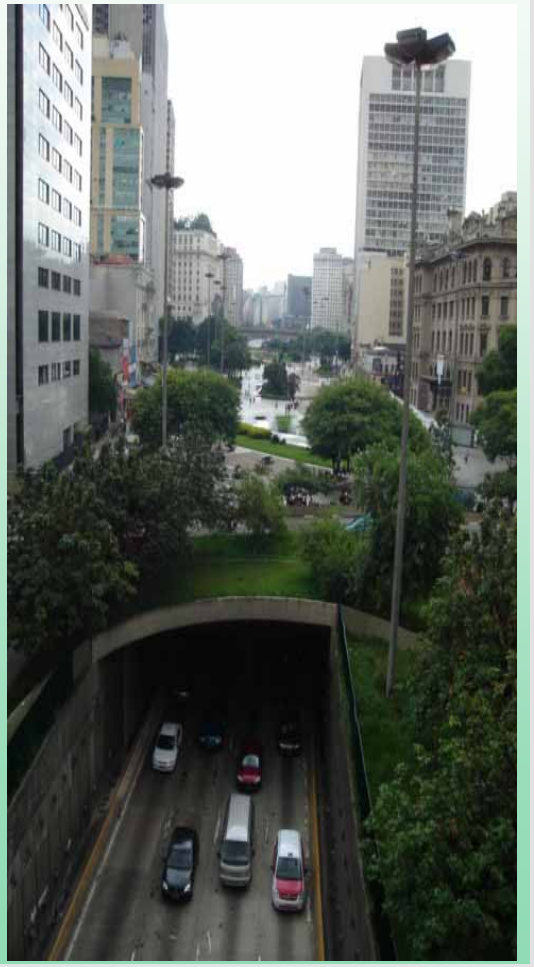
How can Vegetation Impact Air Pollution Control in the Central Valley of Mexico?

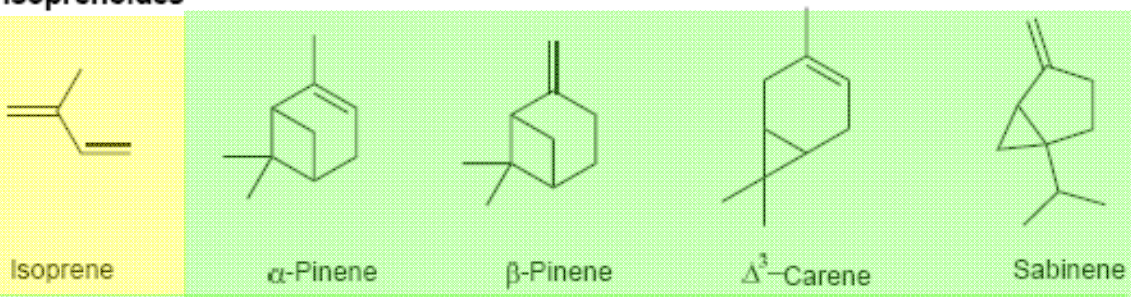
Rainer Steinbrecher

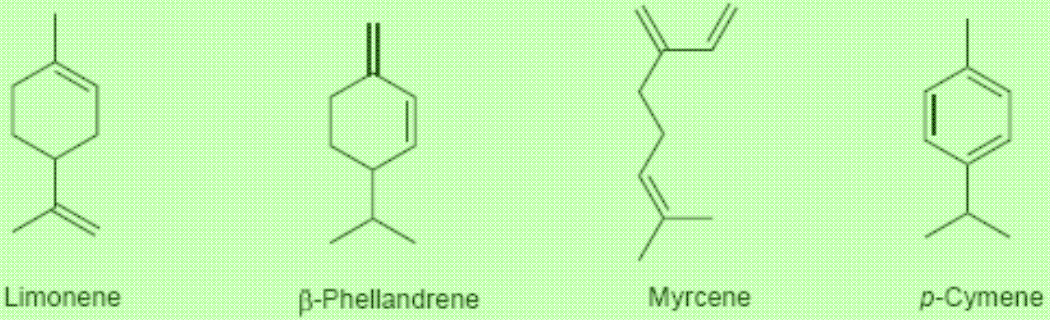
- **Biogenic VOC and Sources**
- **Biogenic VOC and the Atmosphere**
- **Biogenic VOC and Mexico City**
- **Plants and Urban Atmospheres**
- **Synopsis: Plants in Cities**
- **Outlook: Greening Mexico City**

