

# EVALUATING CLIMATE-RELATED ECOSYSTEM SERVICES OF URBAN TREE STANDS IN SZEGED (HUNGARY)

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# Main groups of ecosystem services

## Provisioning services

- food production
- drinking water
- pharmaceuticals
- energy
- building material

## Supporting services

- soil formation
- nutrient cycling
- primary production

## Regulating services

- climate regulation
- water purification
- flood control
- erosion protection
- pollination

## Cultural services

- recreation, ecotourism
- spiritual inspiration
- scientific value
- etc...

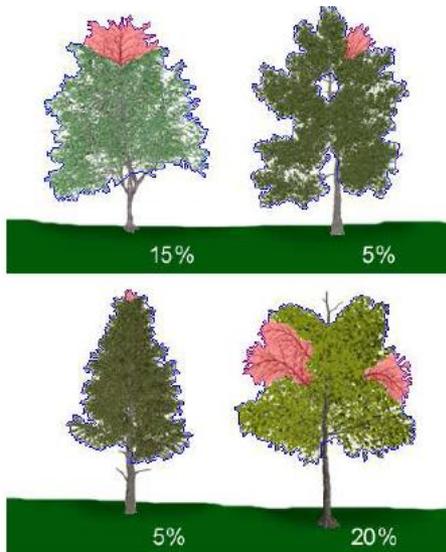
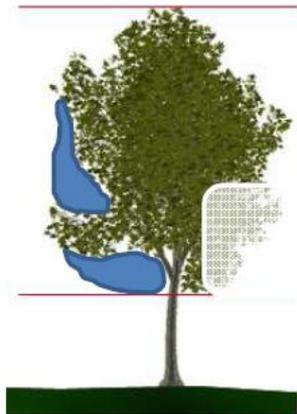
# Methods and study area (I.)



## Field tree cadastre (Greenformatic)

missing

dieback



25%

$h_{tree}$   $h_{trunk}$  DBH  $d_{crown}$

The screenshot shows the Greenformatic software interface. The main window displays a map of the city center with tree inventory data. The map is divided into several zones, each labeled with a code (e.g., VK01, VK02, VK03, VK04, VK05, VK06, VK07, VK08, VK09, VK10, VK11, VK12, VK13, VK14, VK15, VK16, VK17, VK18, VK19, VK20). The map is overlaid with a grid. The interface includes a control panel on the right with various icons and buttons, such as 'Szerviz', 'GPS beállítás', 'Teljes térkép (F1)', 'Nagyítás (F2)', 'Mozgatás (F3)', 'Kiválasztás (F4)', 'Új fa felvétele (F5)', 'Fa adatai (F6)', 'Térkép nyomtatása', 'Térkép képbe', 'Szinkronizáció', 'Listák', 'Program frissítés', and 'Kilépés'. The status bar at the bottom shows coordinates (X: 731649,12 | Y: 98502,19), zoom level (Zoom: 0,0225 | ZoomEx: 0,3378), and other system information.

complete tree inventory of the city centre (3000 trees), individual level assessments



# Methods (II.)

## i-Tree (Eco, Streets, Hydro, Design)

(UFORE model)



- **UFORE-A: Anatomy of the Urban Forest**  
species diversity, leaf area, leaf biomass, etc.
- **UFORE-B: Biogenic Emissions**  
volatile organic compounds can contribute to the formation of  $O_3$  and  $CO_2$
- **UFORE-C: Carbon Storage and Sequestration**  
allometric equations, average standardized growth rates, calculating with decomposition
- **UFORE-D: Air Pollution Removal**  
detailed quantification of deposition velocities for different pollutants, LAI



