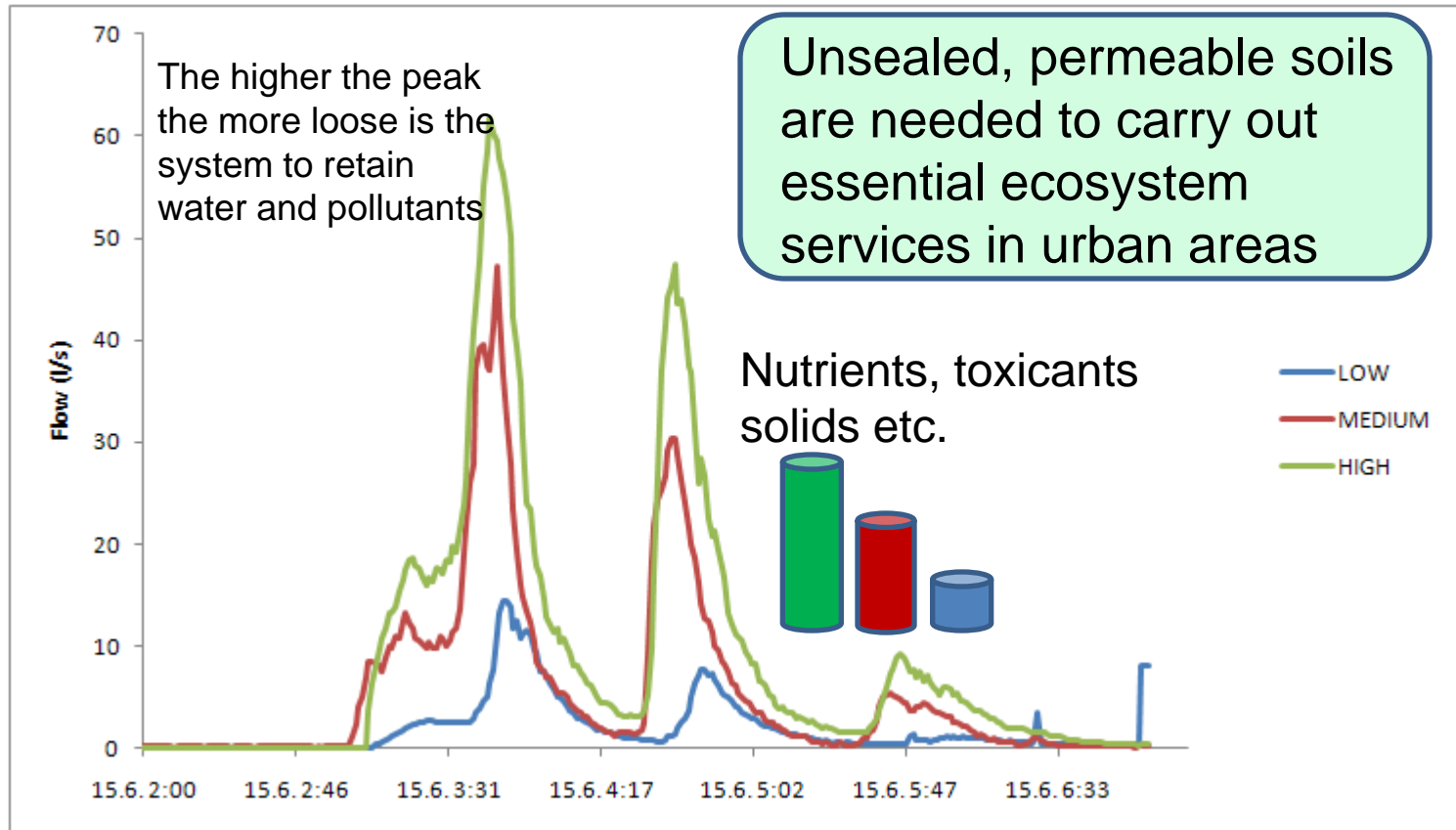


STORM EVENT 15.6.09

Lahti

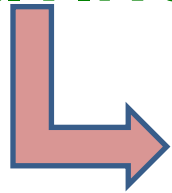
Runoff/precipitation

High: 80% escaped
Medium 49% escaped
Low: 7% escaped



5. Restoring urban ecosystem services – an impossible task?