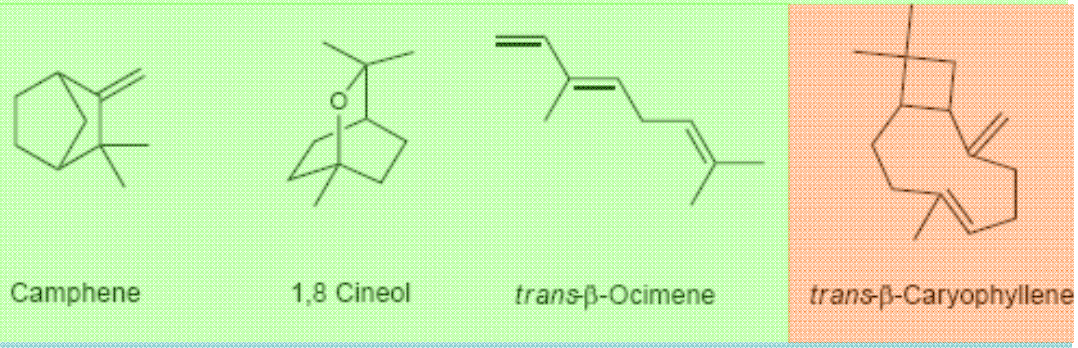


Biogenic VOC and Sources

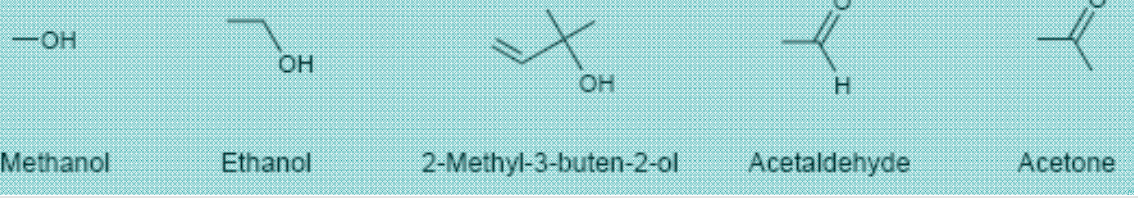
Isoprenoides

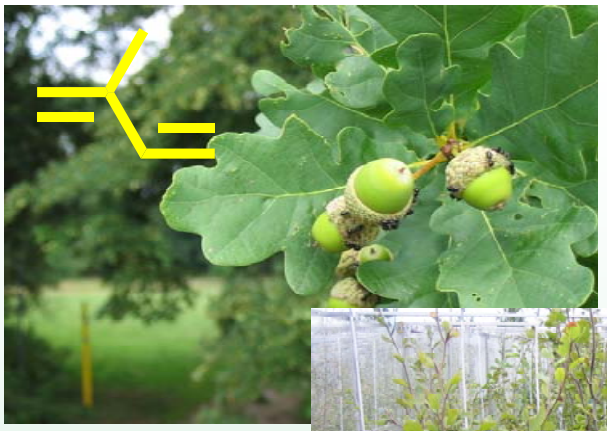


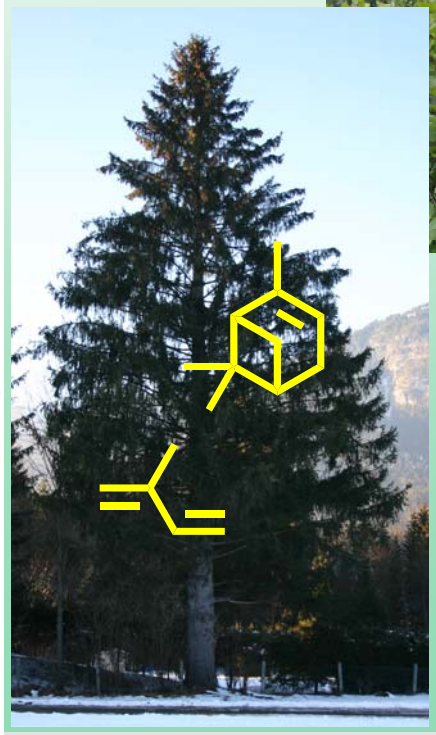




Oxygen Containing Compounds

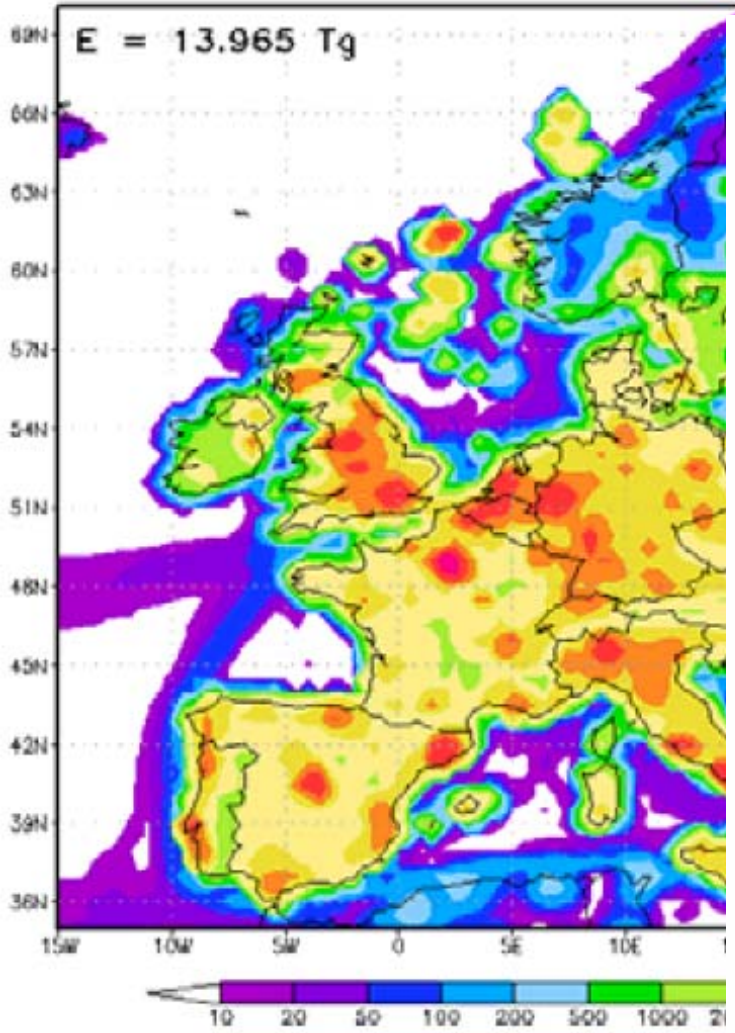






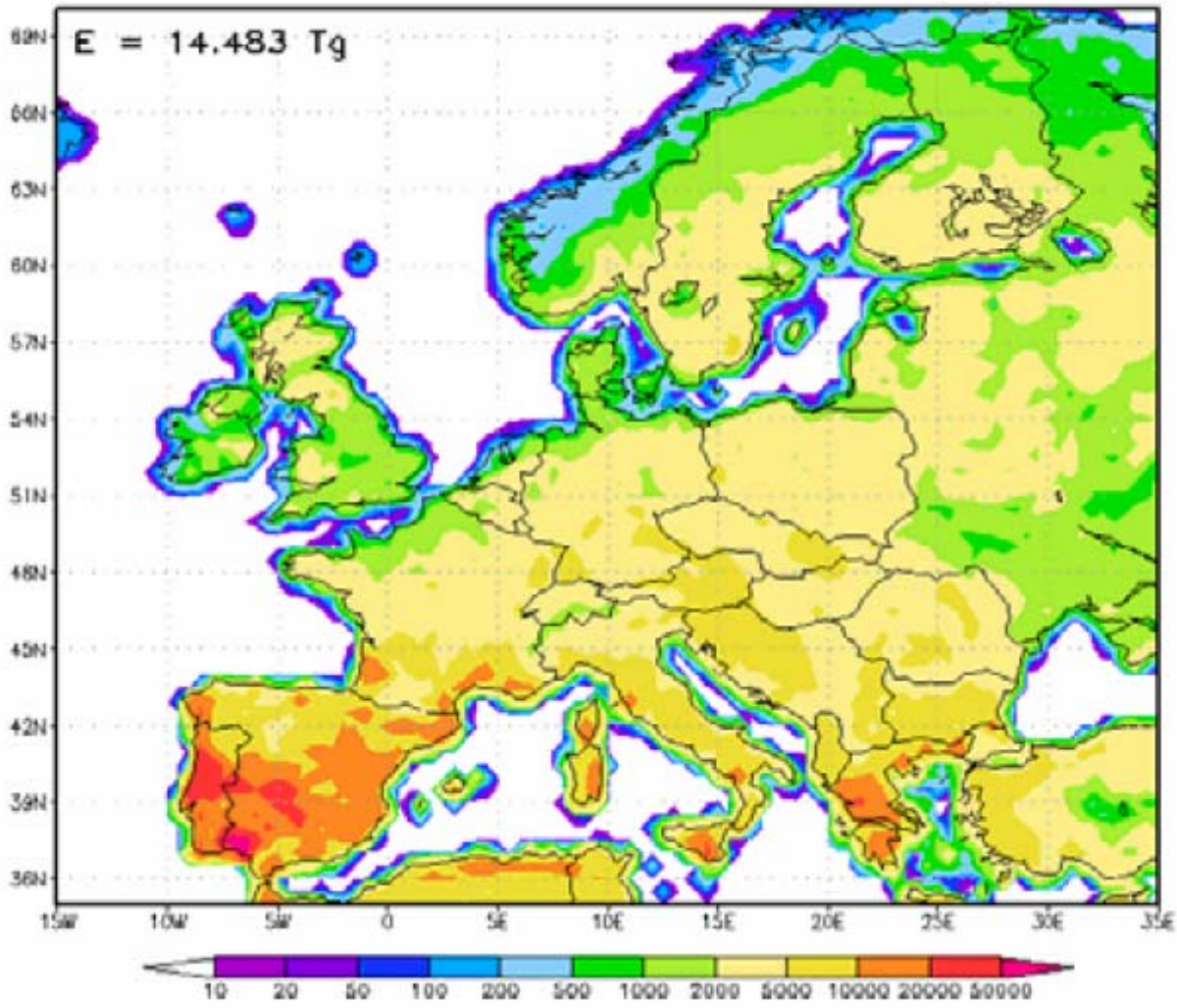
Biogenic VOC and Sources

Europe Antropogenic VOC – 2000 [Mg]

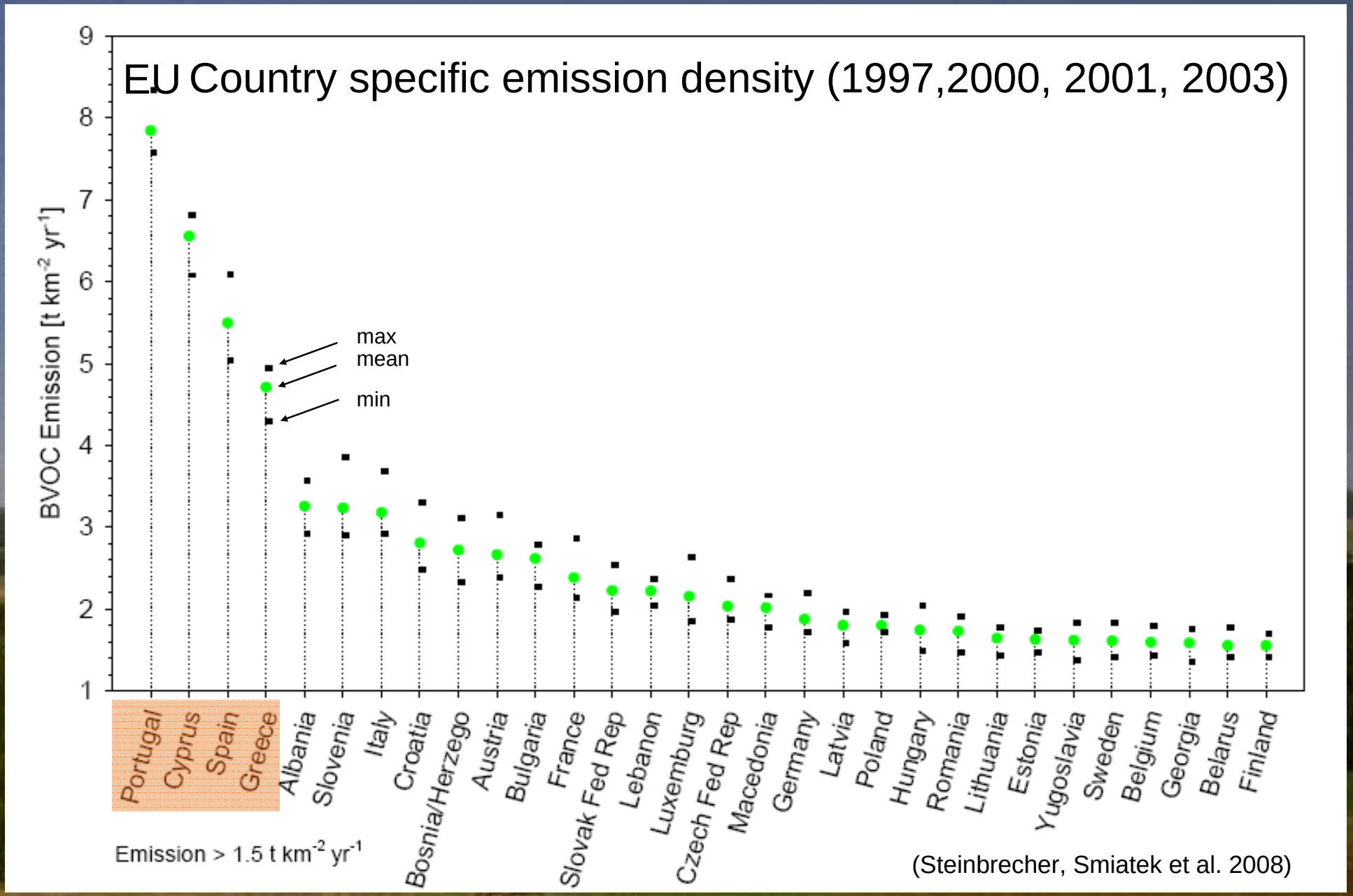


(Curci, Beekmann et al. 2008)

Europe Biogenic VOC – 2000 [Mg]



