AIRFRESH

Newsletter #4

Editorial

We are pleased to present the second Newsletter of the project **AIRFRESH "*Air pollution removal by urban forests for a better human well-being*"**. The main objectives, core actions, and performed activities are presented here.

The Project Team

Project objectives and main actions

AIRFRESH aims to: 1) measure the air pollution removal capacity by trees within a reforested test area in both cities; 2) estimate and quantify the environmental and health benefits provided by urban trees at city scale; and 3) propose **recommendations for reforestation policies** (e.g., list of efficient plant species, number to be planted) for attainment of the air quality standards in both cities.

FlorTree: A unifying modelling framework for estimating the species-specific pollution removal by individual trees and shrubs

Aim of this paper was to develop a new unifying modelling framework (**FlorTree**) for assessing the species-specific balance of ozone O_3 (by summing up potential O_3 formation based on emission of biogenic volatile organic compounds (VOCs), and surface and stomatal deposition of O_3), the total removal of nitrogen dioxide ($NO_{2)}$, the deposition of coarse particles ($PM_{10)}$, and the uptake and storage of carbon dioxide (CO_2)for mature woody plant individuals grown in healthy and isolate conditions. This modelling approach was firstly applied to a case study in Florence (Italy) and allowed to

categorise more than 200 species (trees and shrubs) based on their air pollution improvement capacity.

Selection of the plant species

For each species, a score was assigned to synthesise their ability to remove air pollutants. The ranking was obtained starting from the database and calculating the average removal or abatement value for each pollutant. A score of 0, 1, 2, 3 was assigned when values were ≤ the 25th percentile, between 25th and 50th percentile, between 50th and 75th percentile, ≥ 75th percentile, respectively. The final species ranking was obtained by summing up the individual scores for each pollutant, so that a score > 10 means elevated removal ability and a score < 3 means low ability.

Tree species	Removal capacity				
	O3	NO2	PM10	CO2	Carbon stock
Acer campestre					
Acer monspessulanum					
Acer platanoides					
Acer pseudoplatanus					
Acer rubrum					
Acer saccharinum					
Acer x freemanii					
Aesculus hippocastanum					
Aesculus x carnea					
Alnus glutinosa					
Brachychiton populneus					
Carpinus betulus					
Castanea sativa					
Casuarina cunninghamiana					
Cedrus atlantica					
Cedrus libani					
Celtis australis					
Celtis occidentalis					
Celtis sinensis					
Chitalpa tashkentensis					
Cinnamomum camphora					
Corylus avellana					
Corylus colurna					
Crataegus laevigata					
Fagus sylvatica					
Firmiana simplex					
Fraxinus angustifolia					
Fraxinus excelsior					
Fraxinus ornus					
Ginkgo biloba (mâle)					
Gleditsia triacanthos 'Sunburst'					
Jacaranda mimosifolia					
Koelreuteria paniculata					
Lagerstroemia indica					
Liquidambar styraciflua					
Liriodendron tulipifera					
Magnolia grandiflora					
Melia azedarach					
Morus alba 'Fruitless'					
Pinus densiflora					
Pinus nigra					
Pinus pinea					
Pistacia chinensis					
Platanus orientalis					
Platanus x acerifolia					
Prunus avium					
Pterocarya fraxinifolia					
Pyrus calleryana					
Quercus acutissima					

