

Are current models reliable in assessing ecosystem services from urban forests in the Mediterranean?



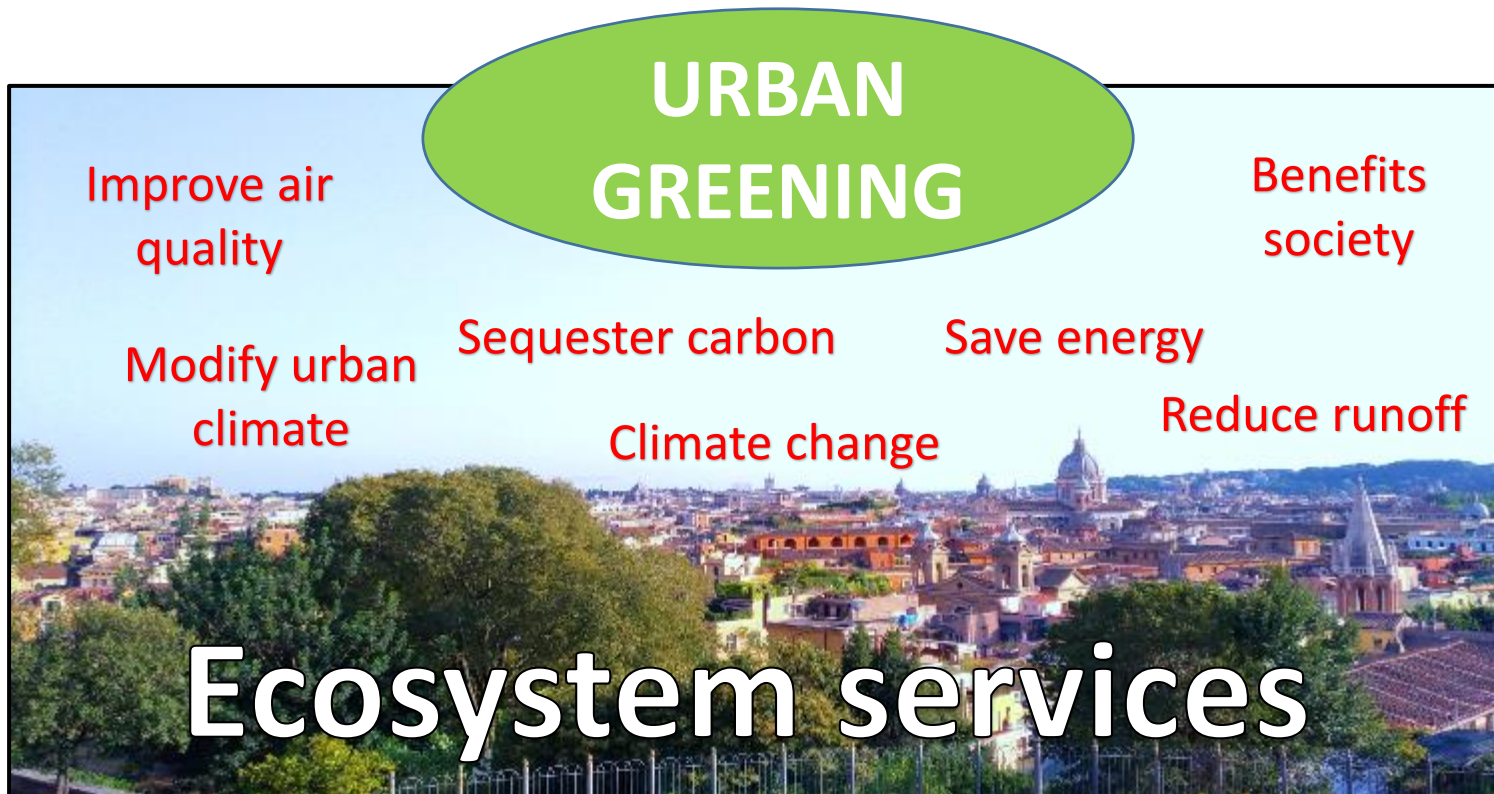
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