

Urban Trees – Challenges of using plants in urban areas



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Baumpflegeportal

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Foto Lukas Handschin, Archiv GSZ (Grün Stadt Zürich)



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The importance of urban trees

Urban trees (when well maintained) have a big impact on urban climate by

- climate regulation and improving air quality (increased evapotranspiration rates)
- Intercepting polluting particles
- enabling beneficial levels of gaseous exchange thus improving the greenhouse gas balance

Additionally the canopies of urban trees have the capacity to normalise or close hydrological cycles in urban areas by

- increasing permeable landscapes
- increasing water filtration and infiltration rates
- recharging ground water
- runoff interception and storage, thus improving the status of both surface and groundwater
- increasing the water-holding capacity (of urban systems) (increasing evapotranspiration rates)

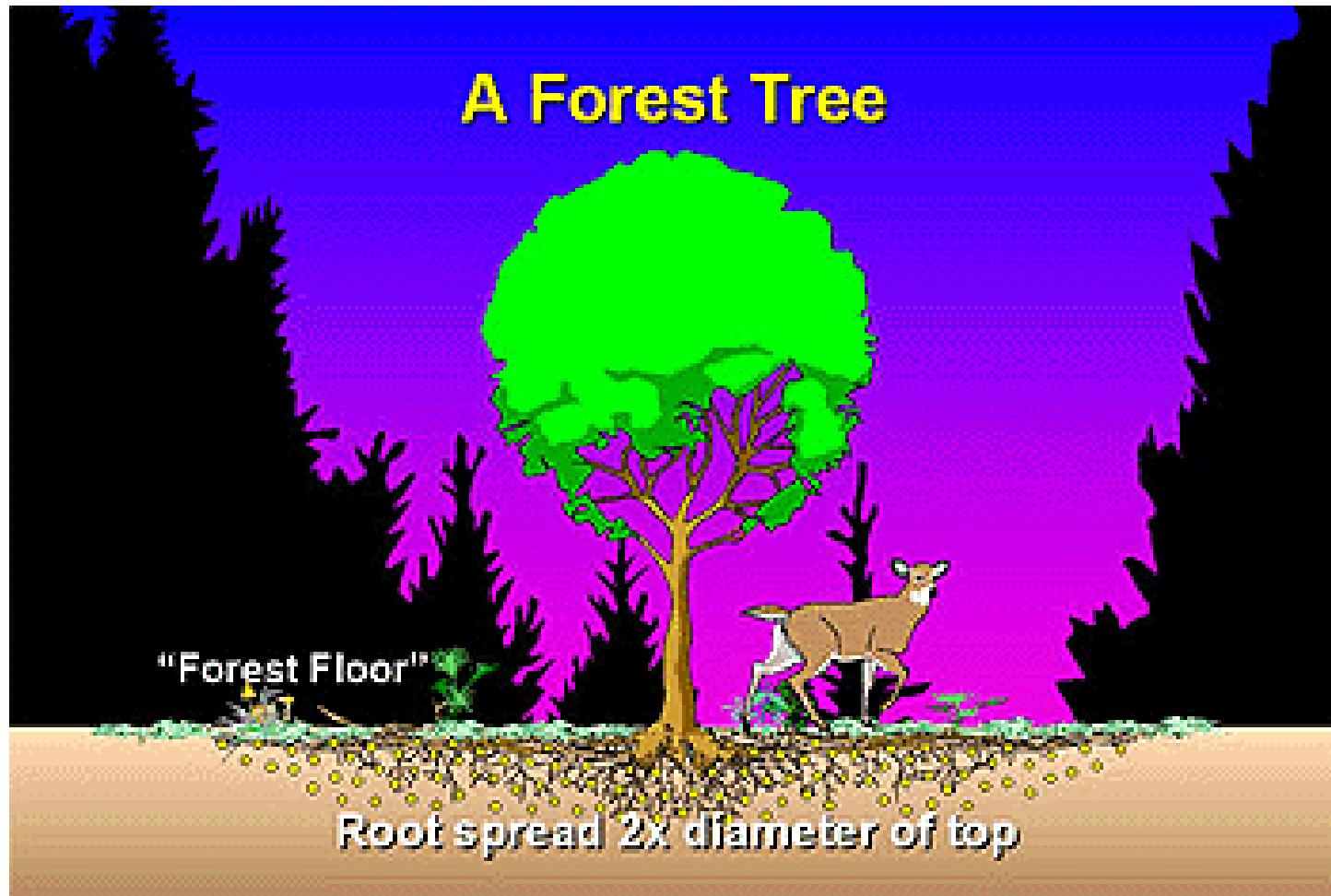
Urban trees – an interdisciplinary field of work

