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Leaf enclosure measurements for determining volatile organic compound emission capacity from *Cannabis spp.*



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ENVIRONMENTAL
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Viewpoint

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High Time to Assess the Environmental Impacts of Cannabis Cultivation

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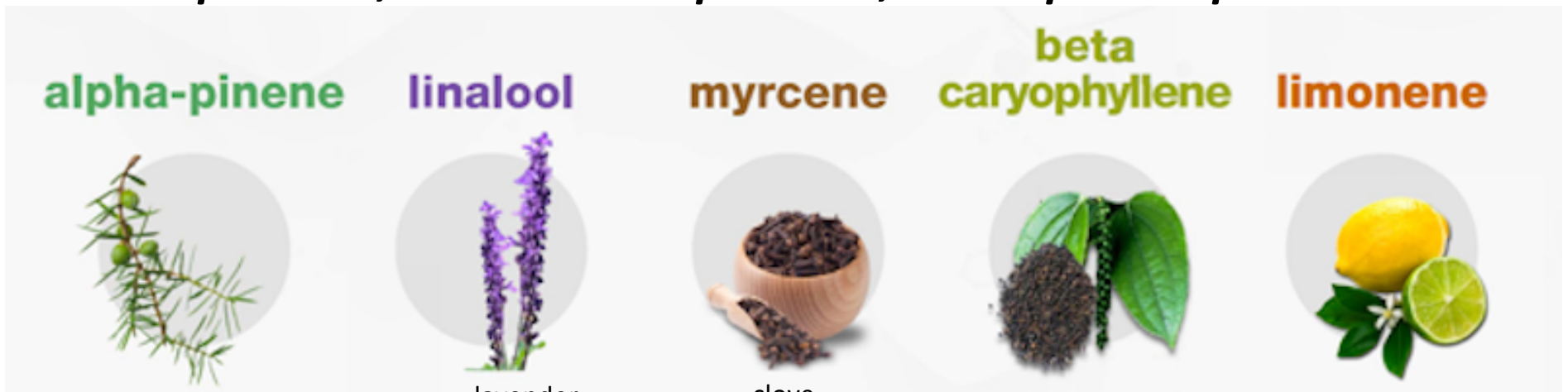
Volatile Organic Compounds (VOCs)

Man Made (Anthropogenic)

Toluene, gasoline, personal products

Natural Made (Biogenic)