Biogenic VOC and Sources



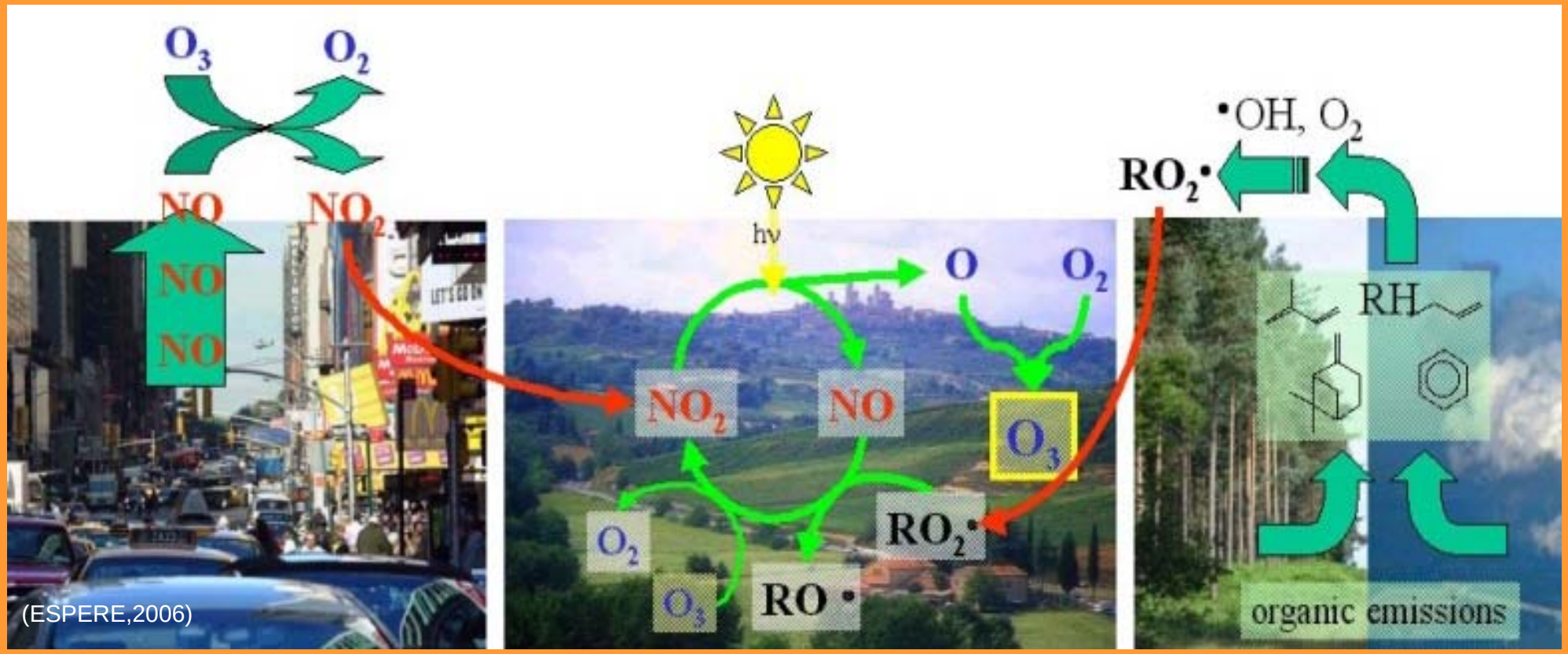
Biogenic VOC and the Atmosphere

Ozone
NO_X
VOC

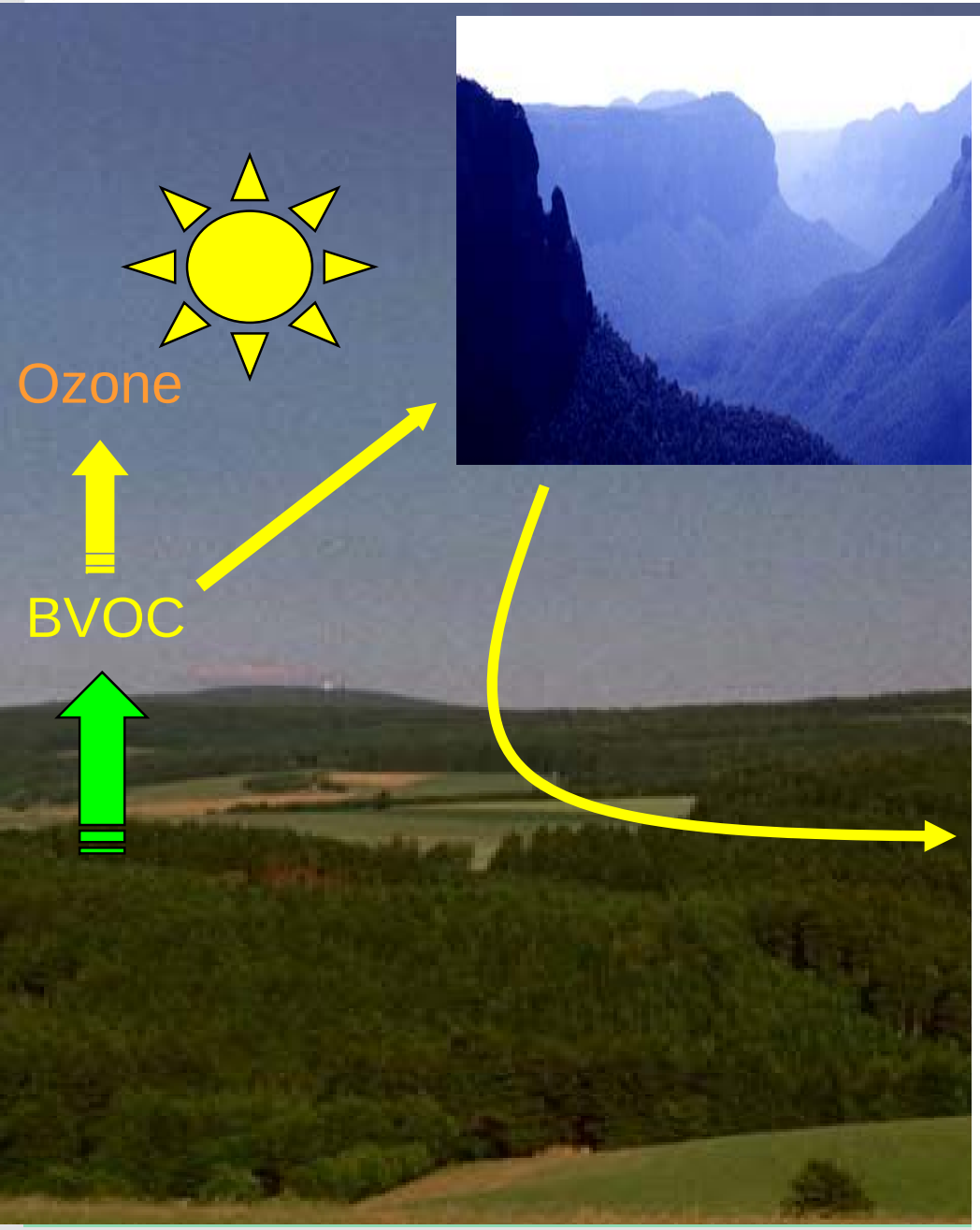
Light

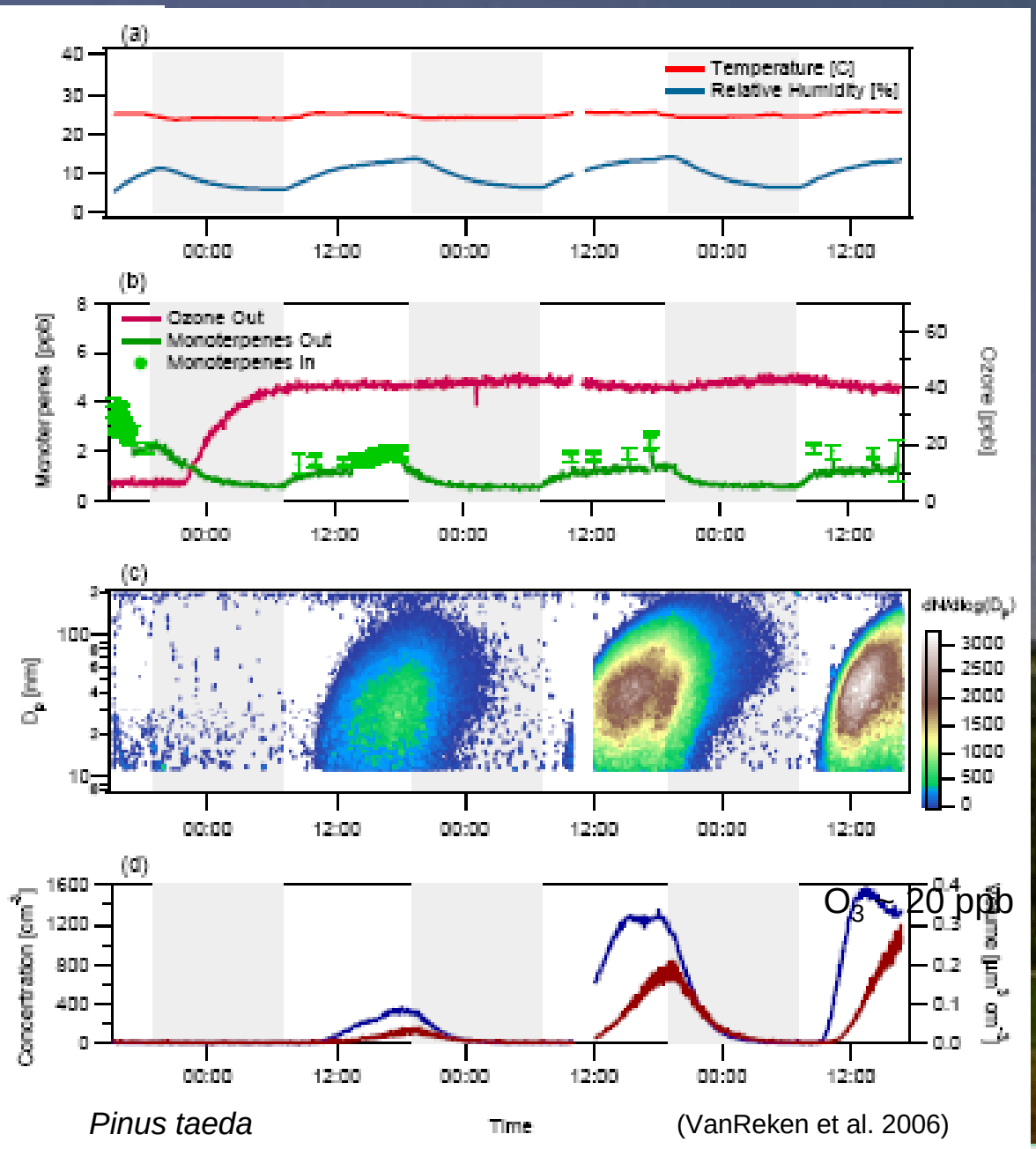
Water Vapor

Radicals
(O_3, HO, NO_3, org-R)
PAN