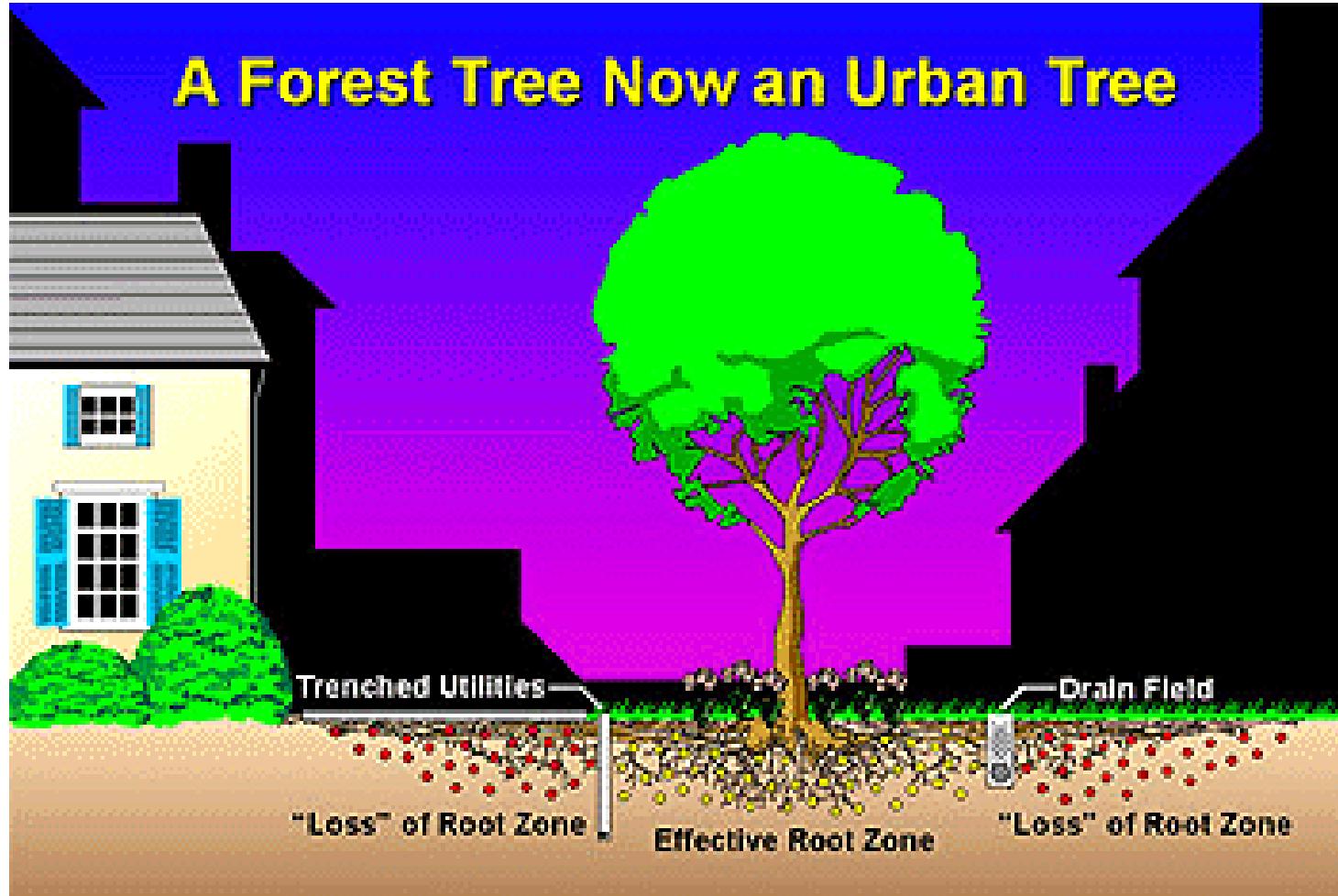
To create a well maintained healthy urban forest and green infrastructure it is essential to have a network of stakeholders spanning many disciplines:

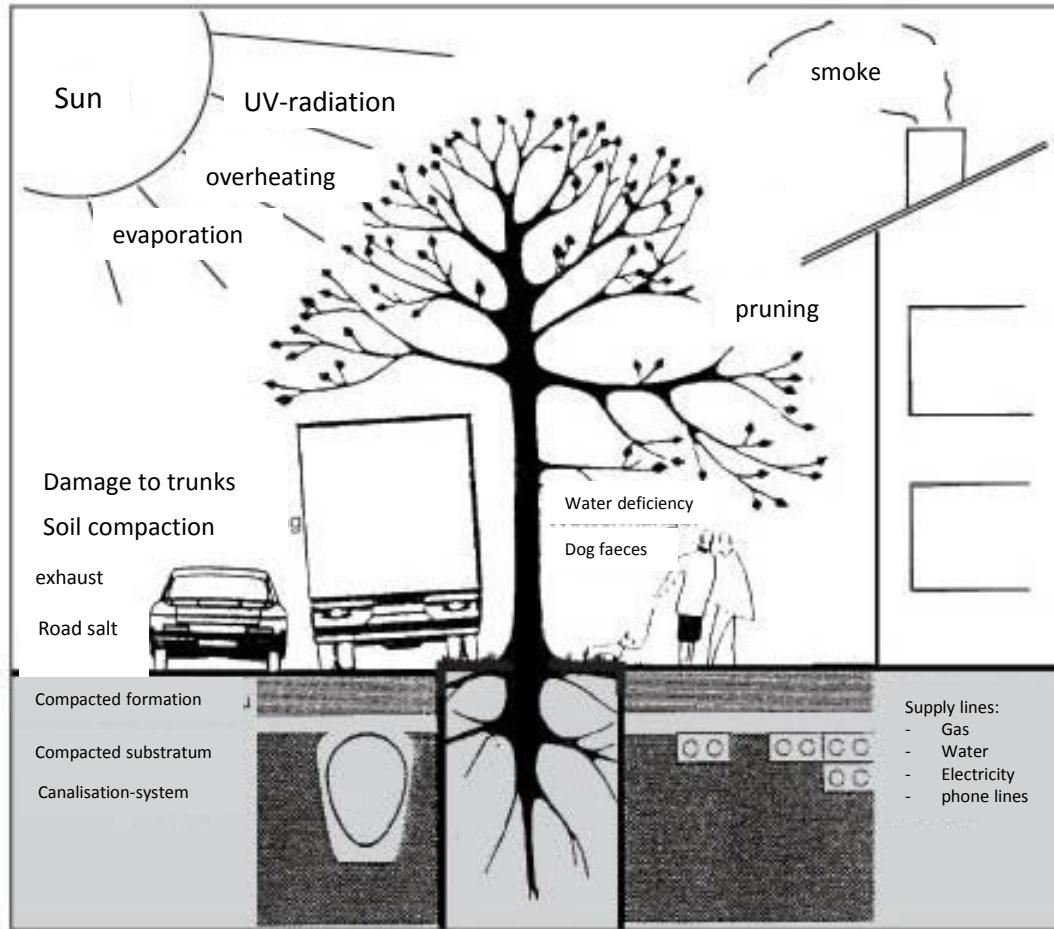
- Arborists
- urban planners and ecologists
- Architects and landscape architects
- Structural and environmental engineers
- And (!) an informed public

Urban green spaces may be improved upon when all stakeholders contribute their unique experiences.

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www.stuttgart.de/item/show/13495

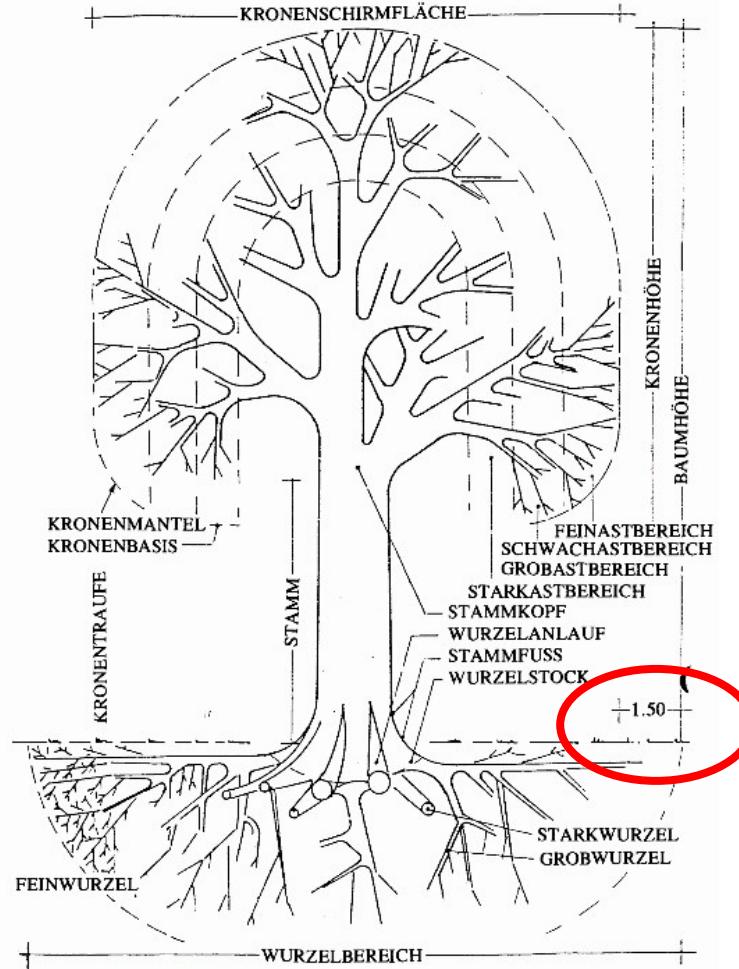
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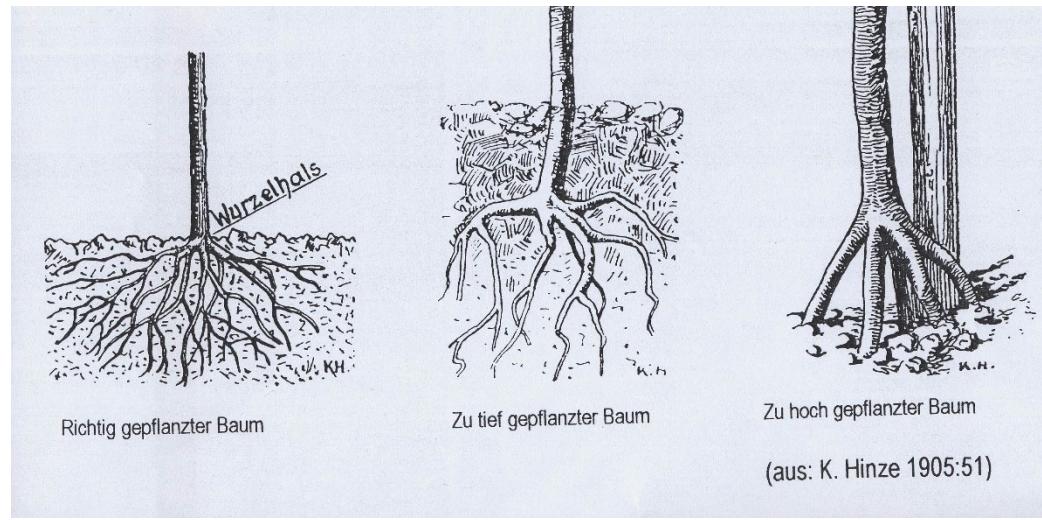
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TEILE DES BAUMES
SCHEMATISCHE DARSTELLUNG





