From big data to micro morphology: an experimental approach to ecosystem services calculation

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The great amount of field work required to collect vegetational data for the calculation of ecosystem services, often hinders the possibility to investigate other parameters involved. This pilot study faced this issue by (I) exploring the potential of open data to calculate the ecosystem services provided by the urban vegetation, in terms of air pollution removal; (II) reworking vegetational data and ecosystem services in a website accessible and comprehensible to the public; (III) integrating the results with measurements on the field. To do so, the arboreal vegetation of the ring road around Bologna city centre was analysed using the software iTree-Eco. Vegetation data supplied to the software were either downloaded from the open data portal of the municipality, or calculated in QGIS on recent orthophotos. Hence, iTree estimated the potential air pollutant removal for each species. Eventually, those indicated by the software as the most efficient species were furtherly investigated with an empirical approach, evaluating their photosynthetic efficiency and leaf micromorphology as proxies for their capability to remove gaseous and particulate pollutants, respectively. These data were compared with plants of the same genera or species grown in a green area nearby (the Botanical Garden). While the photosynthetic efficiency, calculated as Fv/Fm, did not show any significant difference between the Botanical Garden and the roadside vegetation, the stomatal density of some species from the ring road resulted significantly higher (p-value<0.05) than those of the Botanical Garden, an unexpected result since stomatal density is thought to decrease with high CO_2 levels and drought stress. Differences in trichome density and waxes texture between individuals from the two areas were investigated as well.
Summarising, this study demonstrated the potential of open data for the analysis and dissemination of the ecosystem services provided by the vegetation, and integrated iTree results with empirical observations.