CO, etc



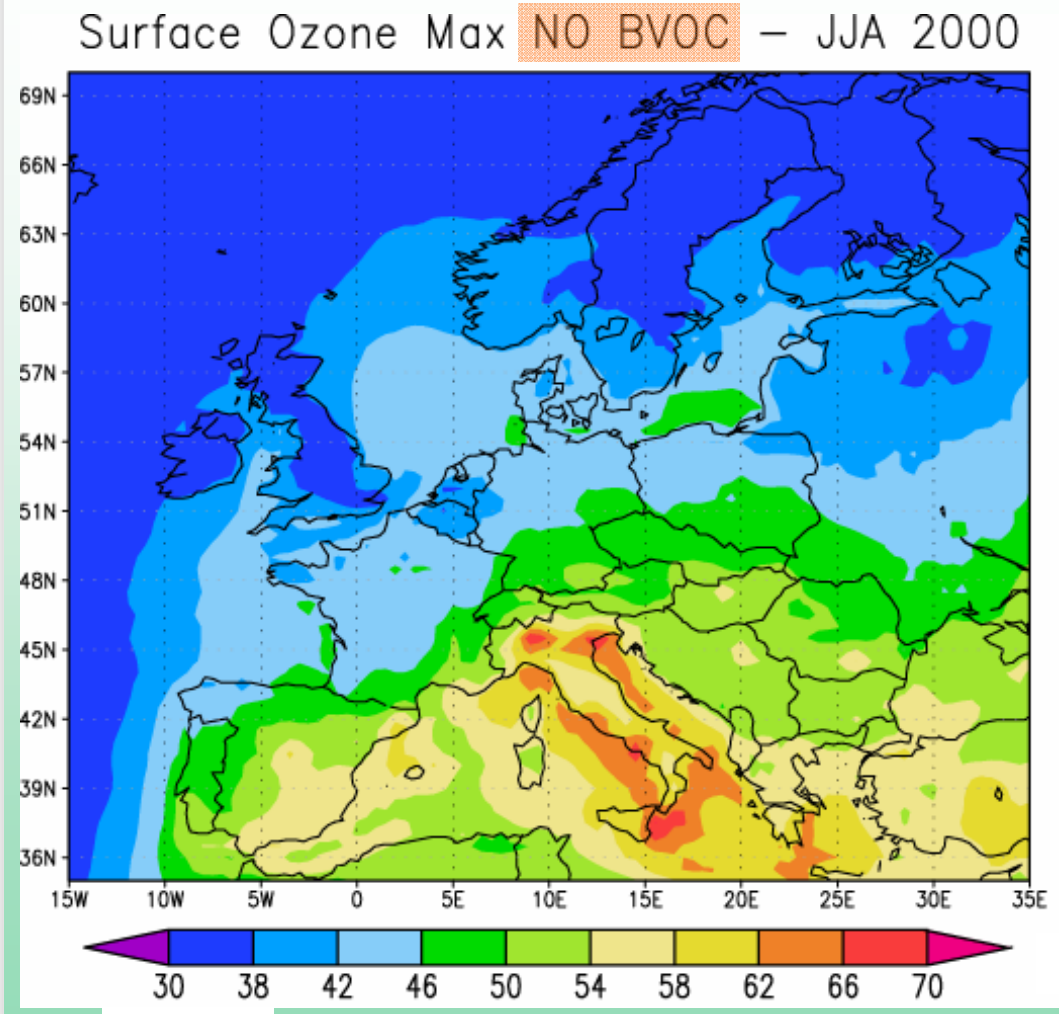
Biogenic VOC and the Atmosphere

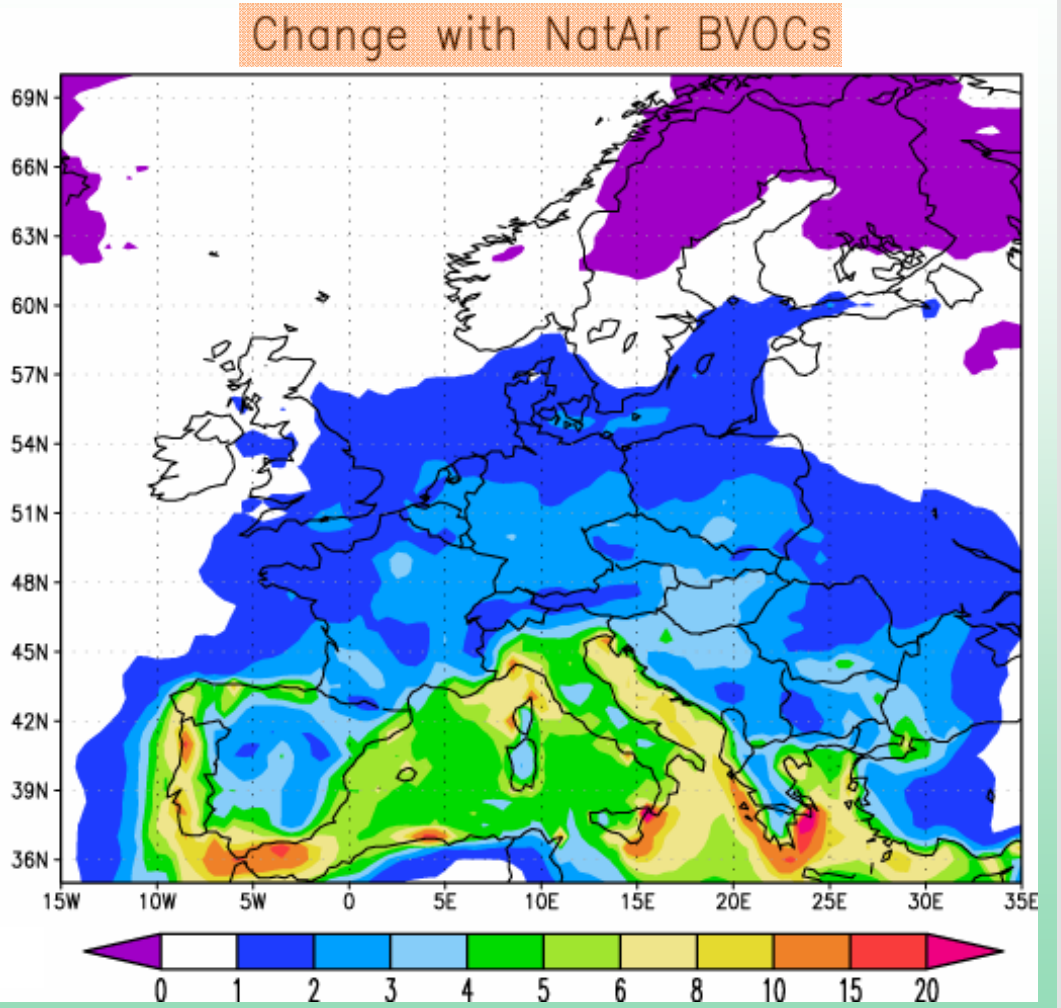




Biogenic VOC and the Atmosphere

NatAir Emissions and Air Quality in Europe with CHIMERE





(Curci, Beekmann et al. 2008)