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Strengthening the vitality of urban trees

The difficulties of urban trees

- Trees found in parks and streets can not unfold their full potential
- Trees only reach up to 25% of their potential age
 - On average 40 years
 - Problematic as trees only unfold their full ecological potential at the age of around 50 years
- In particular Cities (“heat islands”), with elevated day- and nighttime temperatures (+5 °C), elicit latent heat stress upon urban trees – this in turn decreases the resilience to other stress factors (e.g. invasive species)
- urbanization, increase of agglomeration surfaces
(Increase of settlement area of approx. 586 km² in CH between 1979 and 2009)
- Due to maintenance and security checks the costs for a single tree increase with age

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Urban trees are situated within a dynamic environment

- The lifecycle of a tree surpasses that of urban infrastructure
- Compaction does not solely occur above ground
- Modern engineering practices provide hardly any space for root-growth;
- Trees are often situated within engineered constructions (roads, sidewalks, along bicycle paths, parking spaces, bridges, cable routes, noise barriers etc.)
- Strong compaction due to pedestrians walking over the root area, vibrations and tremors caused by traffic
- What can we do?

Strengthening the vitality of urban trees

Possible Solutions

Benefits of Ecosystem Services

- Informing the population as well as politicians about the importance of urban green spaces and the services they provide
- There are comparably few studies on the ecosystem services provided by urban trees
- Urban green spaces (especially urban trees) provide many service almost for free

Plant systems with woody and perennial plants

- Vegetation-technical solutions, that consider the challenges within urbanized spaces

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Vitality of urban trees

ES - Ecosystem Services provided by mature trees

It is crucial to have a better understanding of the overall value of urban trees which offer:

- increased canopy (leads to an exponential increase in the essential ES benefits)
- greatly increased biodiversity benefits (increased habitat for birds/pollinators)
- socio-economic value provided by old trees (meeting point, aesthetics)

Therefore we need to improve our urban tree management in order to protect, preserve and maintain mature urban trees

Strengthening the vitality of urban trees

ES – Ecosystem Services provided by urban Green

Regulating	Provisioning	Cultural	Supporting (Intermediate)	Disservices
Air purification	Woodfuel	Health	Habitats for species / biodiversity	Decrease in air quality
Carbon storage and sequestration	(Biological / genetic resources)	Nature / landscape connections	(Soil formation)	Blocking of light / heat
Noise mitigation	(Food)	Social development/ connections	(Nutrient cycling)	Damage to infrastructure
Storm water regulation		Education/ learning	(Water cycling)	Fruit and leaf fall
Temperature regulation		(Economy)	(Oxygen production)	Fear (stimulation of)
(Disease / pest regulation)		Cultural significance		Allergies (stimulation of)
(Pollination / seed dispersal)				
(Soil protection)				