Isoprene, Monoterpenes, Sesquiterpenes



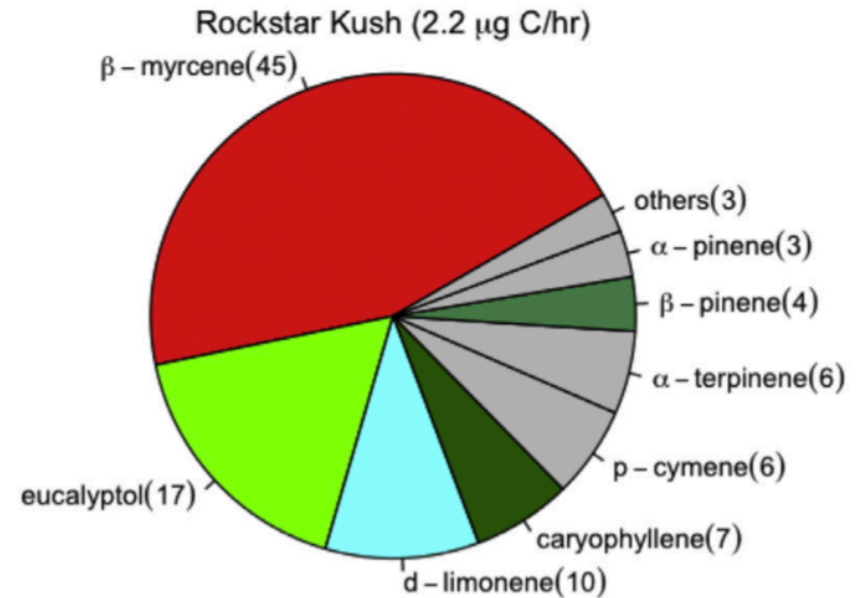
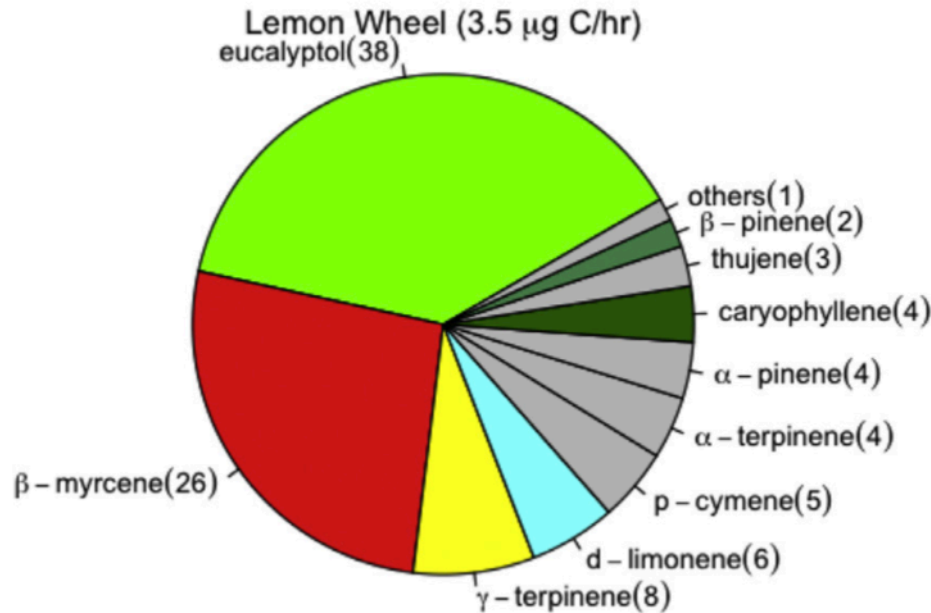