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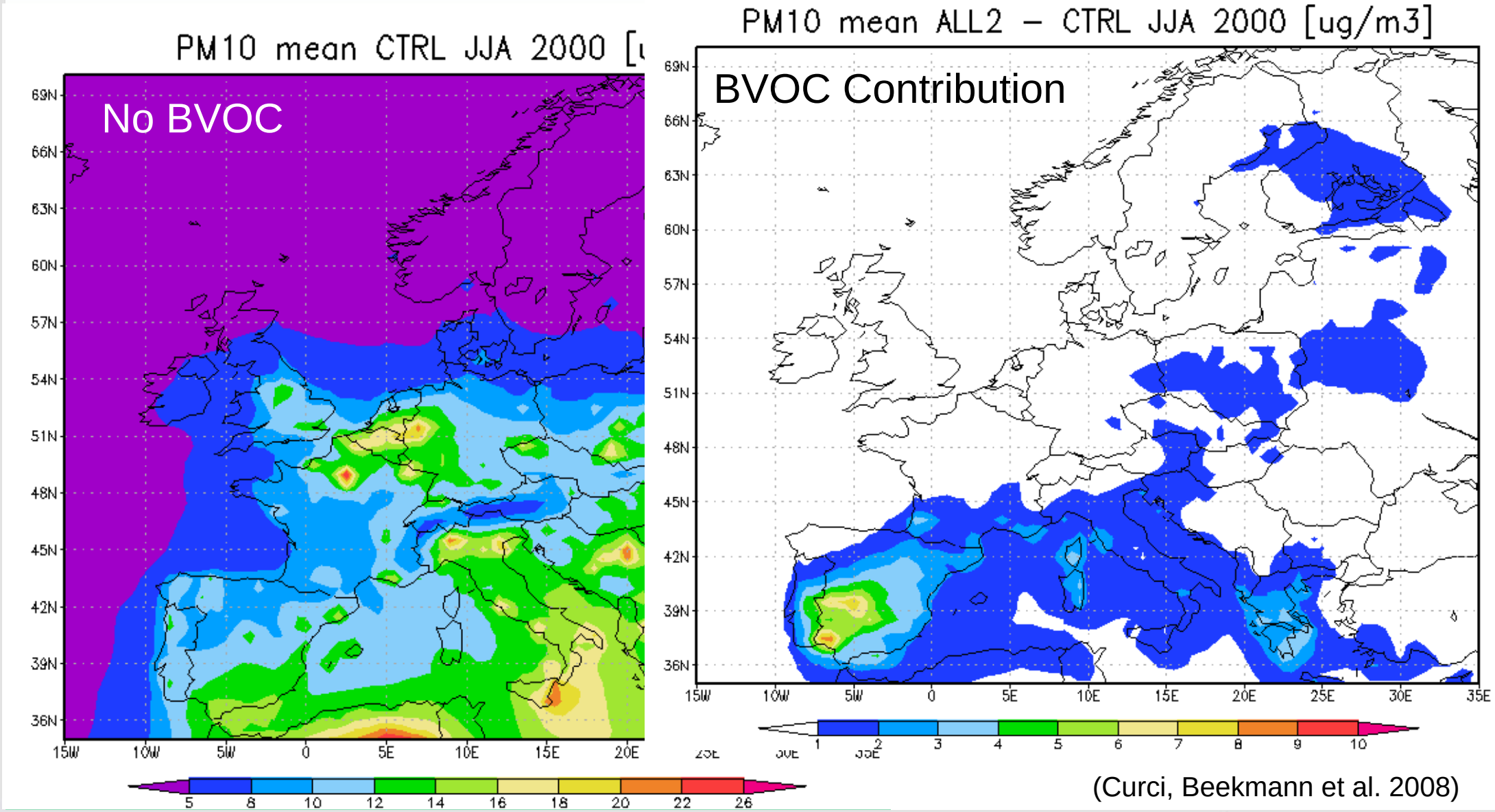
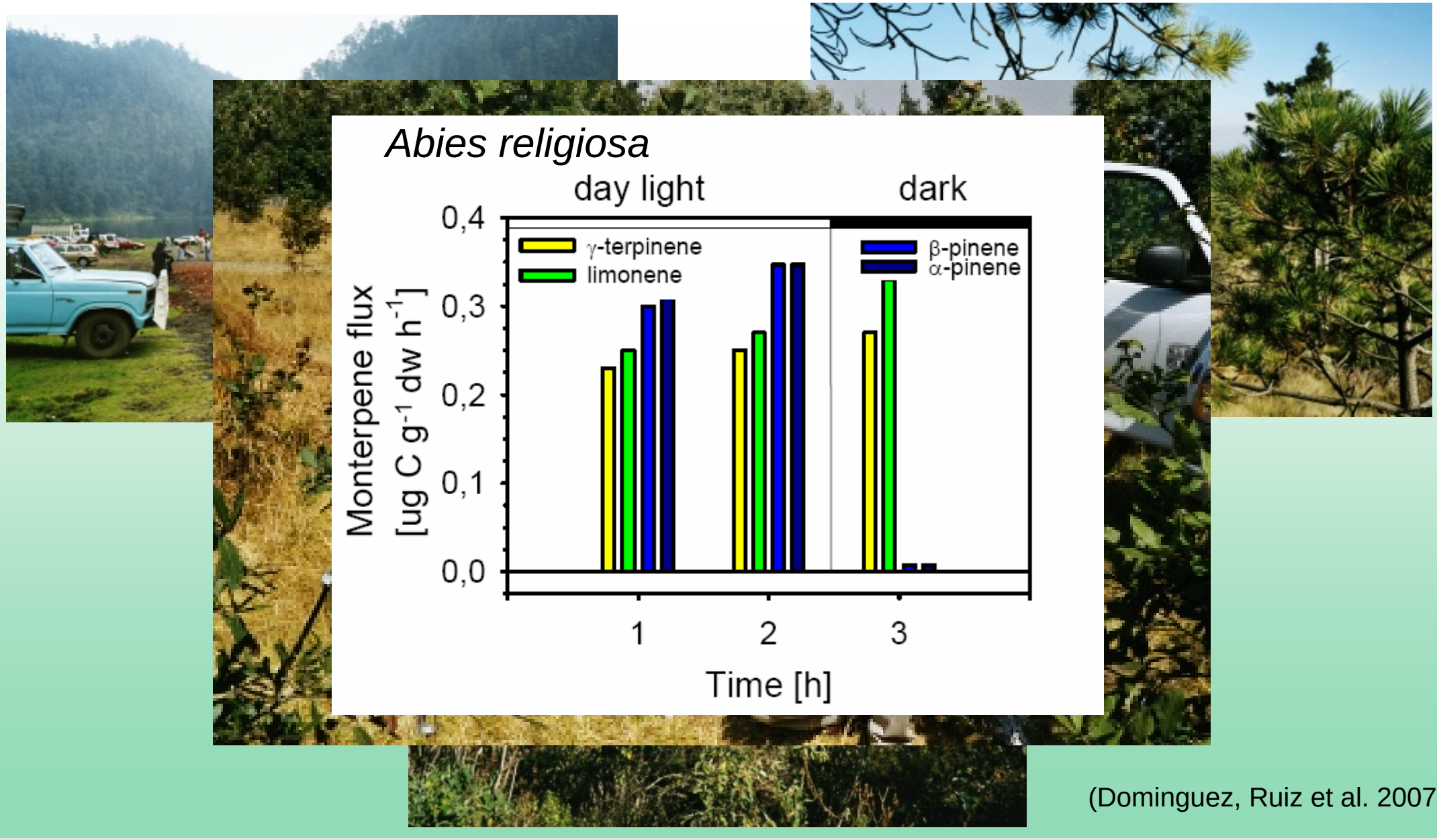


(Curci, Beekmann et al. 2008)

Biogenic VOC and Mexico City

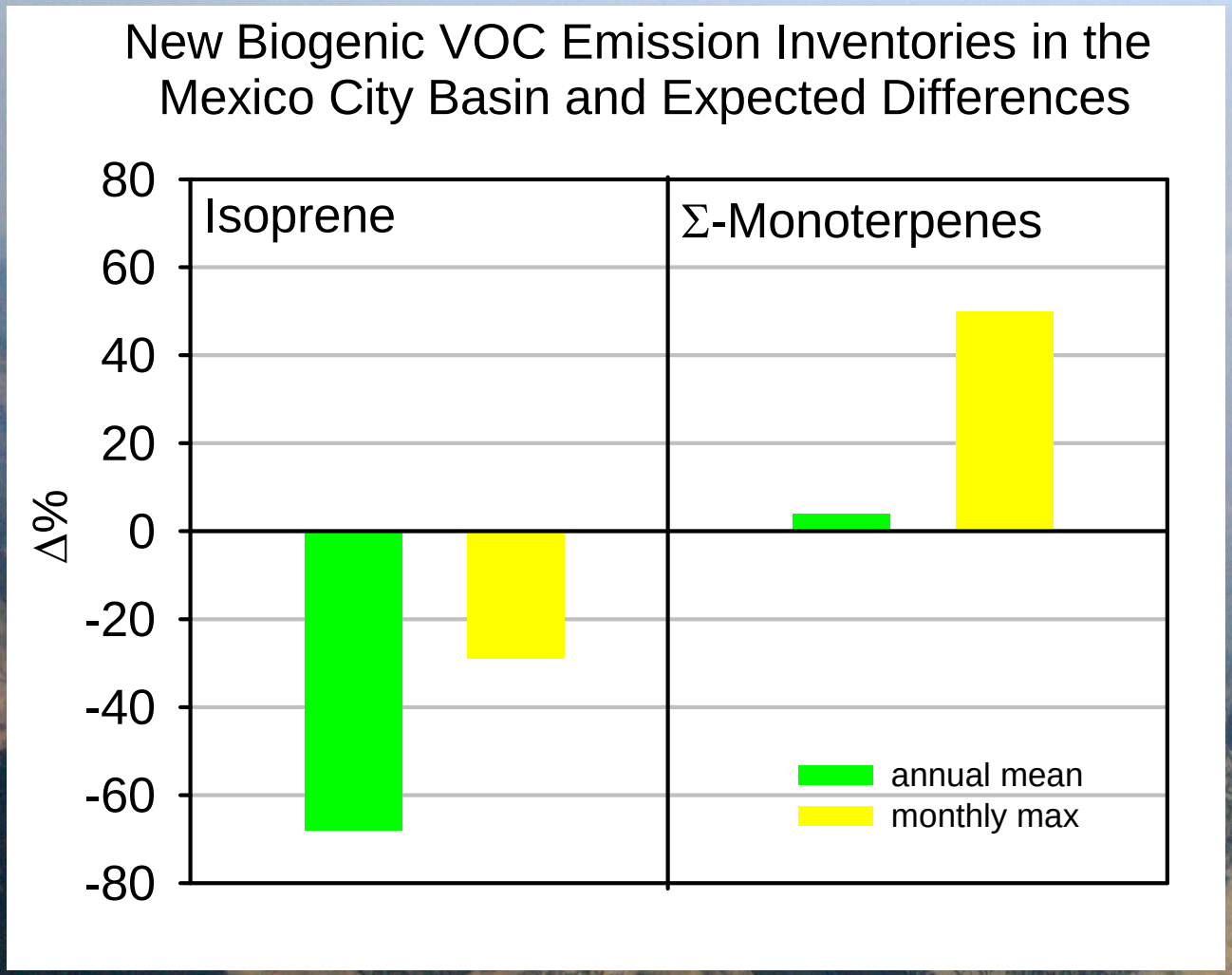
	Área km² (*)	Total áreas verdes km²	Áreas verdes %	% Zonas arbo-ladas	% Zonas de pastos y arbus-tos	Áreas verdes por habi-tante m²	Zonas arbo-ladas por habi-tante m²
D.F.	632.66	128.28	20.4	55.9	44.1	15.1	8.4

Biogenic VOC and Mexico City



(Dominguez, Ruiz et al. 2007)

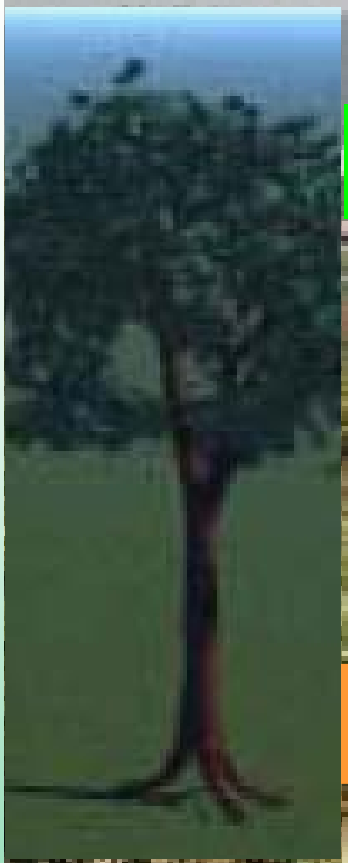
Biogenic VOC and Mexico City



The new isoprenoid emission factors will correct current biogenic VOC inventories with consequences for air quality modeling.