Vitality of urban trees

ES - Ecosystem Services provided by urban green

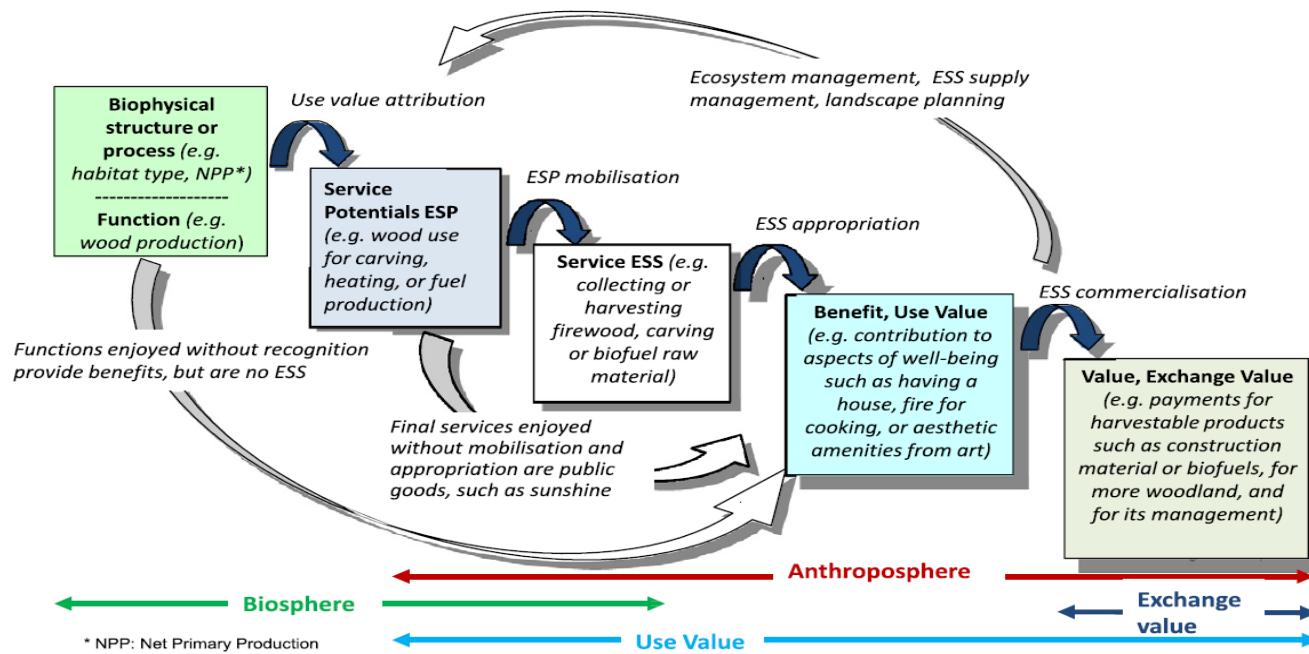


Fig. 3. Different flows exist between the biosphere and the anthroposphere, not all of them ecosystem services as described here. Beneficial functions not recognised as such are no ESS, and final services without human co-production, usually providing public goods, are a different kind of ecosystem services. Within the anthroposphere the scheme allows locating the domains exchange value and use value (in classical terminology), and their overlap.

What is the achievement of urban trees?



Biodiversity – London's trees support and are closely associated with a wide range of priority species such as all bat species, birds like barn owl, butterflies like purple emperor, other insects like stag beetle, and fungi like oak polypore.



Trees prevent
10x

the volume of water in the Serpentine from entering London's drainage system. This helps reduce the risk of localised flooding.



kompenziert den jährlichen
Stickoxid-Ausstoss

Von **1'100** Diesel km

Strengthening the vitality of urban trees (vegetation systems)

- Wooded plant systems
- Nature provides the correct model
- At least 20 species within a plant system
- Of which 20 species are situated beneath the trees = stable plant system
- Wooded plants and shrubs are combined with perennials
- There is no single solution

Strengthening the vitality of urban trees (vegetation systems)



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Strengthening the vitality of urban trees (vegetation systems)



Alcea rosea was planted by a guerilla gardener throughout the city of Zurich

Its capacity for strong root growth loosened the soil and enabled urban trees access to oxygen within the root area.

Trees adjacent to Alcea show an improved and overall quicker growth.

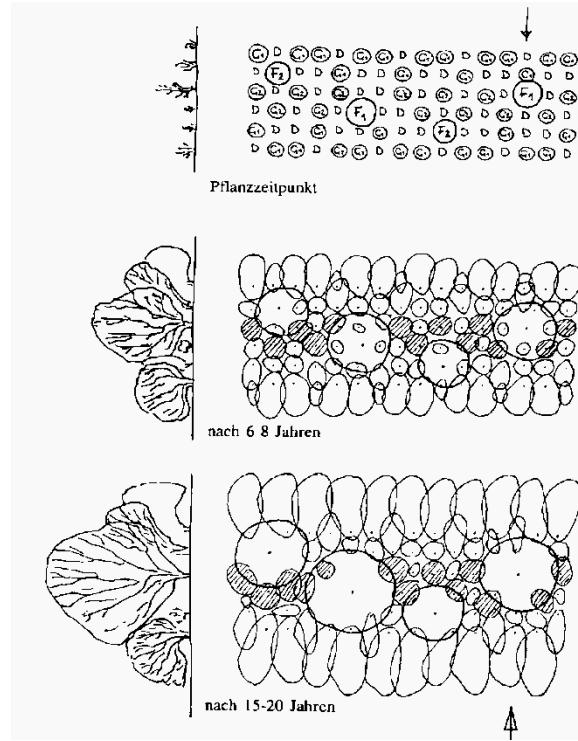
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Strengthening the vitality of urban trees (vegetation systems)