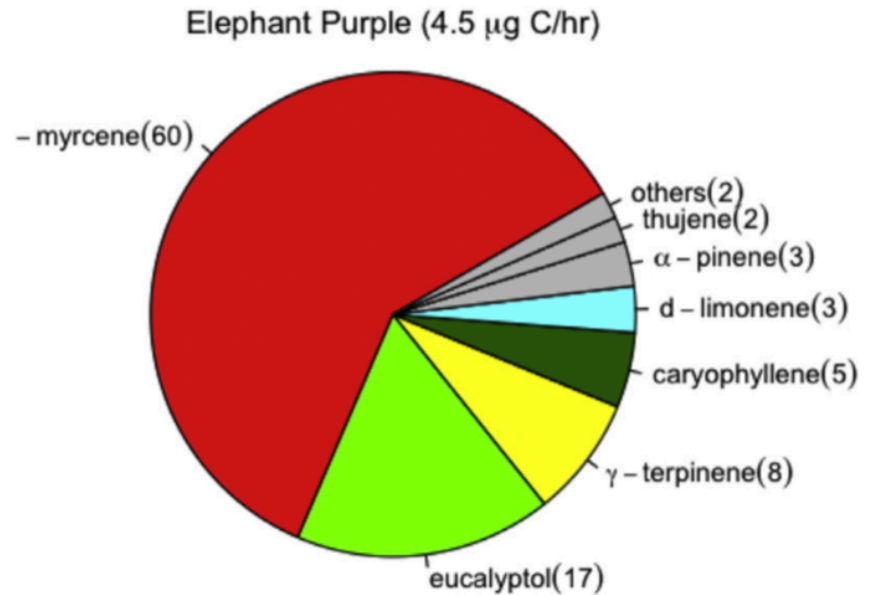
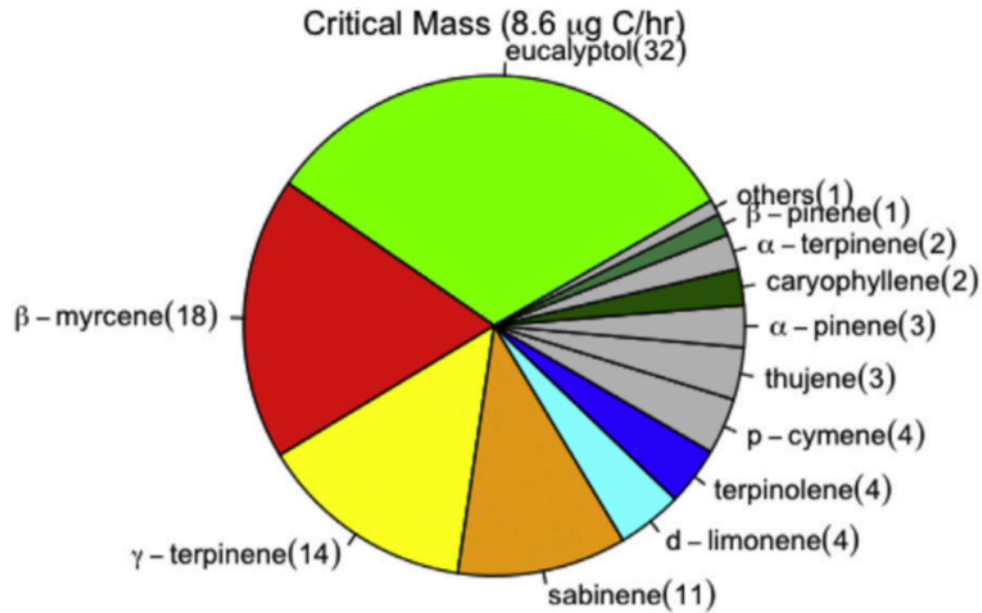
lavender