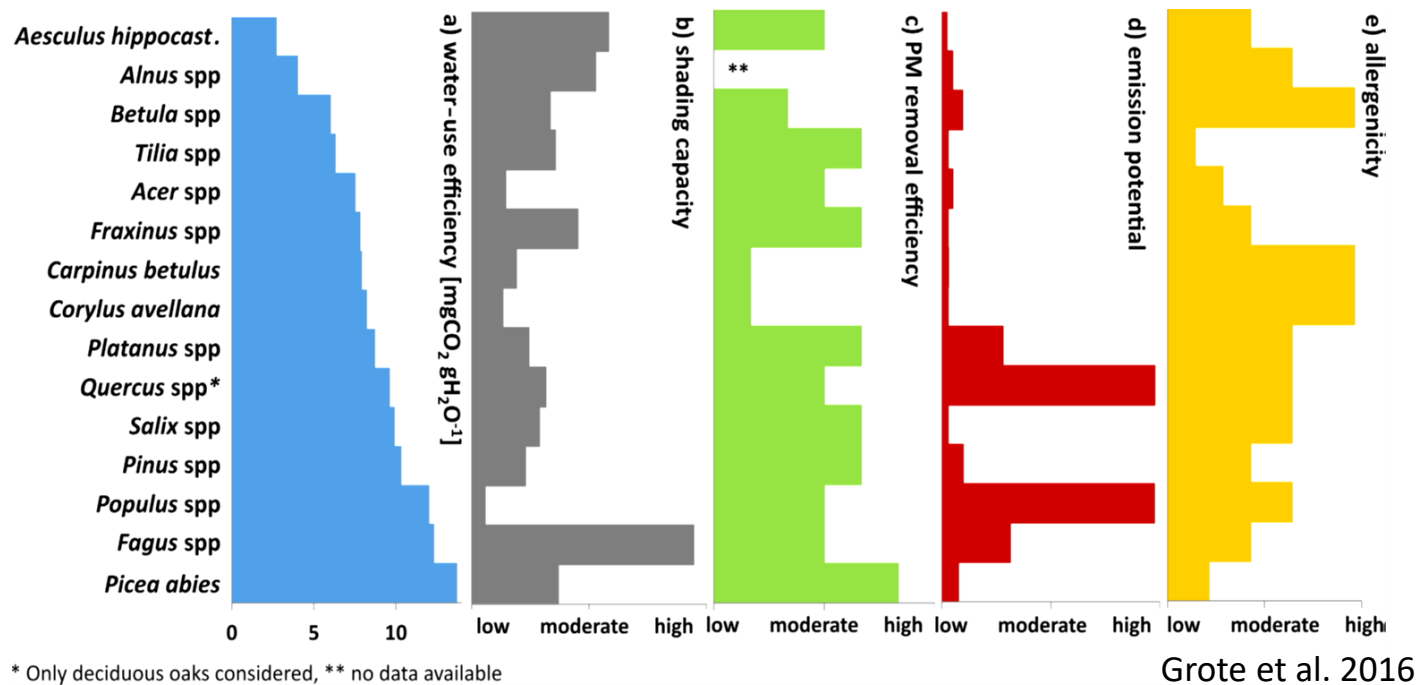
LA FORESTA CHE CAMBIA
Ricerca, qualità della vita e opportunità in un paese in transizione
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INTRODUCTION