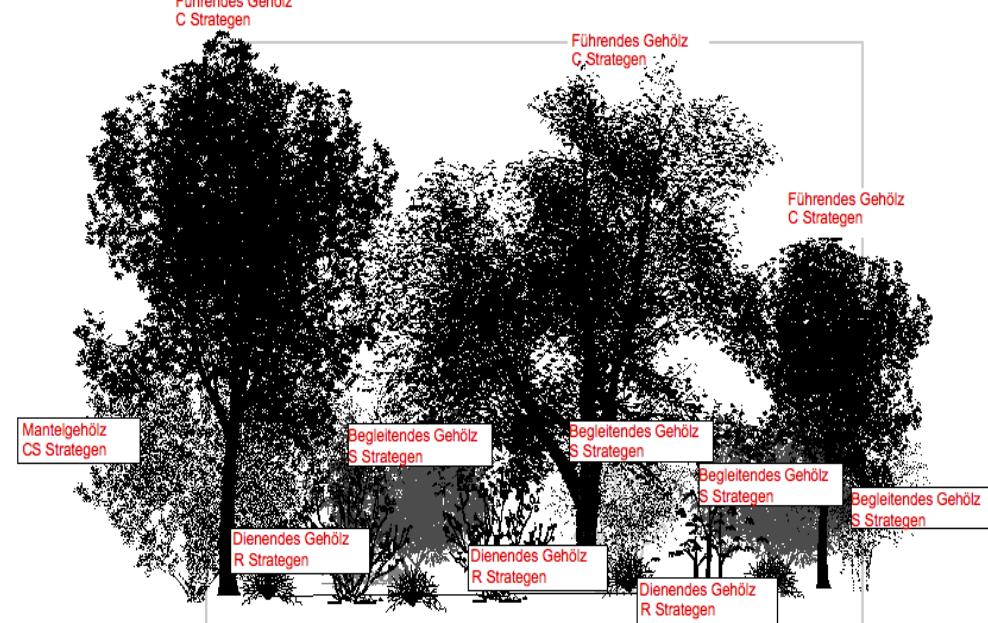
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Why vegetation systems?

- A system can protect the tree around the stem and within the root area
- It insures that microorganisms can colonize the soil
- Root systems ensure that the soil is aerated
- It prevents the excessive compaction of the soil layer and insures that it retains a sufficient amount of water.
- Ideally the system should function within itself and should thus keep maintenance costs low

Strengthening the vitality of urban trees (vegetation systems)



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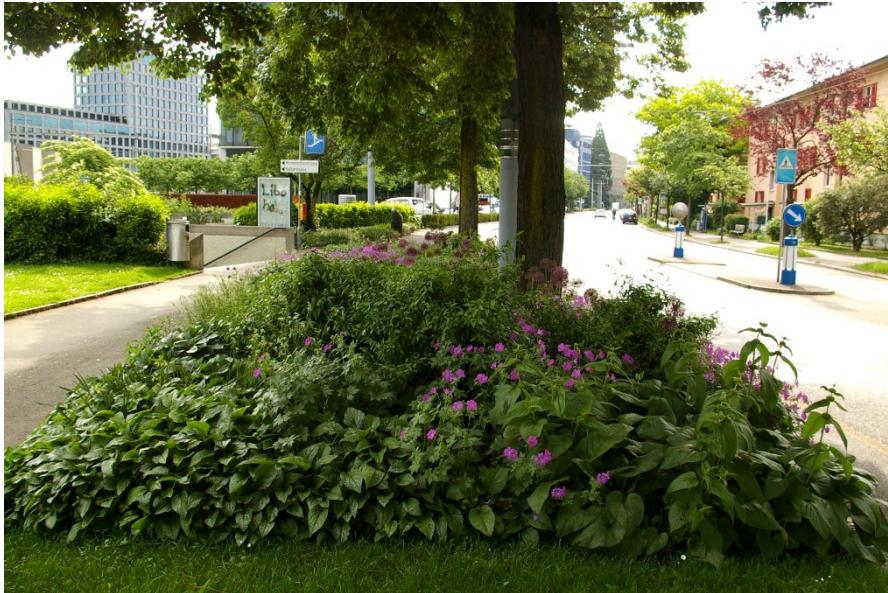
Strengthening the vitality of urban trees (vegetation systems)