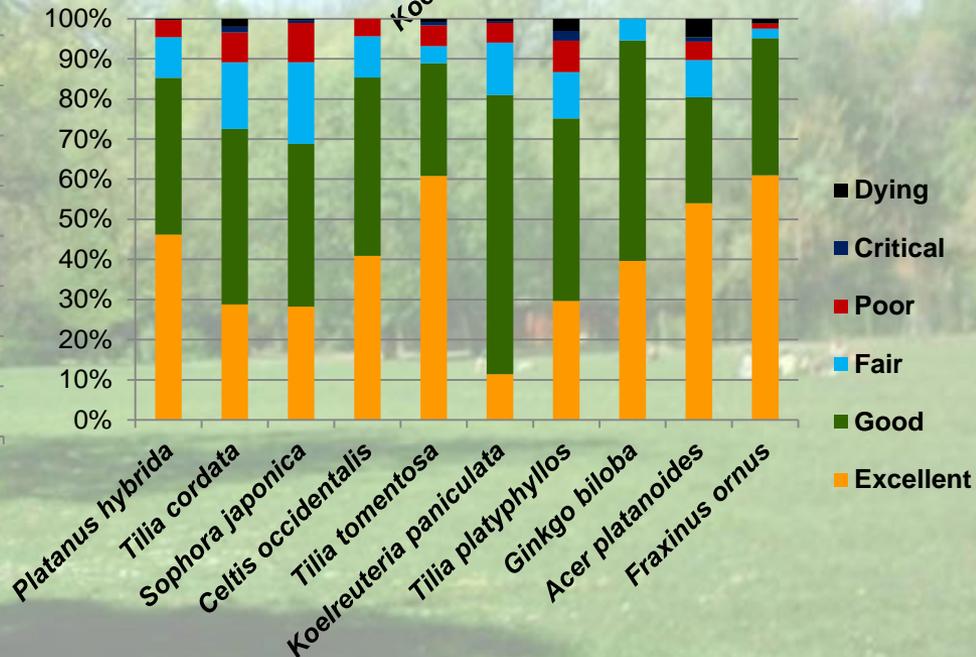
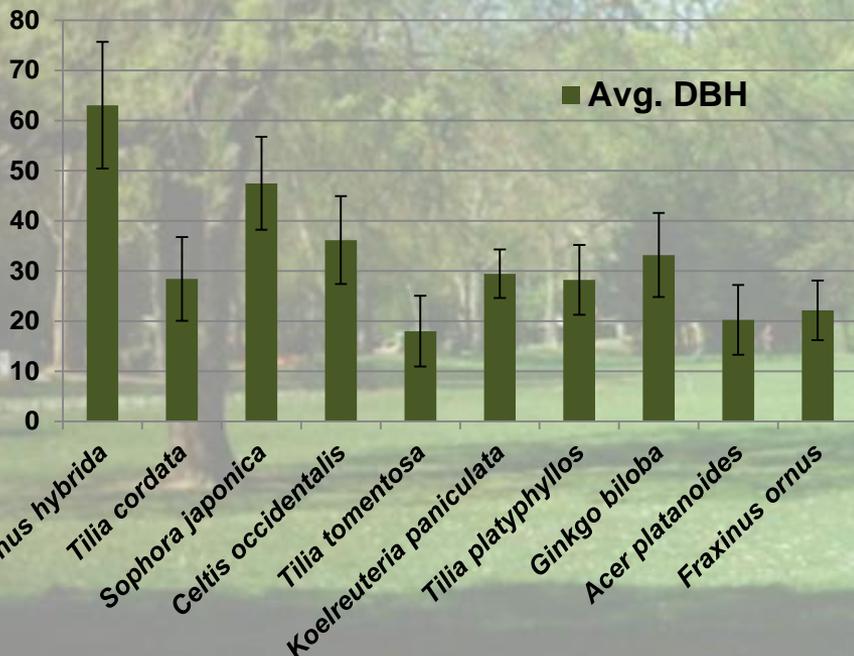
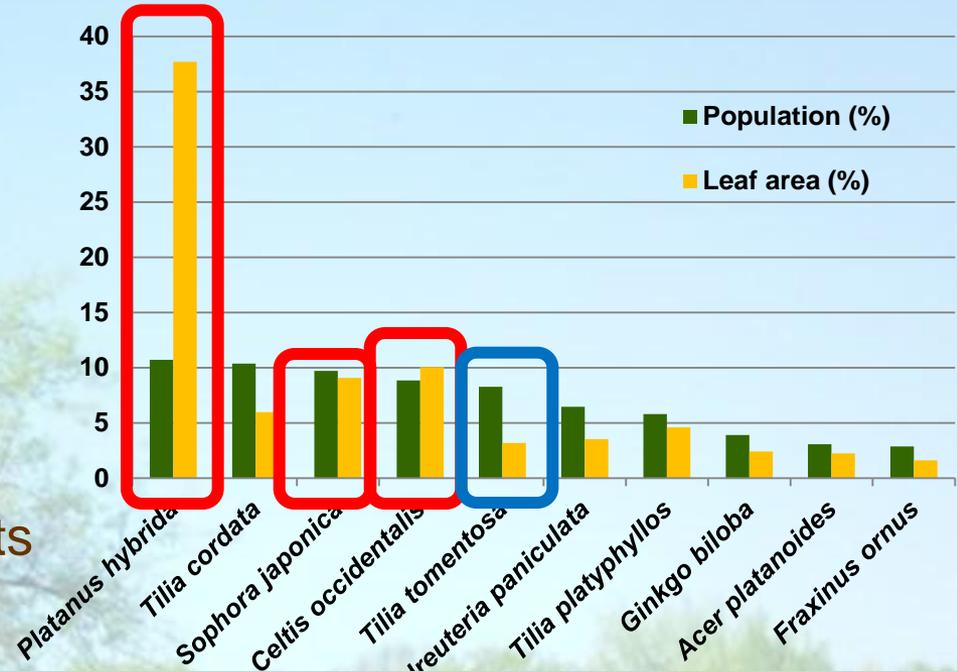
# Results I.