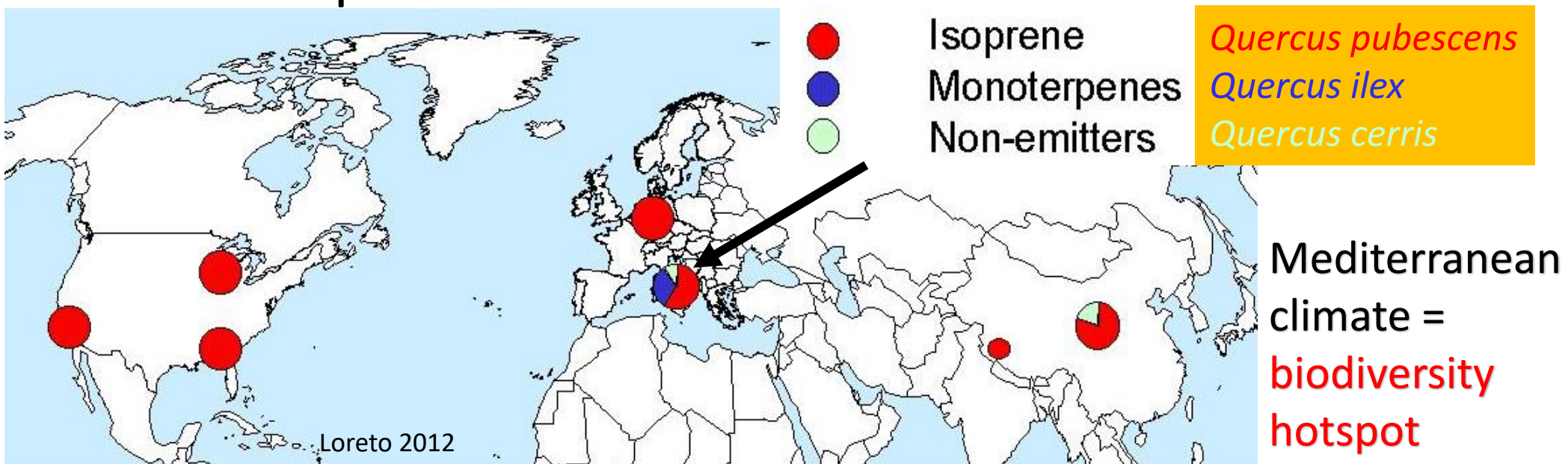


Importance of the species and tree properties to maximize ecosystem services

➔ **MODELING APPROACH**



Different isoprenoids emissions of oaks



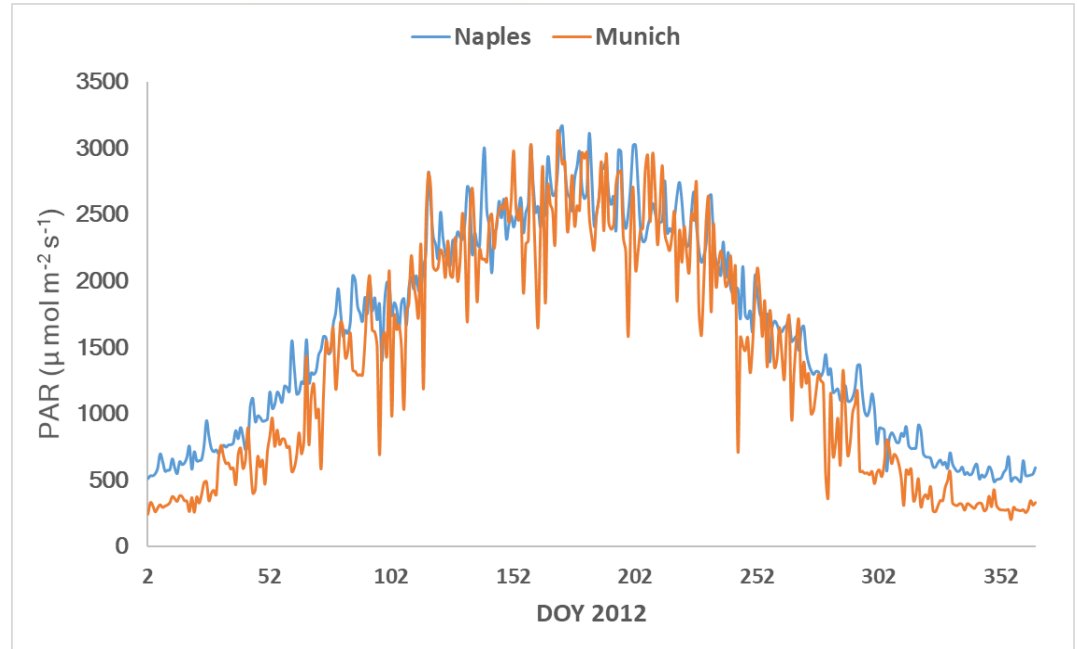