LIVING SOIL: a valuable resource in cities



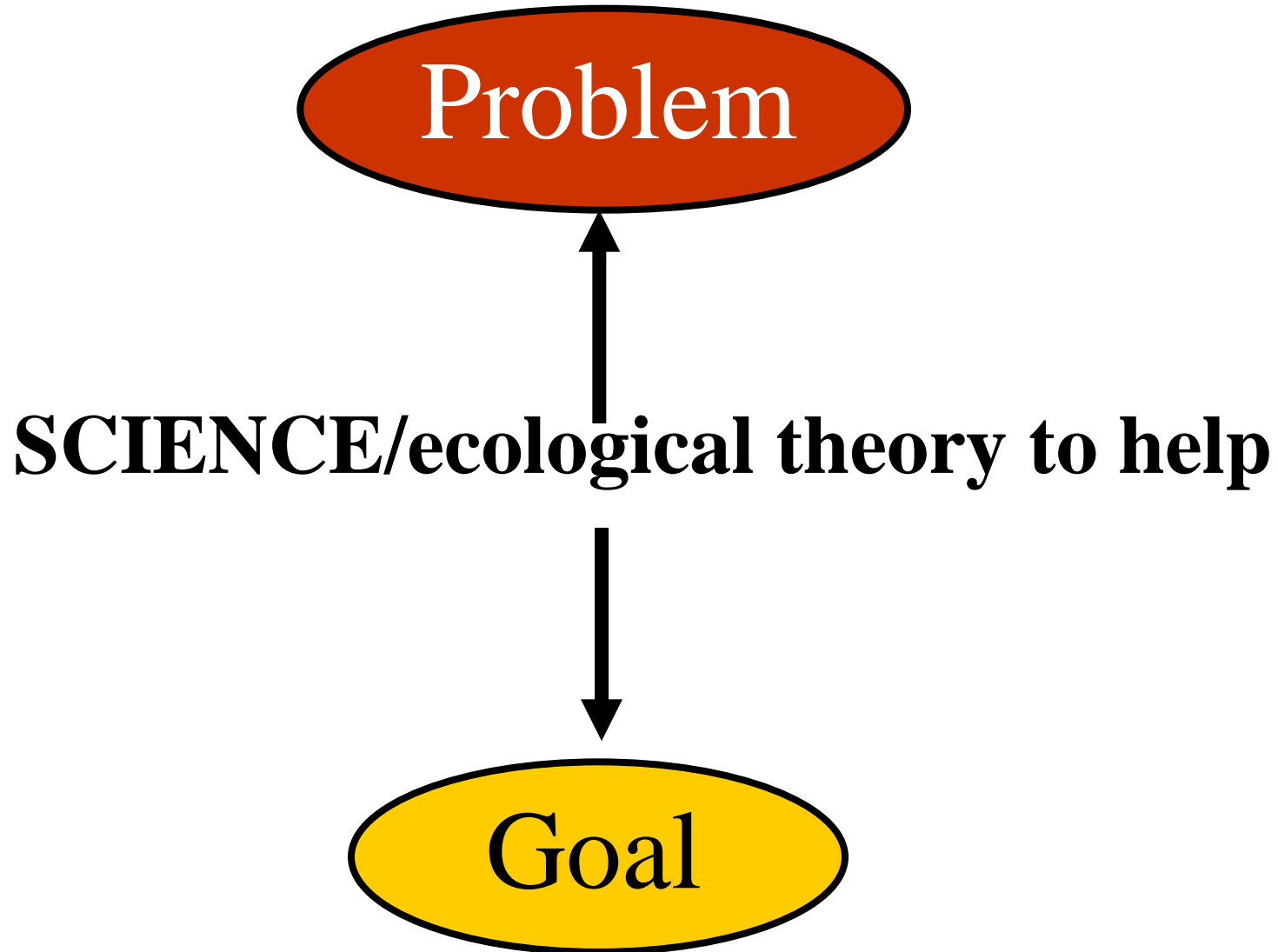
Soil restoration worth of considering/funding

How much does this require?



b) Use of "abandoned" sites:
- brown fields, derelict lands, road verges to make the site "green" and the soils living?