This may partly explain the high fraction of biogenics in OC of particles for this area (Szidat et al., 2007).

Plants and Urban Atmospheres



Temperature Reduction and other Microclimate Effects

Removal of Air Pollutants

Energy Effects on Buildings

Emission of VOC and tree maintainance emissions

(Nowak and Crane, 1998)

Plants and Urban Atmospheres

Modular Urban Forest Effects (UFORE) Model

UFORE- A: Anatomy of the Urban Forest – quantifies urban forest structure (species composition, density, tree health, leaf area, leaf and tree biomass).

UFORE-B: Biogenic Volatile Organic Compound (VOC) emissions – quantifies hourly urban forest VOC emissions (isoprene, monoterpenes and other VOC emissions that contribute to ozone formation) and ozone and CO formation based on VOC emission.

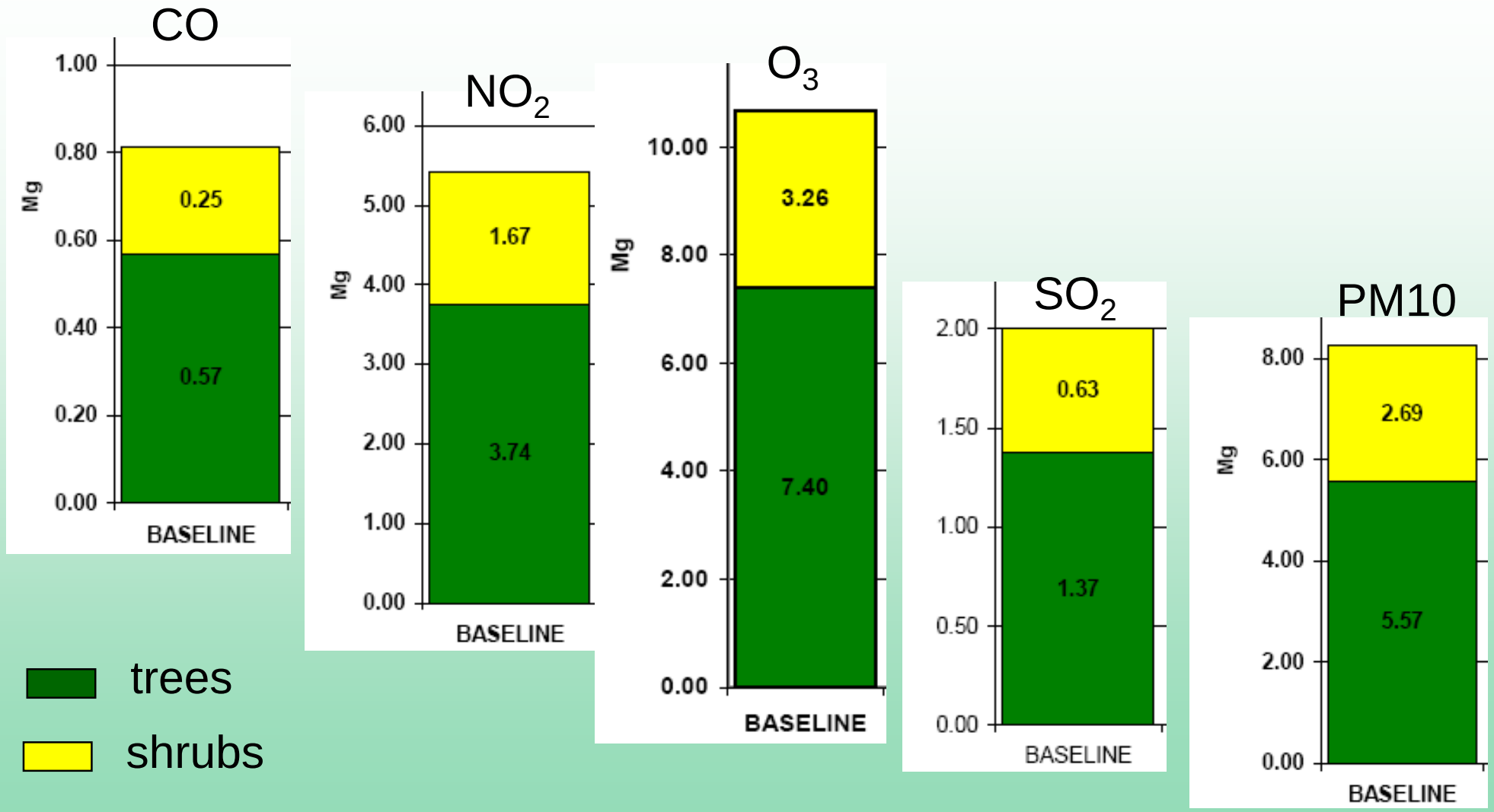
UFORE-C: **C**arbon Storage and Sequestration – calculates total carbon (C) storage potential and gross and net C sequestered annual by the urban forest based on field data.

UFORE – D: Dry Deposition of Air Pollution – quantifies the hourly amount of pollution removed by the urban vegetation and the associated per cent improvement in air quality through out a year. Pollution removal is calculated for 0_3, $S0_2$, $N0_2$, CO and PM10.

(Nowak and Crane, 1998)

Plants and Urban Atmospheres

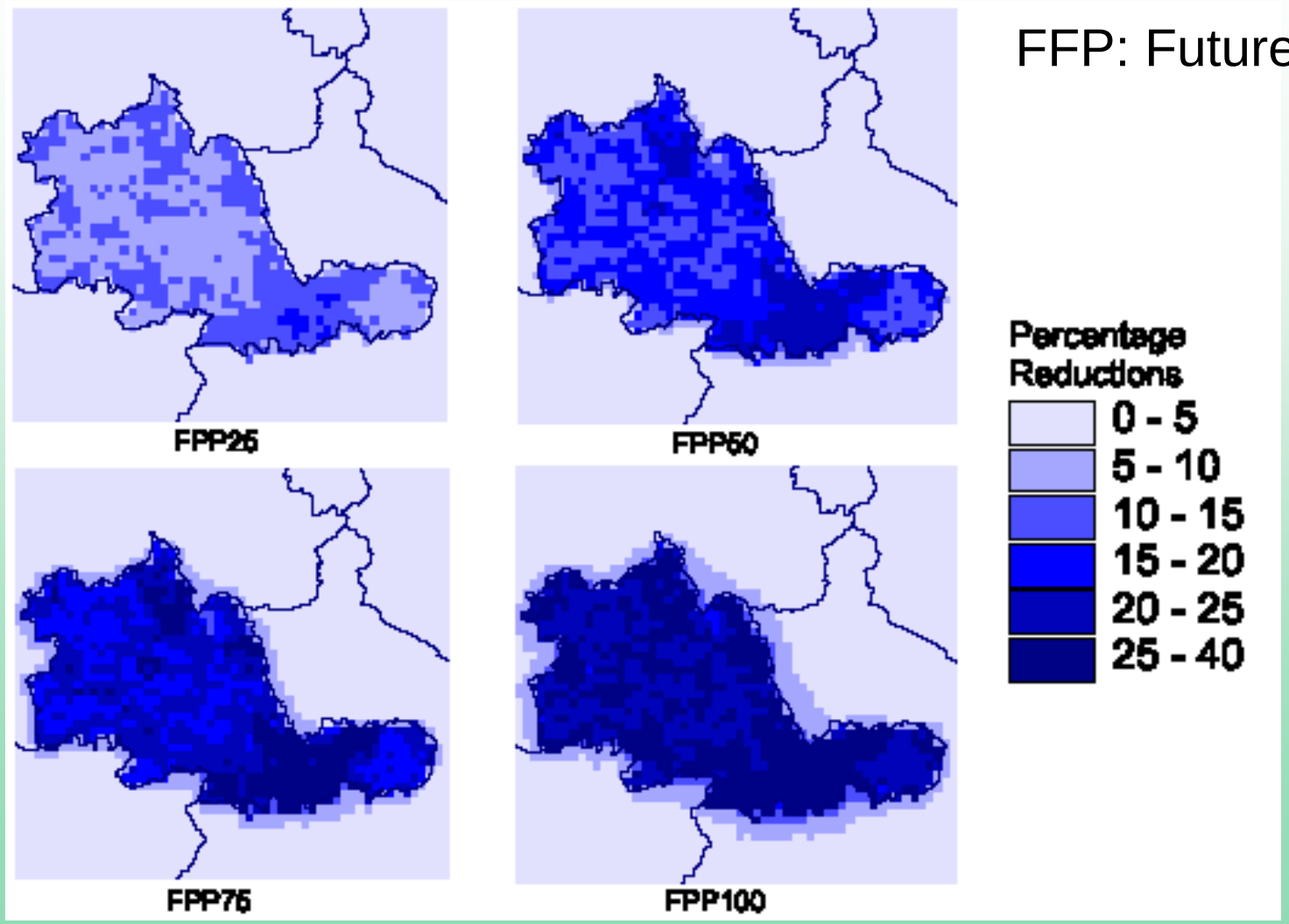
Toronto: Annual Pollutant Deposition with UFORE