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Strengthening the vitality of urban trees (vegetation systems)



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Plant systems – Turbinenplatz Zurich

The “Turbinenplatz” within the heart of Zürich:

- New urban development project within the former industrial zone
- The square was redone in 2003
- The trees were planted within a waterbound flooring, without sufficient root area within a compacted substrate
- In 2009 the trees were at risk to die

Plant systems – Turbinenplatz Zurich



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Plant systems – Turbinenplatz Zurich



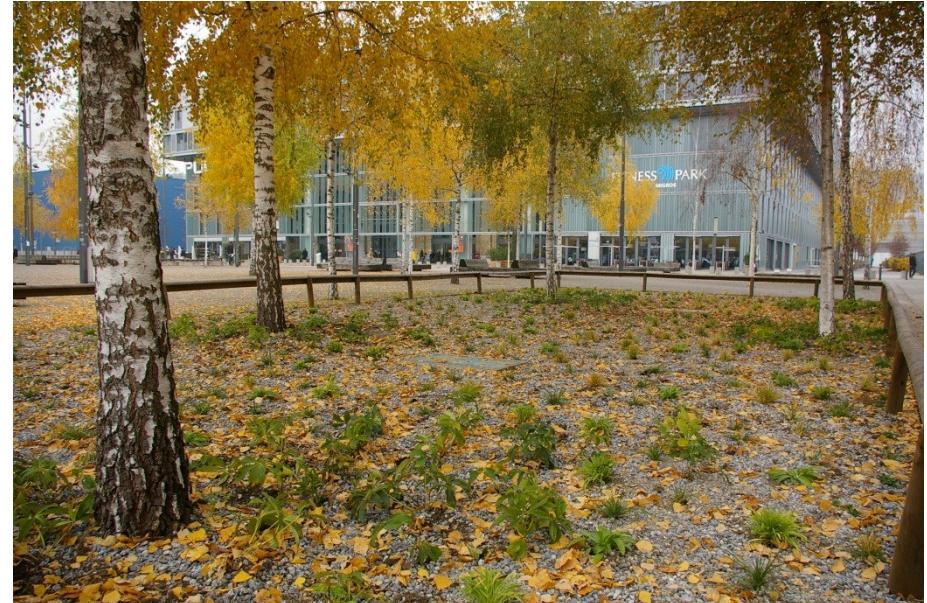
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Plant systems – Turbinenplatz Zurich



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Plant systems – Turbinenplatz Zurich



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Plant systems – Turbinenplatz Zurich