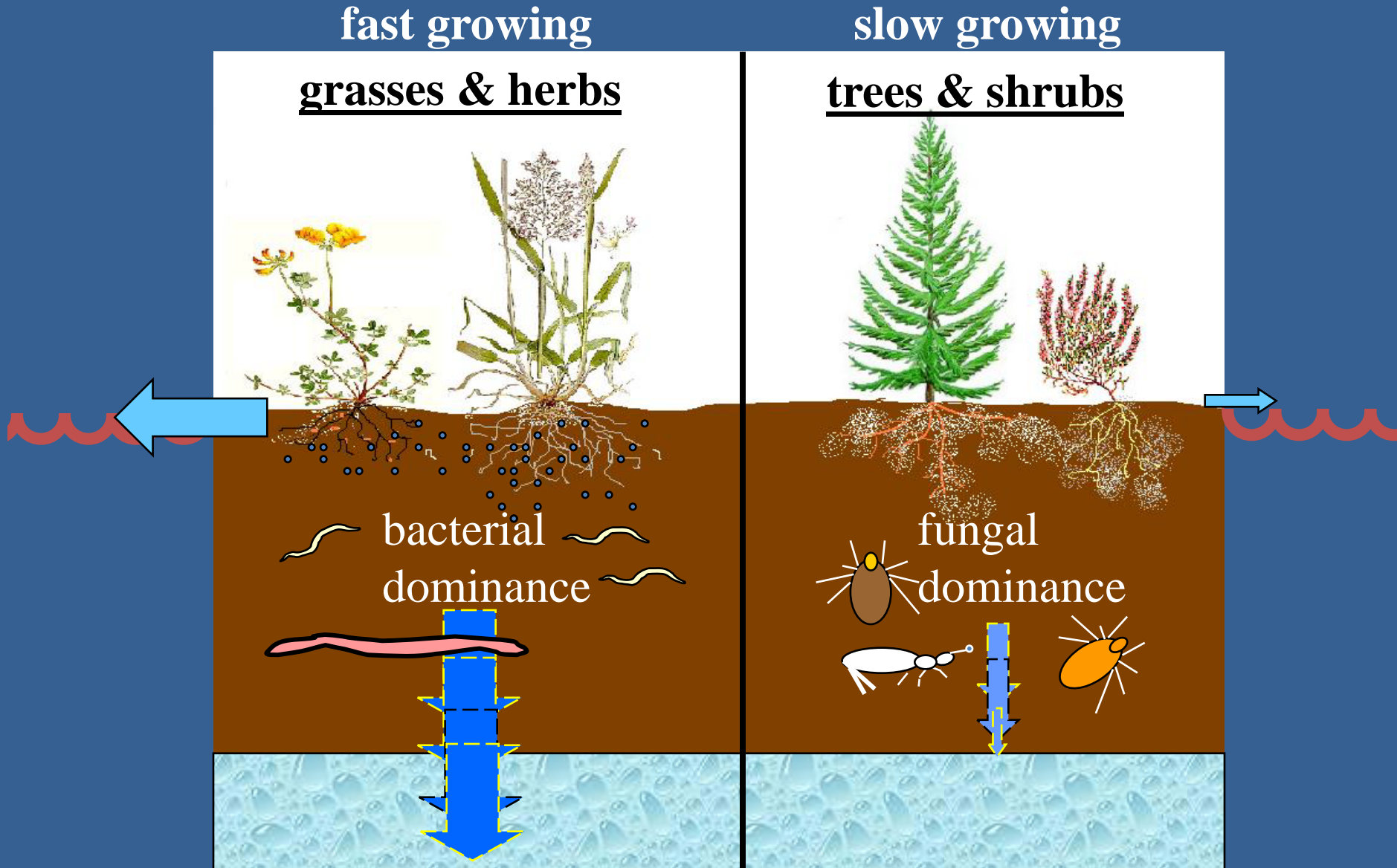
Can one solve urban-induced problems
through **soil restoration**?