(Curie and Bass; brad.bass@ec.gc.ca)

Plants and Urban Atmospheres

UK Midlands: Particle Deposition with FRAME (Base 1998; PM10)
(Fine Resolution Atmospheric Multi-Pollutant Exchange Model)



FFP: Future planting Potential

(McDonald et al. 2007)

Plants and Urban Atmospheres

Reduce Air Pollution

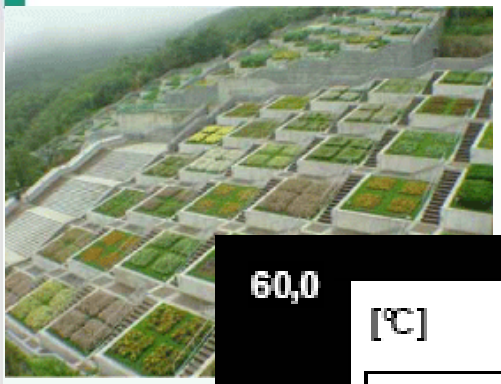
Reduce Heat Islands

Socioeconomic Benefits

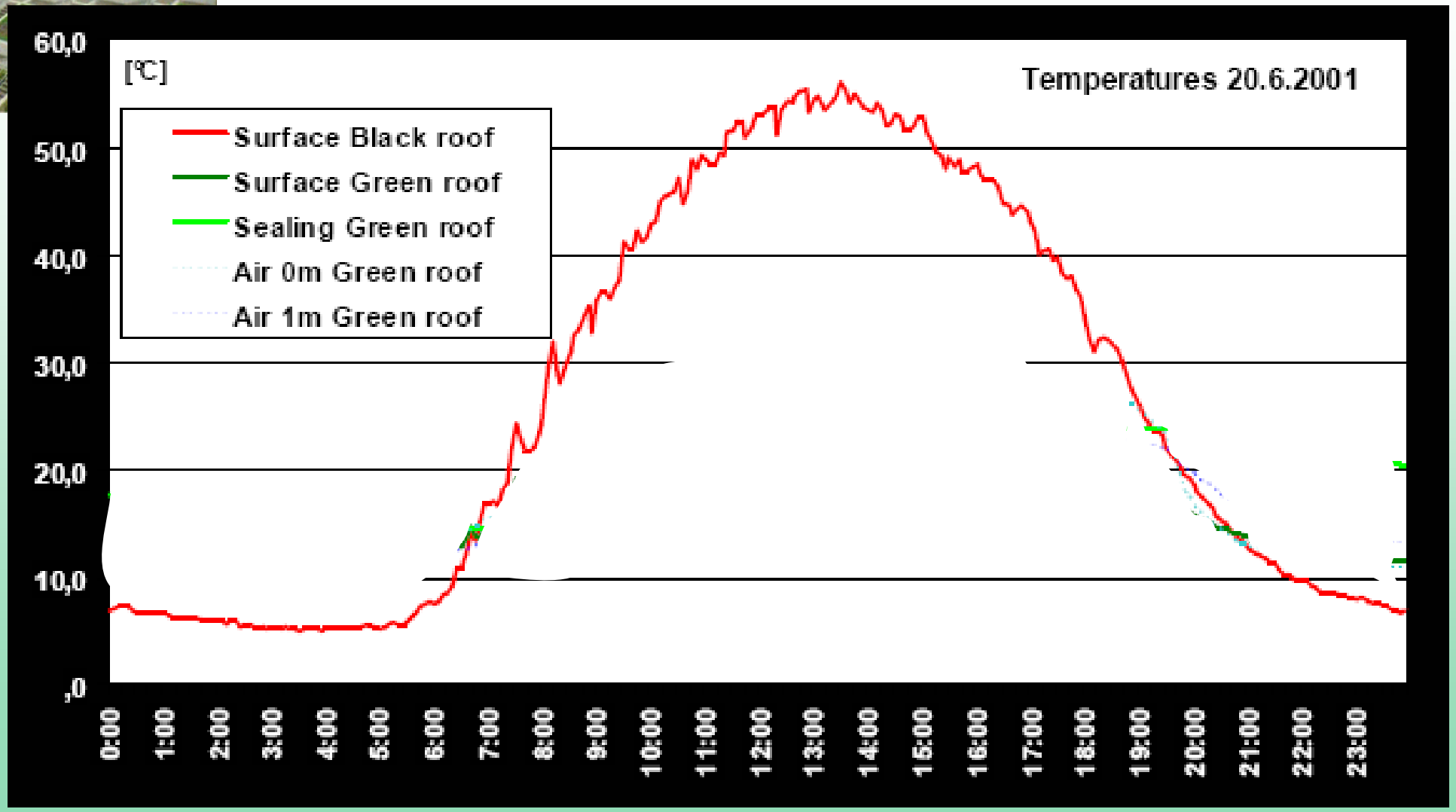
Roof Gardens

Roof Greening

Plants and Urban Atmospheres

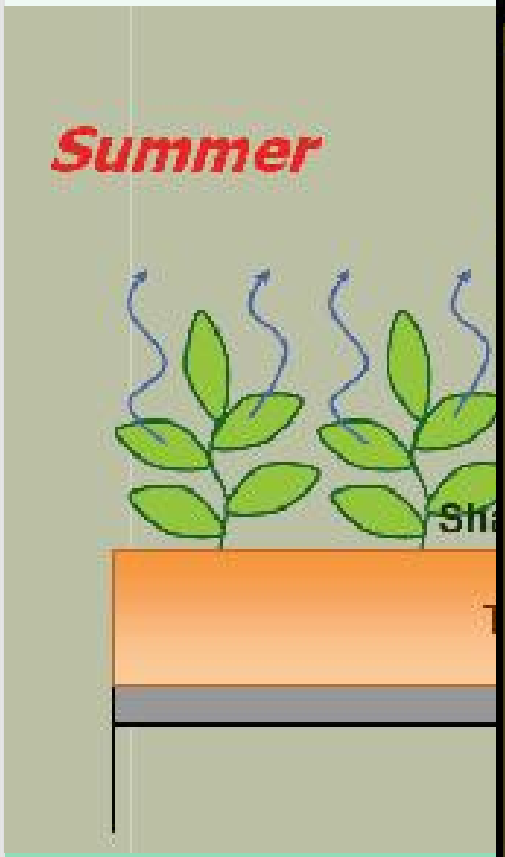


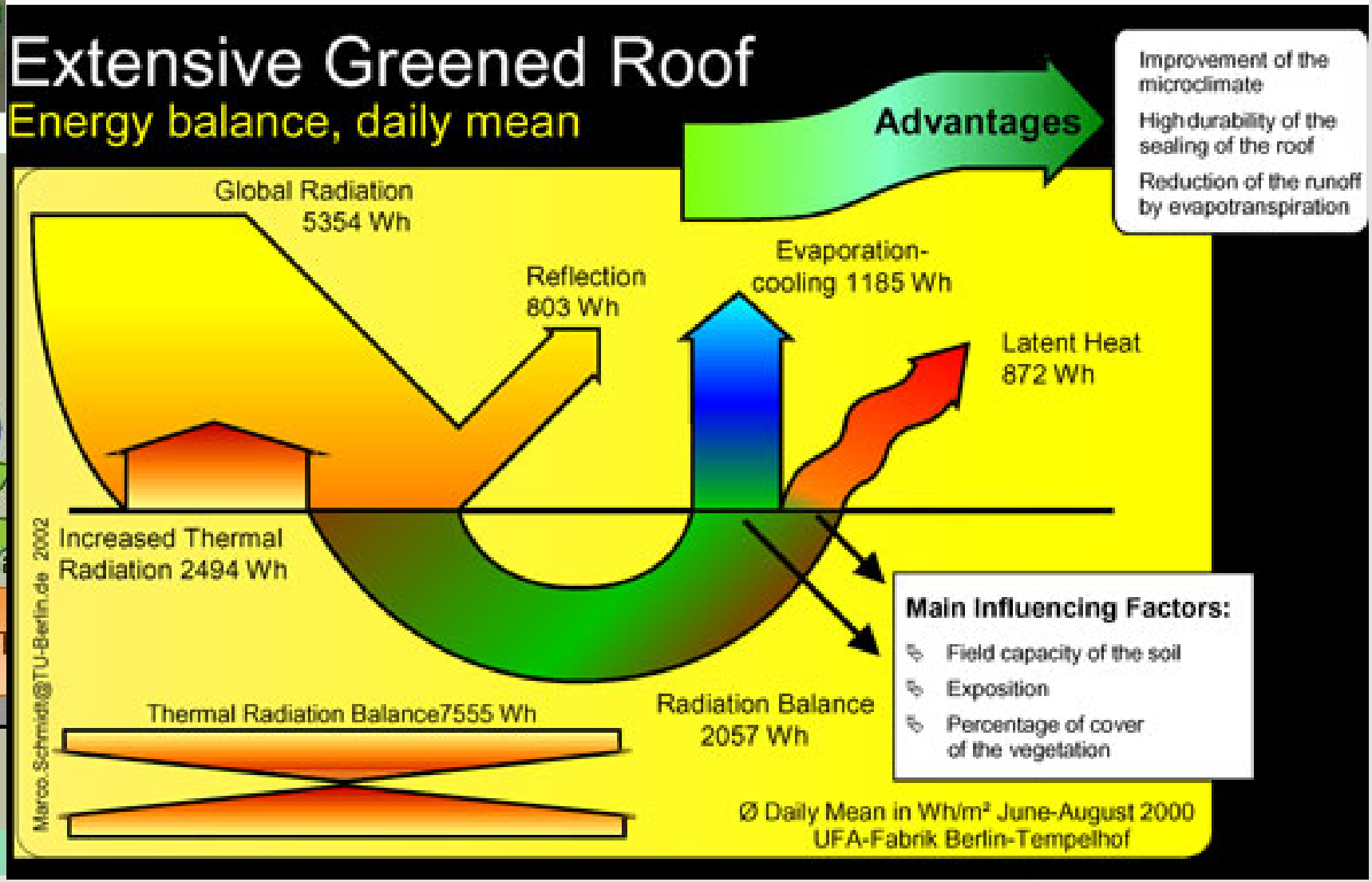
Temperatures



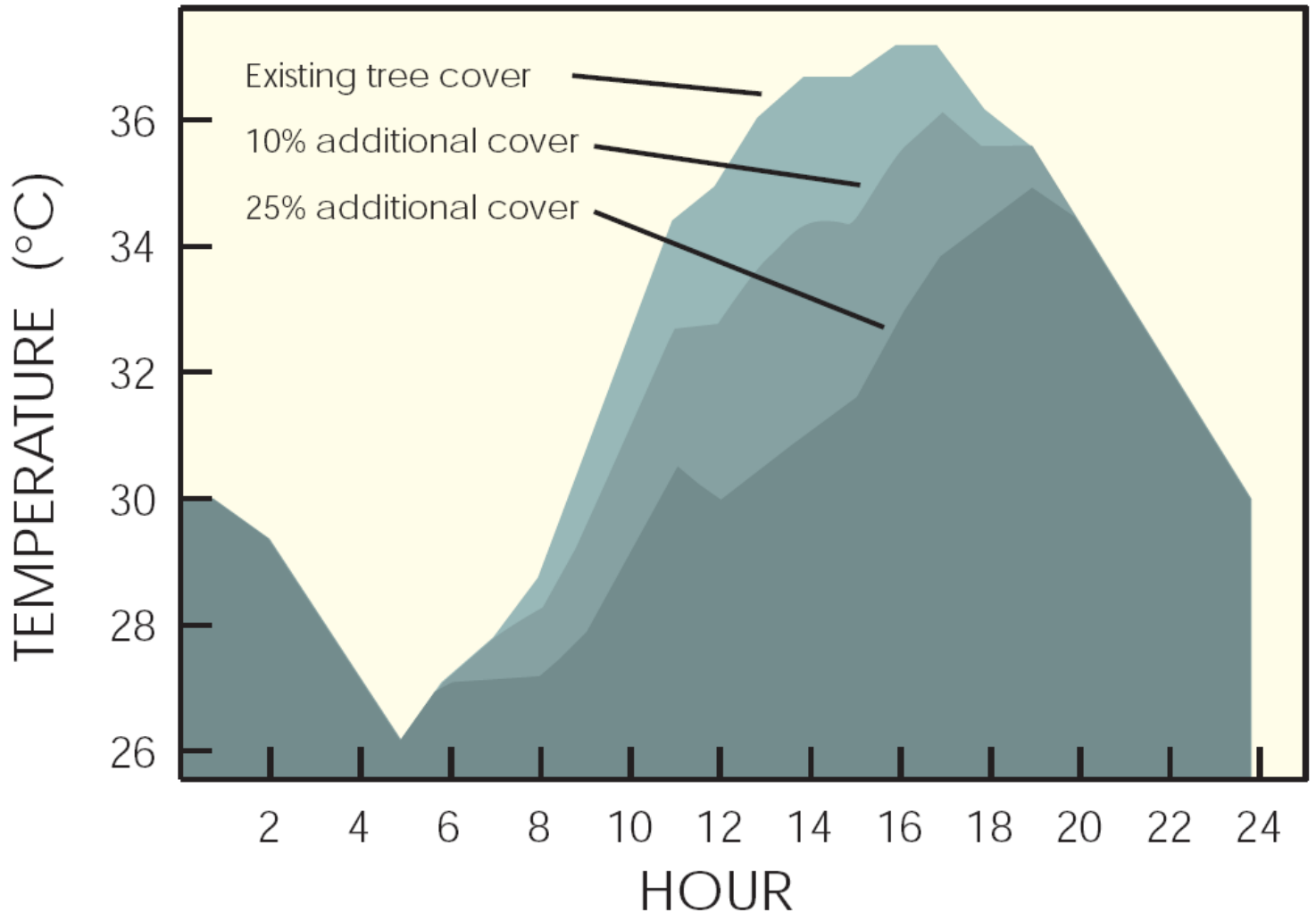
Plants and Urban Atmospheres

Temperatures





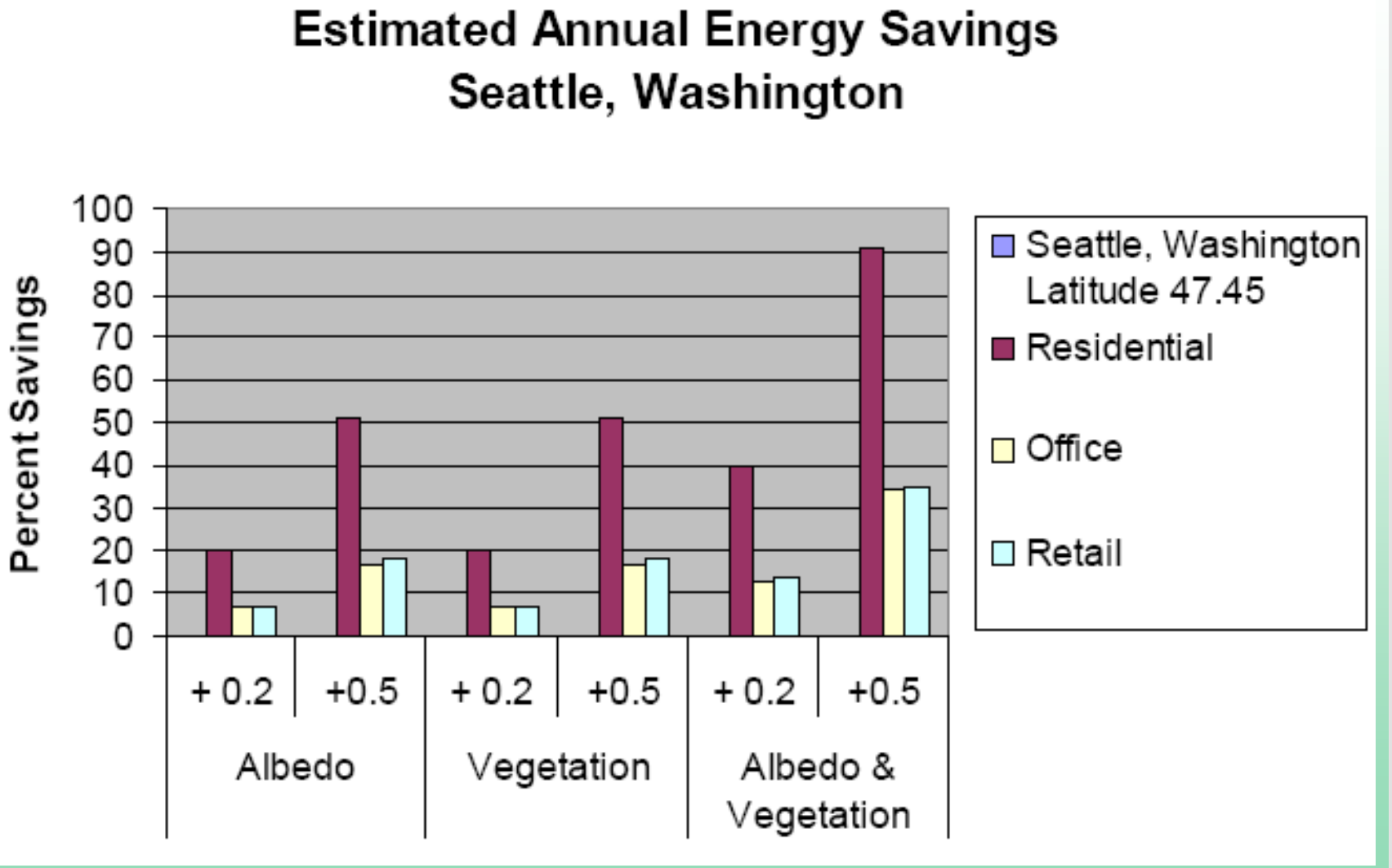
Plants and Urban Atmospheres



Cooling effect of adding tree cover to a city in a hot dry climate zone.

Huang et al., Lawrence Berkeley Laboratory, USA

Plants and Urban Atmospheres



http://epa.gov/heatisland/resources/tools.html

Synopsis: Plants in Cities

- Increase the number of trees (increases pollution removal).
- Sustain existing tree cover in particlular large healthy trees (maintains pollution removal levels).
- Maximize use of low VOC emitting trees (reduces ozone and particle formation, increase carbon sink).
- Use long-lived trees (reduces long-term pollutant emissions from planting and removal).
- Use low maintenance trees (reduces pollutants emissions from maintenance activities).
- Reduce fossil fuel use in maintaining vegetation (reduces pollutant emissions).

(modified after Nowak, USDA Forest Service)

Synopsis: Plants in Cities

- Plant trees in energy conserving locations (reduces pollutant emissions from power plants).
- Plant trees to shade parked cars (reduces vehicular VOC emissions).
- Supply ample water to vegetation (enhances pollution removal and temperature reduction).
- Plant low VOC emitting trees in polluted areas or heavily populated areas (maximizes tree air quality benefits).
- Avoid pollutant sensitive species (increases tree health).
- Utilize evergreen trees for particulate matter reduction (year-round removal of particles)

(modified after Nowak, USDA Forest Service)

Synopsis: Plants in Cities

- Moreover

Esthetic Value and Meeting Points

Outlook: Greening Mexico City

Let's Green the Cities

Reduce CO2

Fight Global Warming

Not always easy to achieve!