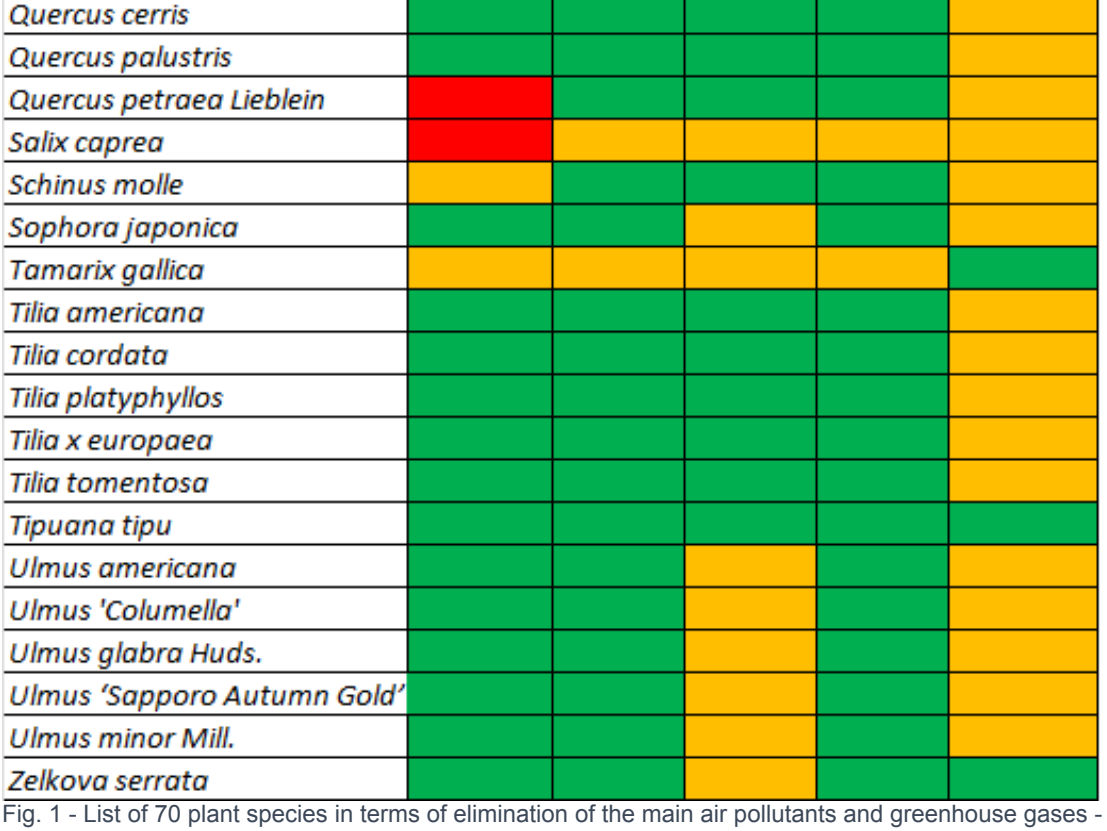

Fig. 1 - List of 70 plant species in terms of elimination of the main air pollutants and greenhouse gases - Ozone (O_3), nitrogen dioxide (NO_2), particles (PM_{10}), carbon dioxide (CO_2): not or little efficient (red), moderately efficient (orange) and efficient (green).

We proved that the newly-developed single-tree FlorTree model is useful for species selection in urban green areas and can be applied to different climate and pollution conditions. FlorTree has the great advantage to be highly species-specific (maximum stomatal conductance, biogenic VOC emission and leaf-trait based deposition velocity) and easy to apply in a given urban context where meteorological data and pollutant concentrations are available. Indeed, FlorTree may be adopted as **decisional tool** by urban planners, landscape architects and authorities to choose the correct species for ensuring better air quality in a given city via the green infrastructure.

In particular, for Florence our results suggest that **24 species offered optimal performances** for air pollutant removal. Among them hardwoods, with large crowns at maturity such as **linden, maple,** and **ash**, are generally better for the removal of gaseous pollutants, while conifers are to be preferred if we have high levels of PM_{10} in the air. Conversely, **Quercus, Populus and Eucalyptus species should be avoided** in areas with high concentrations of O_3 considering their high biogenic VOC emissions. However, we demonstrated that different local conditions of weather and air pollution may change the species-specific responses. For instance, some species, such as Quercus rubra, may show a positive or negative O_3 uptake depending on the local climate. Therefore, planting "**the right species at the right place**" is crucial to maximise an important ecosystem service offered by urban trees such as air pollution removal. Nevertheless, further research and constant updates are needed to improve the knowledge about species-specific input parameters that inevitably can vary according to measuring and climatic situations.

Upcoming events

European Forum on Urban Forestry
24-26 May 2023
Kraków, Poland
https://efuf.org

Partners

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