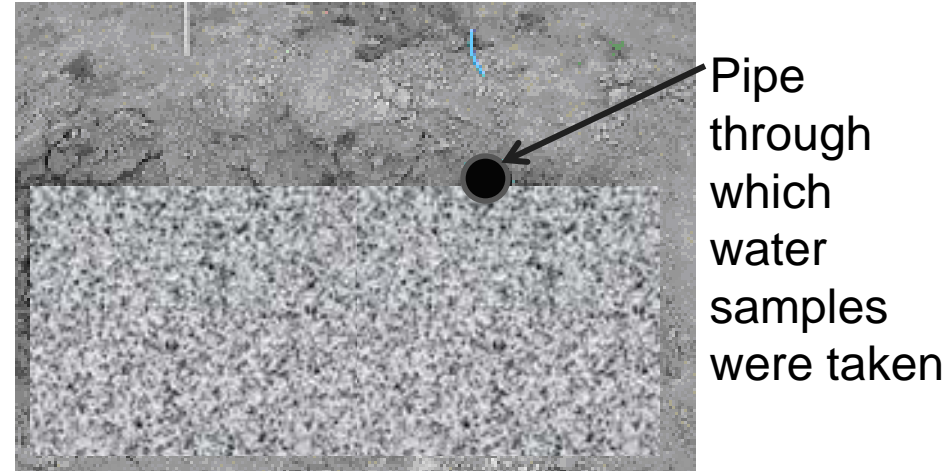
Three scientists and an urban dump yard (to test the theory)



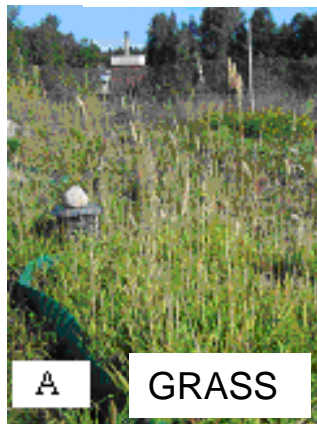
- Plants modify the soil (biota and structure), and
- this process is plant-trait dependent



A field experiment (2004 – 2007) was established to study above-belowground linkages and effects on nutrient cycling