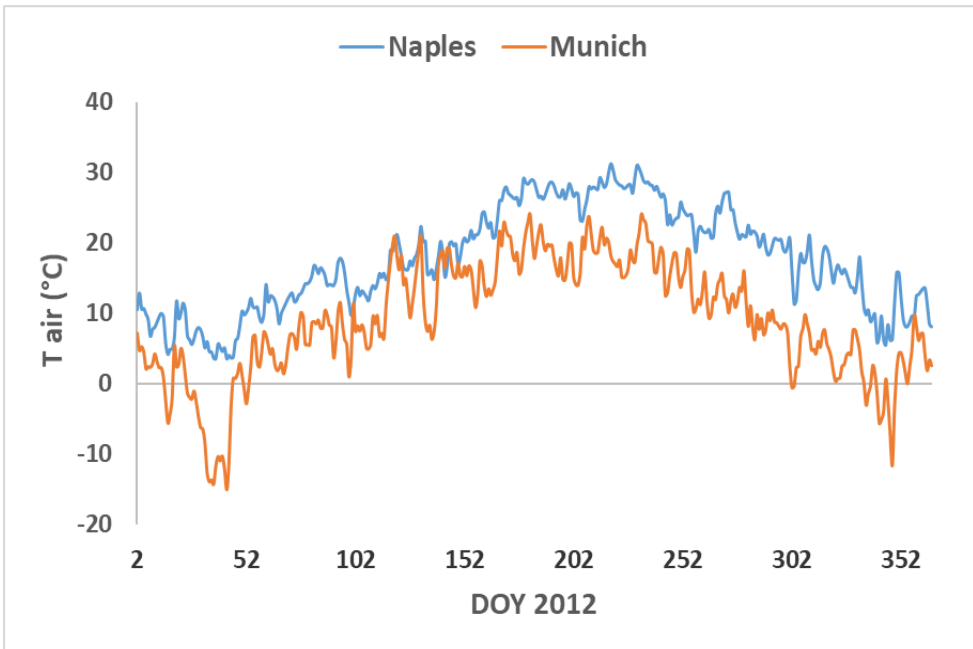
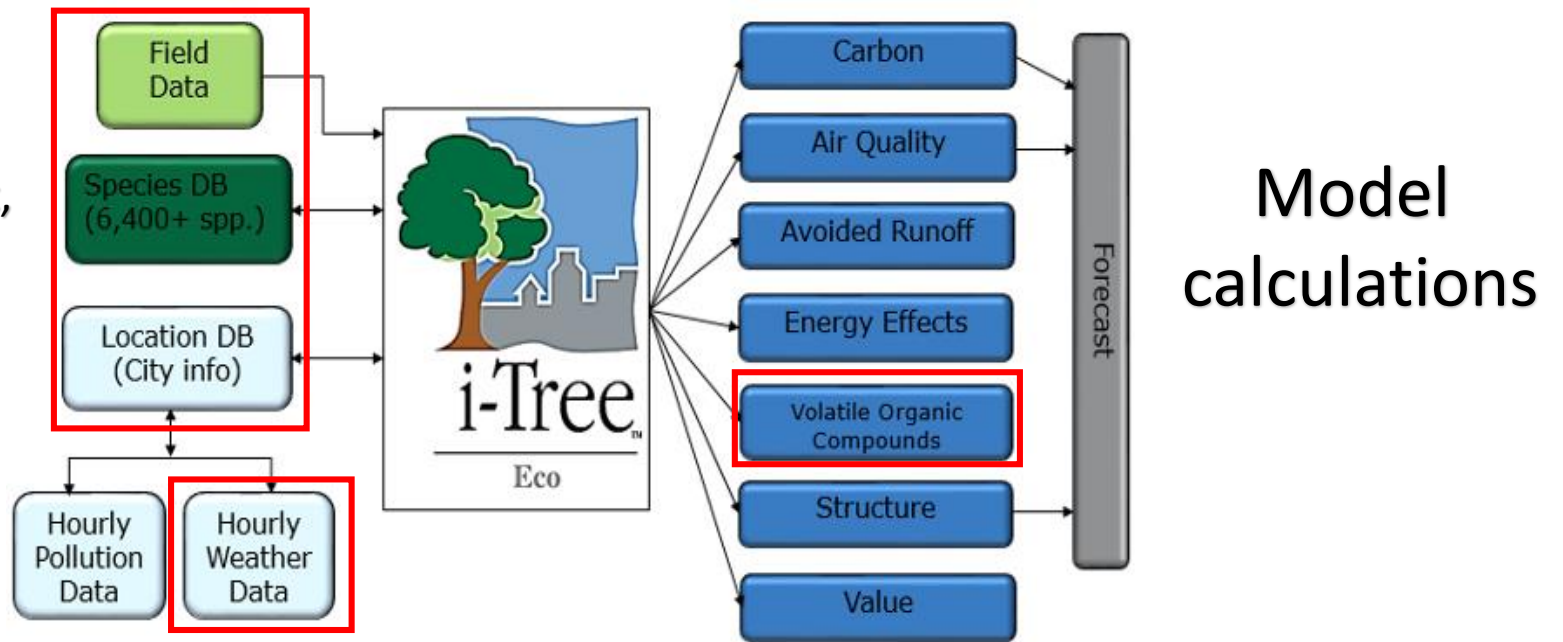
OBJECTIVE: Investigate the sensitivity of the i-Tree model in calculating oaks BVOCs emissions using the city of Naples as study case