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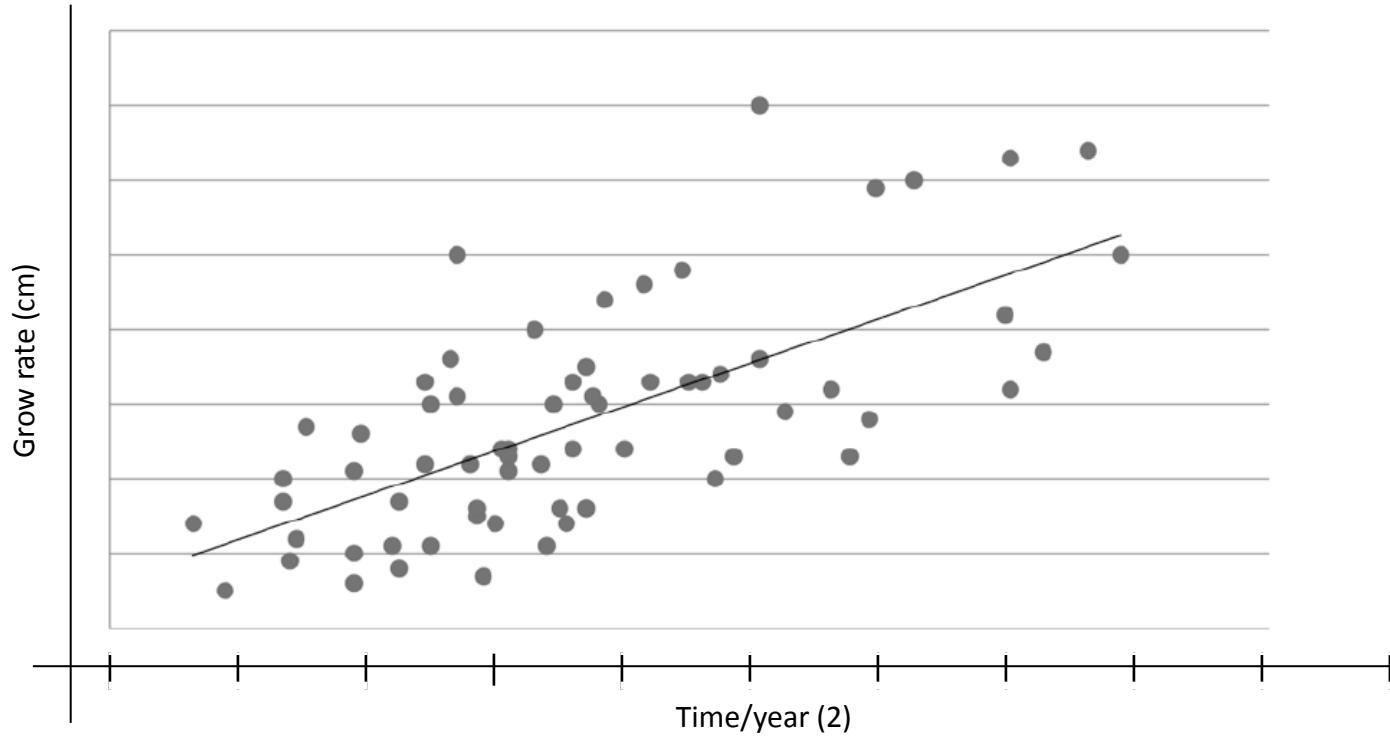
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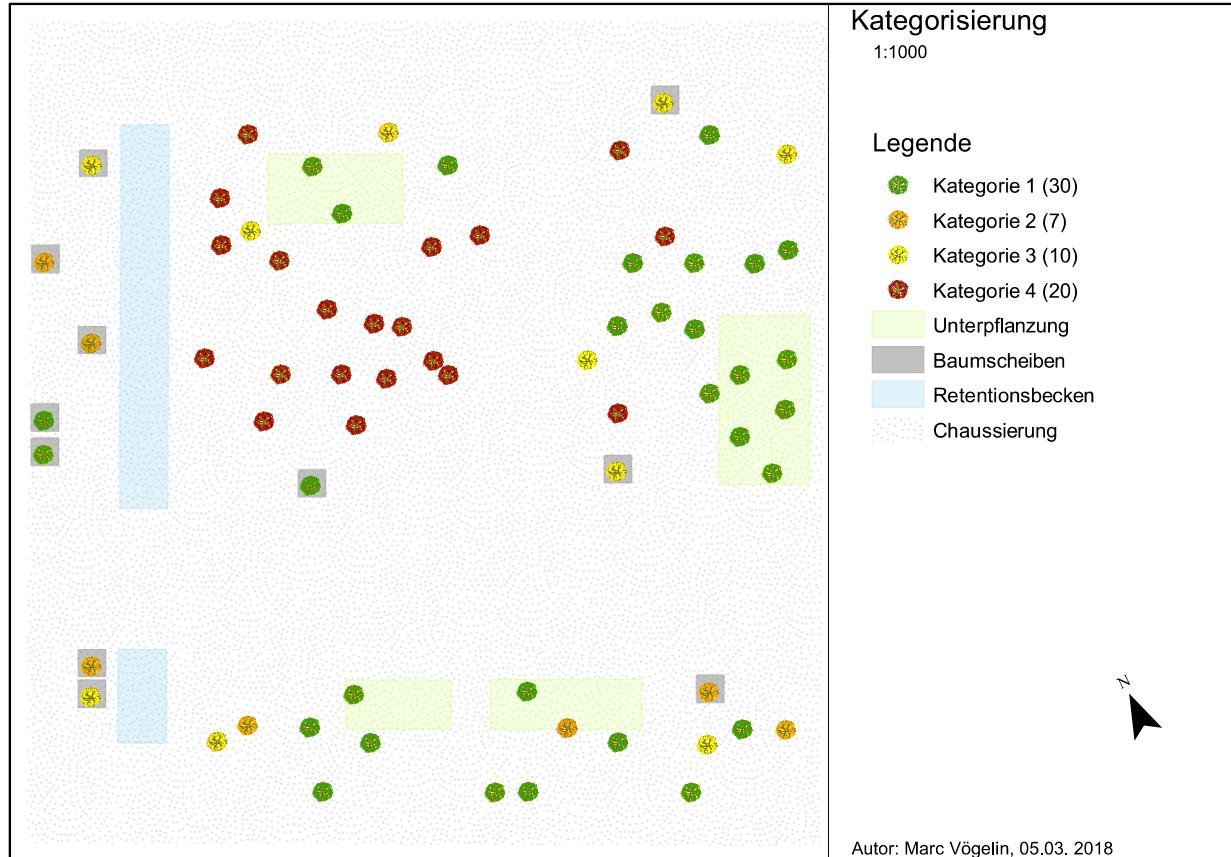
Plant systems – Turbinenplatz Zurich

- Birches naturally form shallow growing root systems that directly profit from the shrubberies activities
- Over the span of 10 years the trees have shown;
 - An improvement in vitality
 - An increase in annual growth
 - An increase in girth
 - An improvement in phenology

Plant systems – Turbinenplatz Zurich



Plant systems – Turbinenplatz Zurich



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