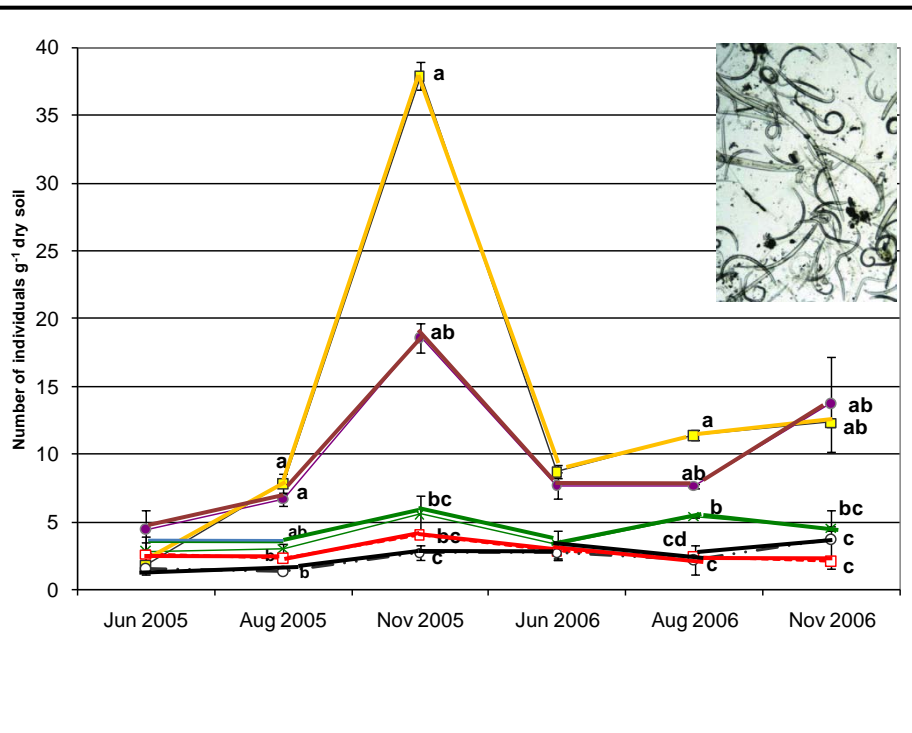


Lysimeter system to collect rain water

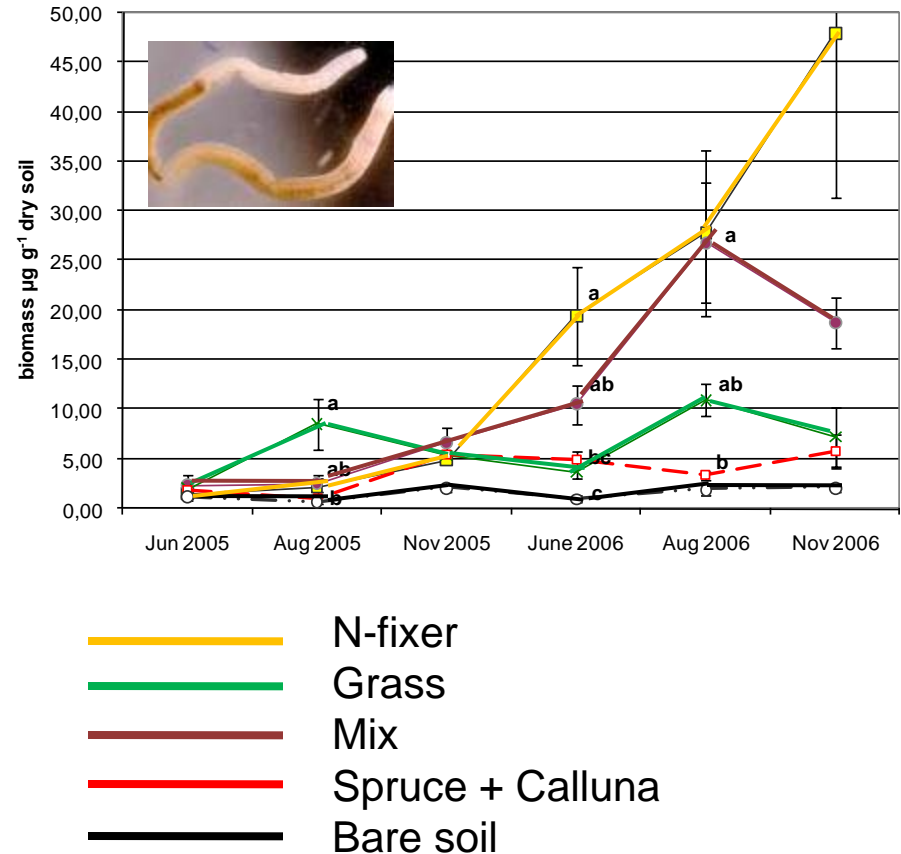


Soil animals can "detect" plant influence

Number of soil nematodes

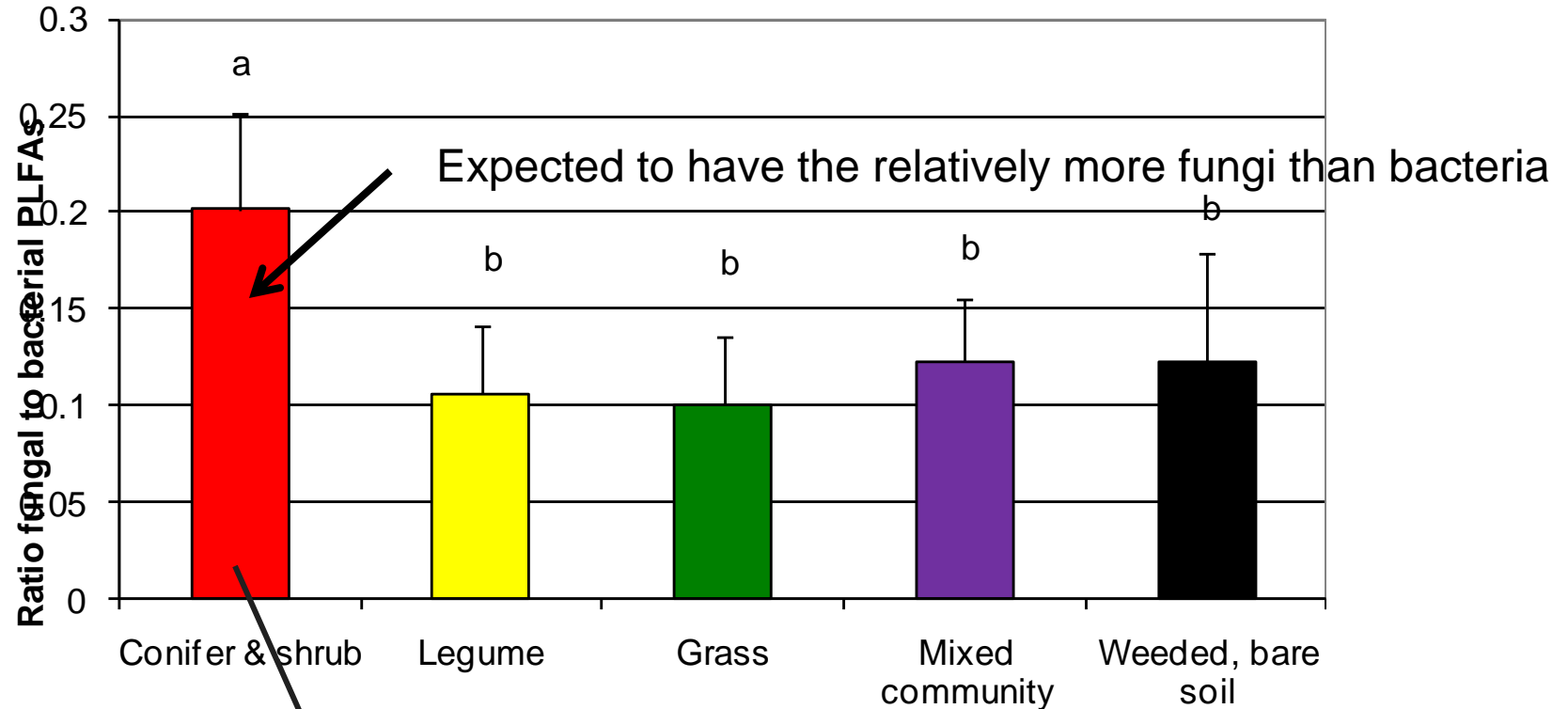