- Grote, R., Samson, R., Alonso, R., Amorim, J.H., Cariñanos, P., Churkina, G., Fares, S., Thiec, D. Le, Niinemets, Ü., Mikkelsen, T.N., Paoletti, E., Tiwary, A., Calfapietra, C., 2016. Functional traits of urban trees: air pollution mitigation potential. *Front. Ecol. Environ.*
- Loreto, F., 2002. Distribution of isoprenoid emitters in the *Quercus* genus around the world : chemo-taxonomical implications and evolutionary considerations based on the ecological function of the trait. *Perspect. Plant Ecol. Evol. Syst.* 5, 185–192.

METHODS

Inventory data
(species, DBH, total height, height to live top/crown base, crown diameter...)

Climate data



SIMULATIONS

LOCATION: Naples

YEAR: 2012

WEATHER STATION: Napoli Capodichino (airport)

N° of trees: 9391

- *Quercus spp.* i-Tree emission rate (Iso $E_B = 70$; Mono $E_B = 0.2$)**
- *Quercus pubescens* High isoprene emitter (Iso $E_B = 70$; Mono $E_B = 0.3$)*
- *Quercus cerris* Low BVOCs emitter (Iso $E_B = 0$; Mono $E_B = 0.6$)*
- *Quercus ilex* High monoterpenes emitter (Iso $E_B = 0,1$; Mono $E_B = 43$)*

Biogenic emissions calculation (Guenther approach)

$$E = E_B * LB * C_T * C_L$$

E_B = base emission rate in $\mu\text{gC (g leaf dry weight)}^{-1} \text{ hr}^{-1}$ at the standard temperature of 30°C and PAR flux of $1000 \mu\text{mol m}^{-2} \text{ s}^{-1}$;

LB = leaf dry weight biomass (g)

C_T, C_L = hourly temperature and light correction factors

*Karl, M., Guenther, a., Köble, R., Seufert, G., Leip, a., Seufert, G., 2008. A new European plant-specific emission inventory of biogenic volatile organic compounds for use in atmospheric transport models. Biogeosciences Discuss. 5, 4993–5059.