## Structural attributes

high species diversity (~100) → ES diversity

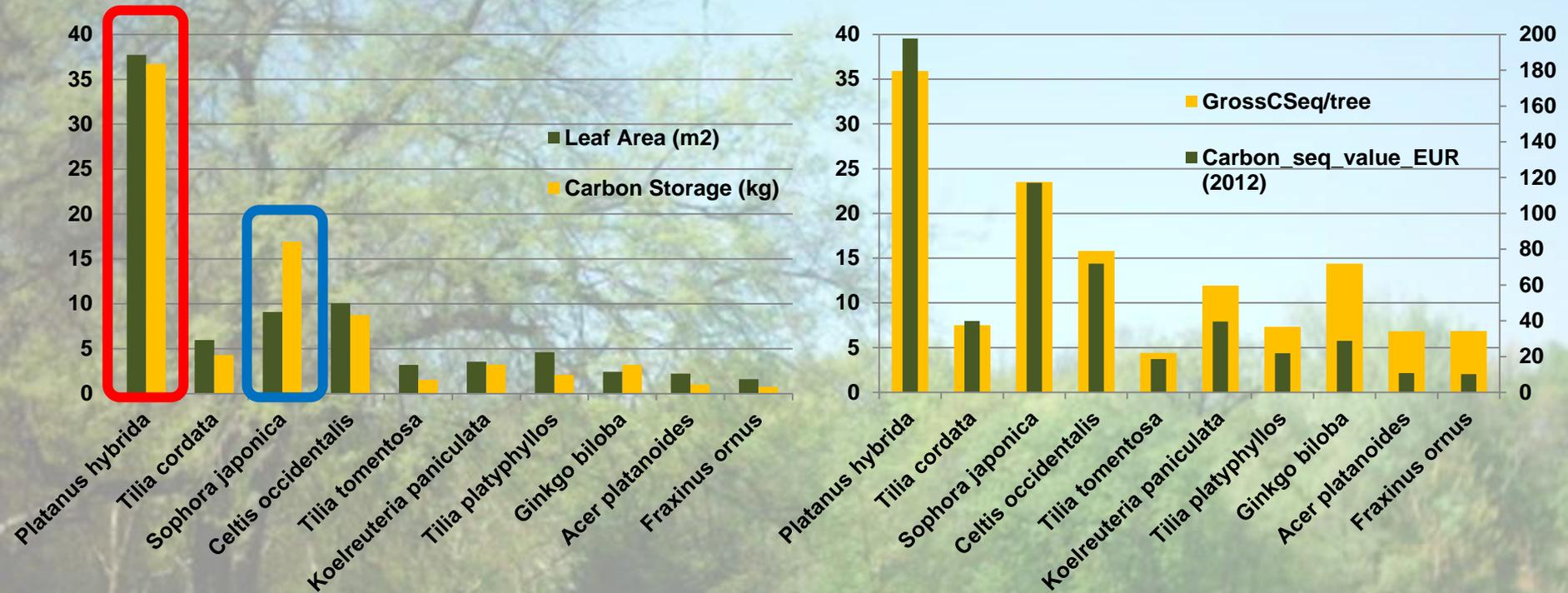
species ~ equal age → facilitate ES quantification in wider assessments

