

# Powering Horticulture's Future

## *Electric and Bio Alternatives to Fossil Fuels*

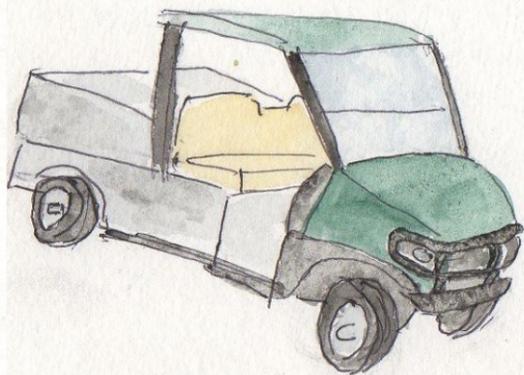
### Climate and Health

The diesel utility vehicles and mowers used for horticulture and landscape management are largely exempt from the EPA Tier IV emission standards. As a result, they produce high levels of harmful pollutants (20—40 times the emissions of regulated equipment with exhaust aftertreatments). Globally these contribute to climate change, while locally impacting the health of people and wildlife. There are several harmful components of petroleum-based diesel exhaust.

- CO<sub>2</sub> comprises about 12% of diesel exhaust gas, impacts climate.
- CO contributes to pollution, inhibits oxygen transfer in blood.
- Hydrocarbons (HC) facilitate ozone formation, contain toxic VOCs.
- Particulate matter (PM) pollutes air, water, and soil. Causes asthma.
- NO<sub>x</sub> causes acidification and reacts with other emissions to create ozone. NO and NO<sub>2</sub> are both toxic to breathe, but NO<sub>2</sub> is worse and has been identified as a direct cause of lung disease.

### Experiment

In 2014, A UWBG team received Campus Sustainability funding to purchase electric and biodiesel utility vehicles. This is enabling us to study emissions and performance firsthand. Our experiment measures CO<sub>2</sub>, CO, HC, PM, and NO<sub>2</sub> for biodiesel in comparison to petro diesel for the Gator and models the overall carbon emissions of both vehicles. Research is ongoing, but preliminary data indicates a reduction of over 1700 lbs CO<sub>2</sub> in the last year.



#### **Club Car Carryall 550**

48 volt electric, solid state motor

20 peak HP, 500 lb box load

Zero direct emissions



### Phytotoxicity

Diesel emissions (especially NO<sub>x</sub> and VOCs) also negatively affect plants.

- Accelerated senescence, attributed to VOCs - ethylene in particular.
- Changes in surface wax structure, due to accumulation of lipophilic VOCs.
- Despite accelerated senescence, delayed flowering is also observed, which may be due to metabolic changes from foliar absorption of NO<sub>x</sub>.
- NO<sub>x</sub>, VOCs, and CO combine to form ozone, which is transpired through the stomata causing chlorosis and necrosis.



#### **John Deere Gator TH 6x4**

B99 Biodiesel, year round, no additives

18 HP, 1200 lbs box load

Significantly reduced tailpipe emissions

**What about Ethanol?** Unlike biodiesel, ethanol cannot be used safely at high blends in equipment that was not designed for it. However, there are electric or manual replacements available for gas powered leaf blowers, trimmers, and mowers. If you choose to use gasoline equipment, the emissions can be minimized by using 4-cycle rather than 2-cycle engines, maintained in good order.