Biomass of enchytraeid worms



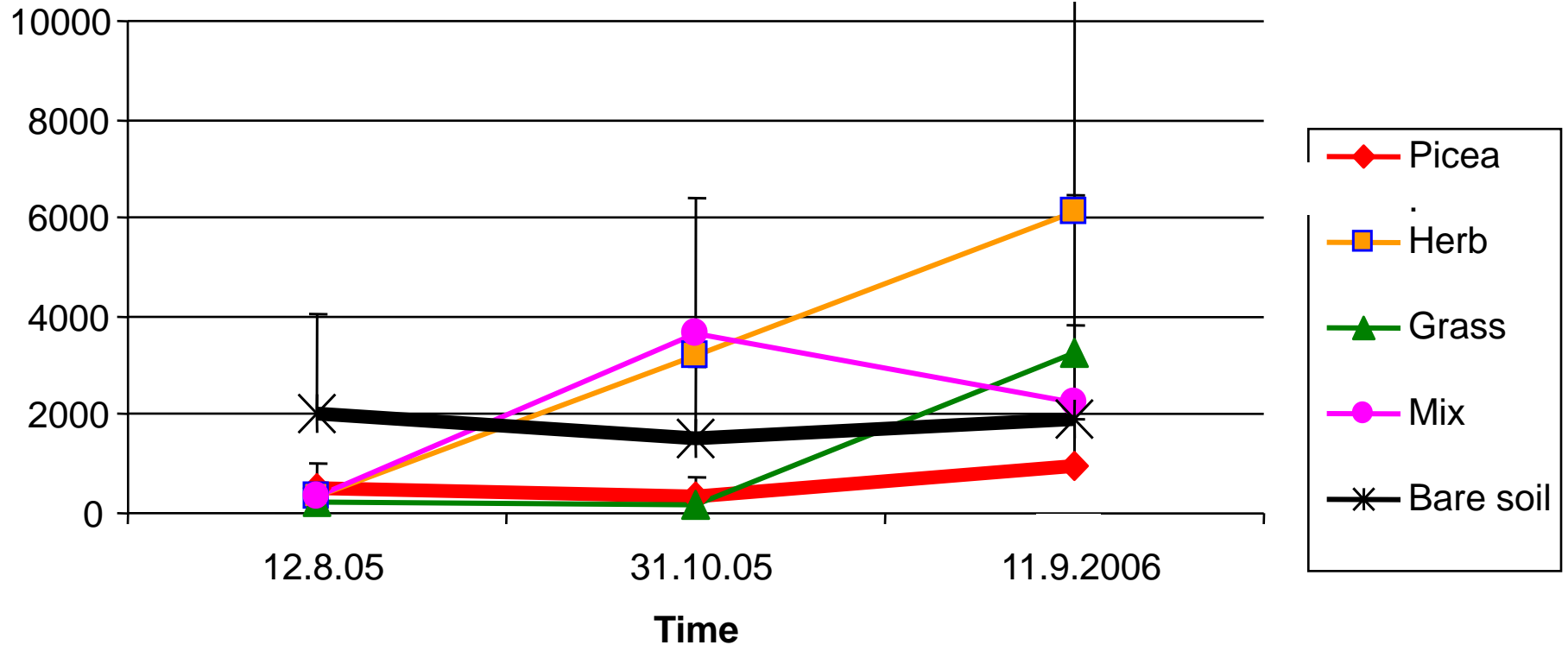
Relative proportion of fungi and bacteria underneath the plants

(fungi/bacteria –ratio)



Also the best nutrient retention ability?