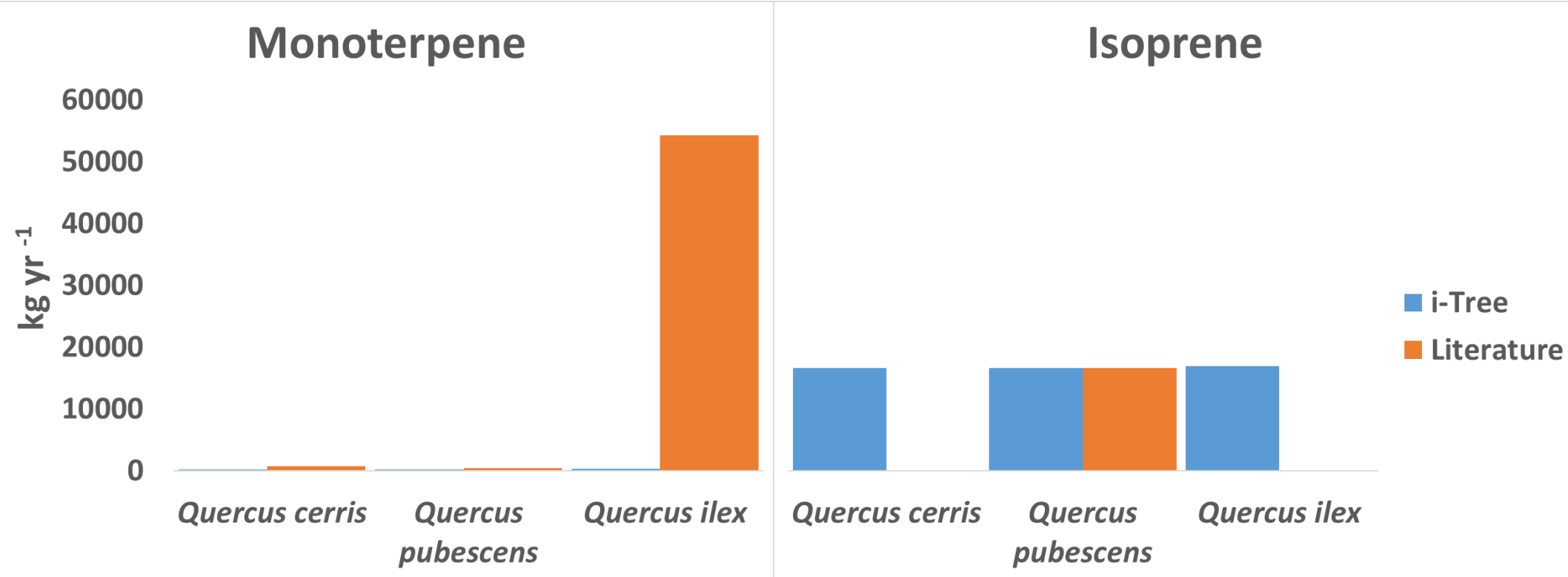
**Nowak, D.J., Crane, D.E., Stevens, J.C., Ibarra, M., 2002. Brooklyn' s Urban Forest. United States Dep. Agric. 107.

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BVOCs model calculation vs literature

Lack of distinction between oaks species in i-Tree



Genus emission factor	SPECIES	i-Tree		Literature	
		Monoterpene (kg yr ⁻¹)	Isoprene (kg yr ⁻¹)	Monoterpene (kg yr ⁻¹)	Isoprene (kg yr ⁻¹)
→	<i>Quercus spp.</i>	234.3	16082.8		
	<i>Quercus pubescens</i>	234.3	16082.8	351.45	16082.8
	<i>Quercus cerris</i>	234.3	16082.8	702.9	0
→	<i>Quercus ilex</i>	252.4	16360.4	54266	23.37

Evergreen oak = emissions throughout the year

CONCLUSIONS

- I-Tree model doesn't distinguish oaks species regarding BVOCs emissions but uses a single emission factor for the *Quercus* genus;
- Considerable uncertainty exists in estimating BVOCs emissions of Mediterranean oaks (*Quercus ilex, cerris*);
- It is necessary to update BVOCs emission factors database for specific oaks species.

Next steps:

- i-Tree application to Rome case of study to test the deposition model sensitivity;
- Update BVOCs emission factors of all species with literature species-specific values as far as possible;
- Validate model results taking into account actual climate and air chemistry.

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