clove

VOCs from Marijuana?



VOCs from Marijuana?



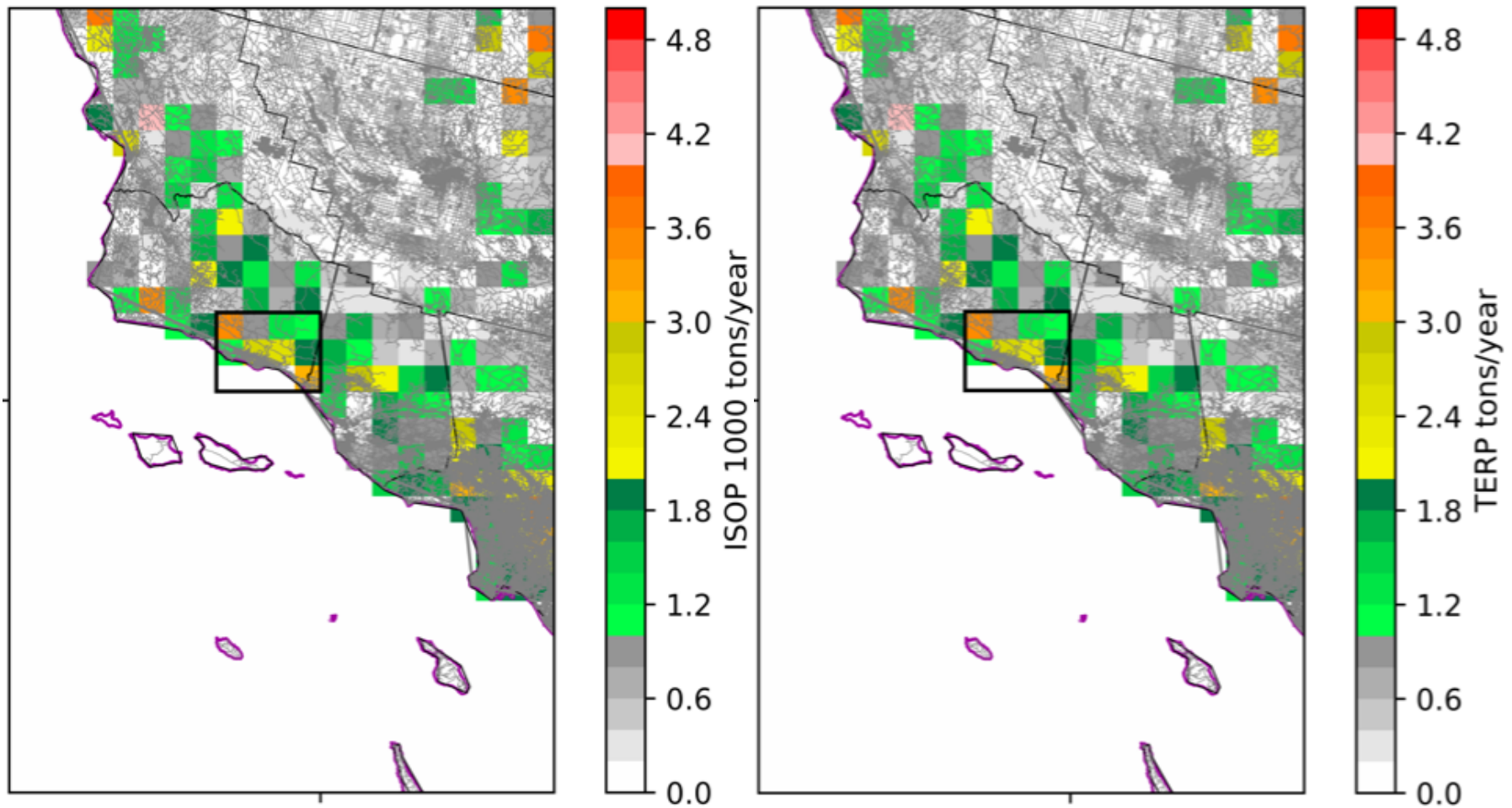
Monoterpene Emission Rates

- Critical Mass – $8.6 \mu\text{g C/g/hr}$
- Elephant Purple - $4.5 \mu\text{g C/g/hr}$

- Pine Trees – $\sim 16 \mu\text{g C/g/hr}$
- Pistachio Trees – $\sim 8 \mu\text{g C/g/hr}$
- Rosemary – $\sim 4 \mu\text{g C/g/hr}$

Monoterpene Emissions

- EPA 2011 Santa Barbara County
- 39,042 tons/year Biogenic VOCs (78% of all VOCs)



Monoterpene Emissions

- 39,042 tons/year Biogenic VOCs
- Replacing Gerbera Daisy/Tulips are also BVOC emitters
- ~5 tons/year Monoterpenes from Cannabis Industry Carpinteria, CA

Biogenic VOC Exposures

- Model Predicted Concentrations Summer 2011
 - Santa Barbara County .25 ppb (.8 ppb)
 - Denver 0.1 ppb (0.2 ppb)
- Measured downwind Cannabis, Denver CO
 - 0.4 – 0.8 ppb
- Amazon Rain forest – 2-4 ppb isoprene
- Peeling an orange - ~100 ppb Limonene
- Saw Mills – ~50-100 ppm of α -pinene

Monoterpene Toxicity

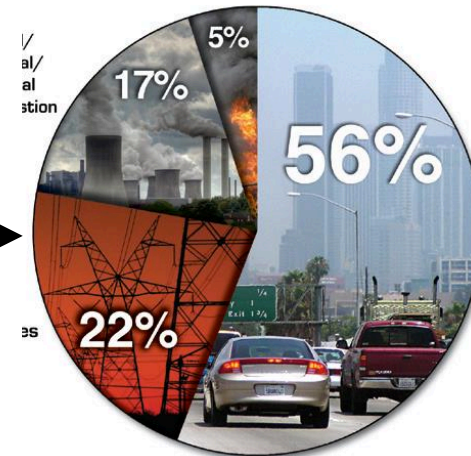
- Most terpenes non-toxic
- Acute short term inhalation (limonene, α -terpineol, and α - and β -pinene) is ~ 106 ppm (59 mg/m^3)
- 5,000 times higher in ambient terpene hotspots

VOCs and Ozone/PM

1. Sunlight



2. NOx



3. VOCs