Inorganic N (ug/L) in lysimeter (soil) water

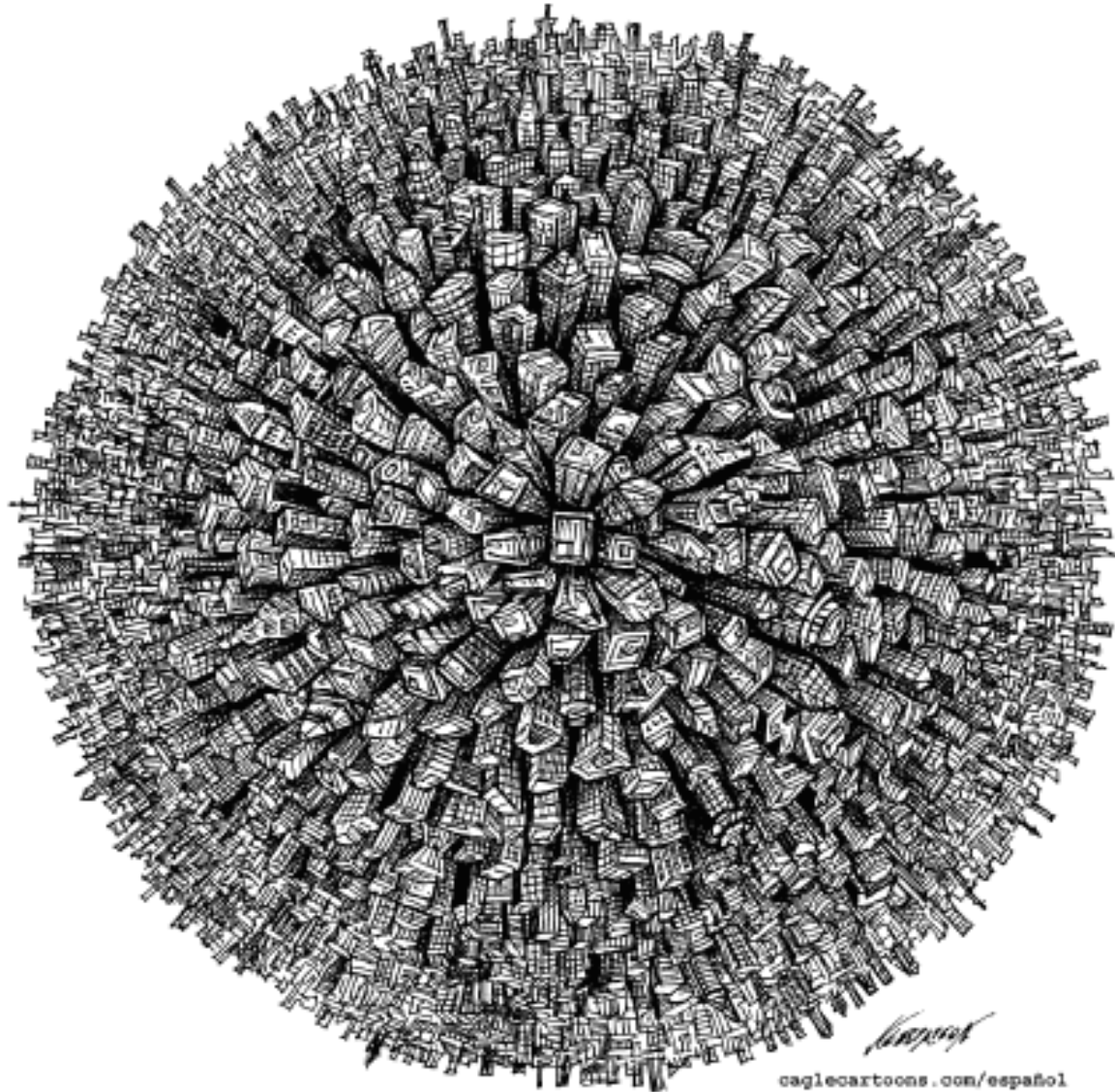


Urban soil can be manipulated ecologically →

Urban soil restoration possible with minimal costs

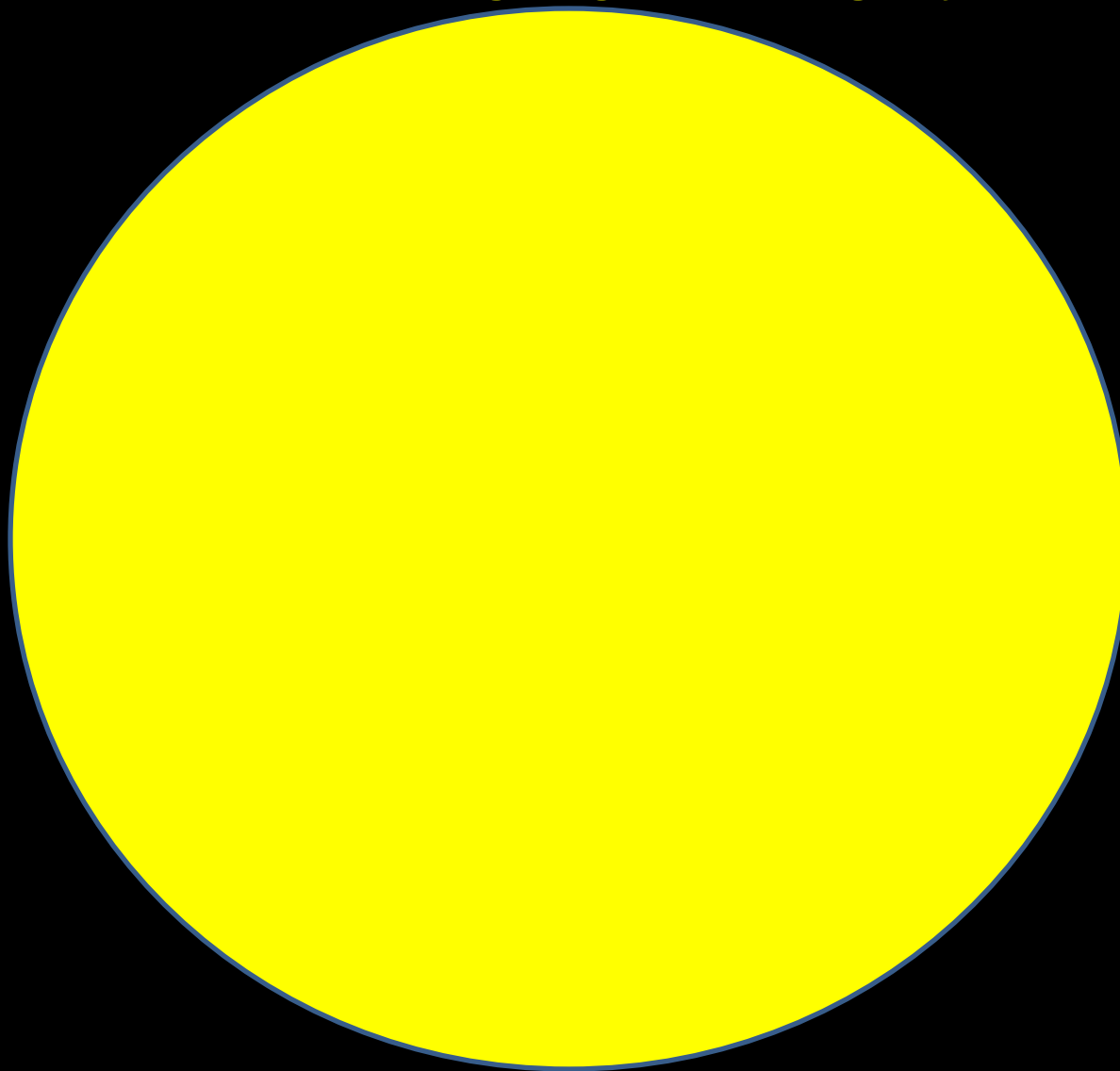
Restoration of functions rather than the original biotope

The Urban Future?



Cagle
caglecartoons.com/español

NASA satellite image: light in the night y. 2100



Social, economic variables