varying tree condition



# Results II.

## Carbon storage and sequestration



urban trees may sometimes store more carbon than in natural/near-natural forests

old-growth trees have a major role in carbon storage

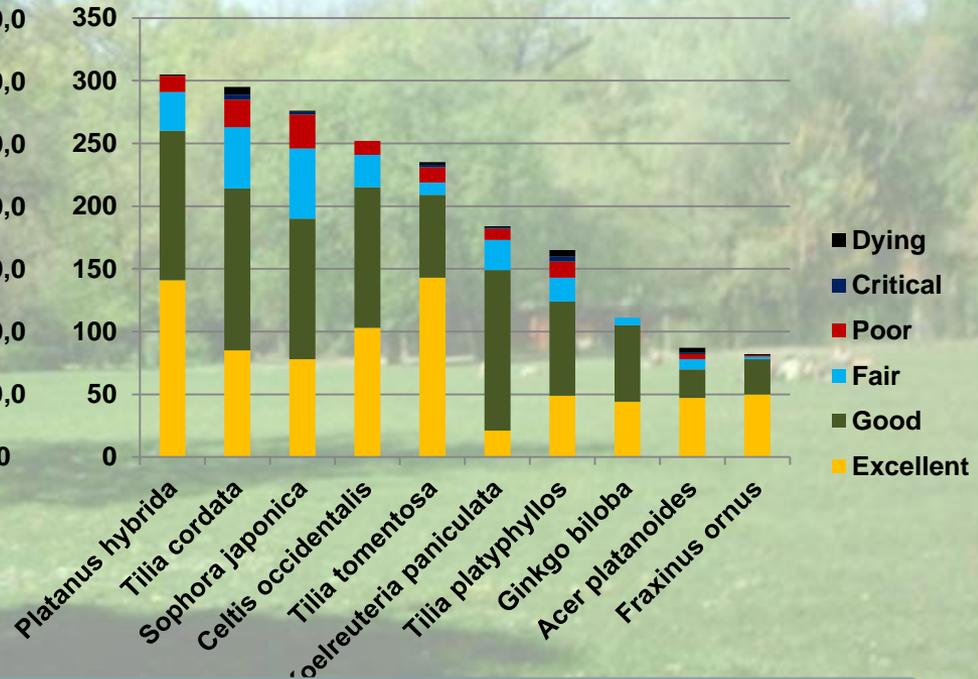
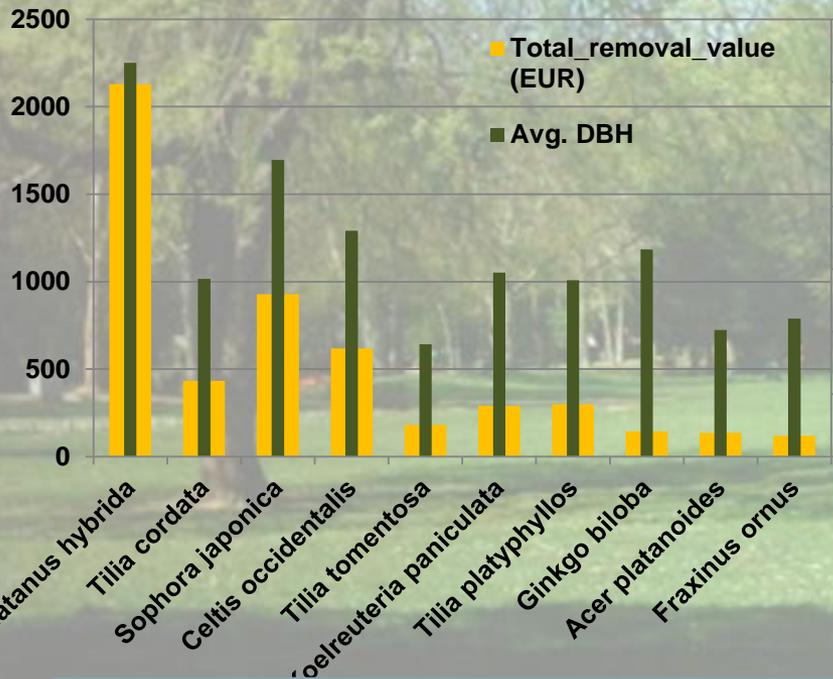
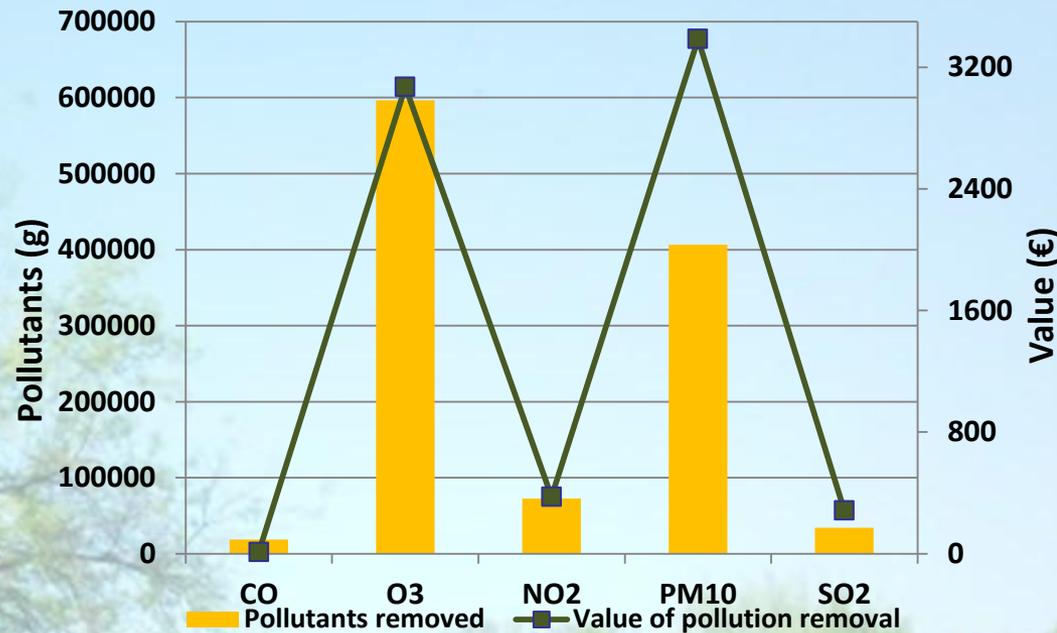
easy to incorporate in city climate strategies

# Results III.

## Air pollution removal

removal of traffic-related pollutants is dominant

service provision is resultant of structural attributes and tree condition



# Results IV. - Conclusion

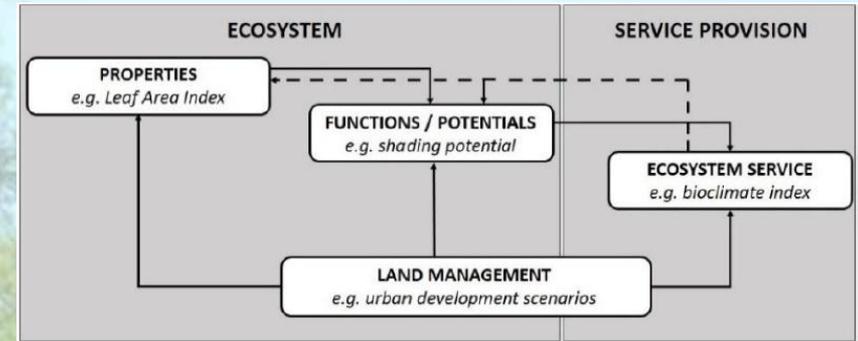
## Benefits and costs

Total cost of tree management (~3000 individuals): ~20300 €/year

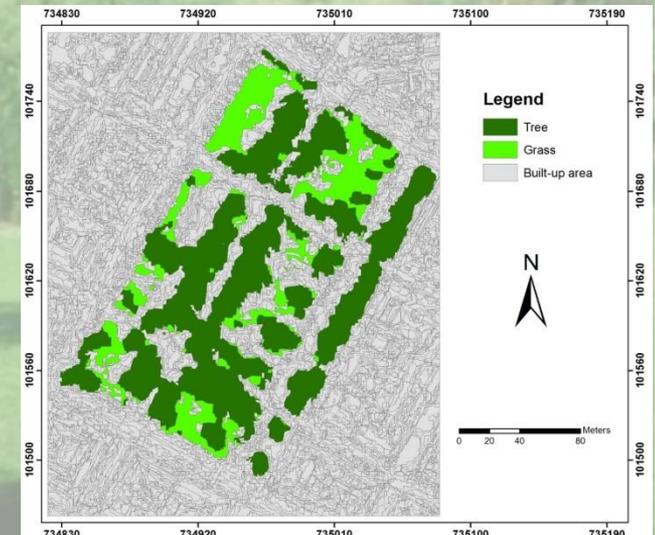
! Monetary value of the two investigated services: ~7846 €/year

## Conclusions

- individual-based investigations are necessary baseline data for several types of urban ES assessments
- species selection should take tree condition into account
- ES assessments are effective tools to enforce interests of urban climatology



## Ongoing work



# THANK YOU FOR YOUR ATTENTION!

**Ágnes Gulyás**



**Márton Kiss**



**Ágnes Takács**

