

Evaluating the 2009 Carbon Footprint of Carrboro, NC

Baseline Greenhouse Gas Emissions & Recommendations



Produced by the Spring 2011
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Intro - Why Carbon Accounting?

- Greenhouse gas (GHG) emissions disrupt global climate patterns
- They result mostly from energy consumption and agriculture
- Impacts:
 - Sea level rise
 - More severe storms and droughts
 - Poor air quality
- Carbon Pricing

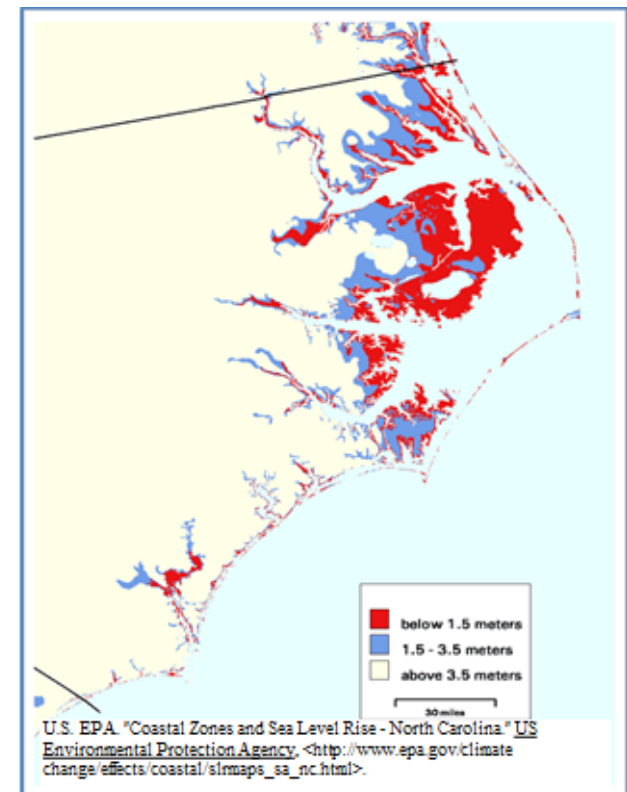
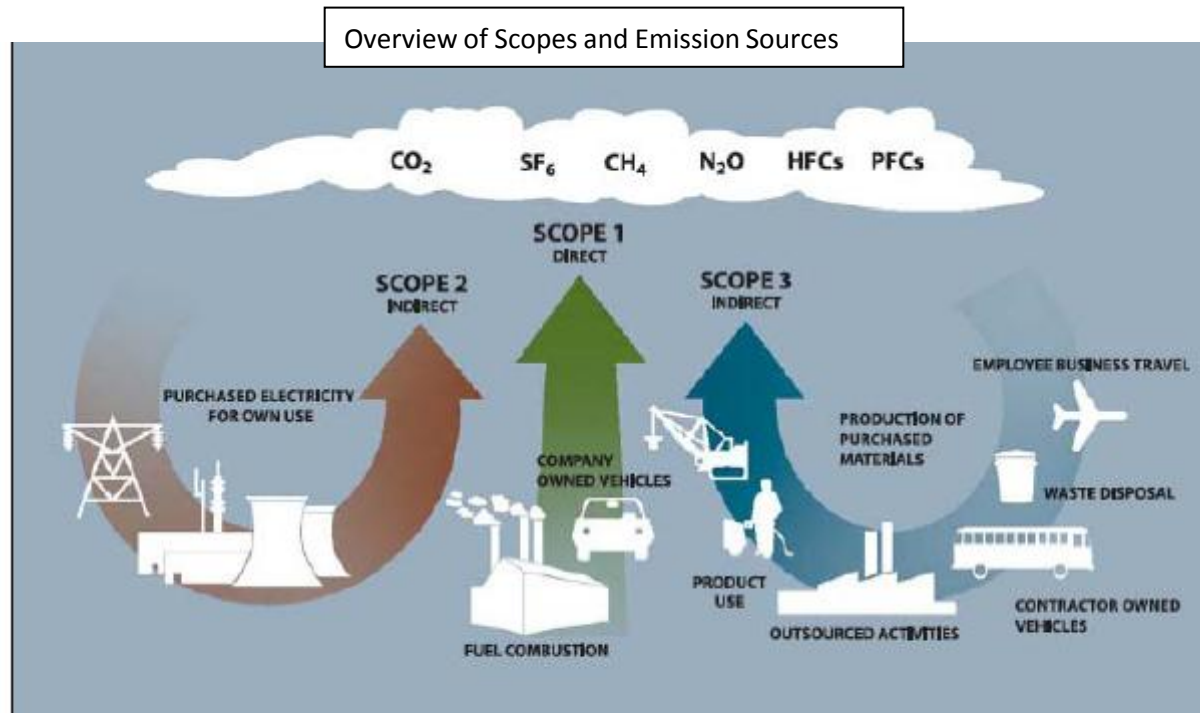


Figure 1. Elevations along the North Carolina coast. Regions in red are most vulnerable to sea level rise.

Intro - Methods

- Acquired data from utilities
- Distinguished public sector from community emissions
- Community subdivisions:
 - Residential, industrial, commercial, waste, industrial
- Public subdivisions:
 - Municipal
 - Buildings, water, transit, vehicles, waste, streetlights
 - Schools
 - OWASA

Intro - Scope Definitions



Source: WRI/WBCSD *GHG Protocol Corporate Standard*, Chapter 4 (2004).

Intro - CACP Software

Community Analysis for Year 2009

Community Analysis | Community Measures | Government Analysis | Government Measures

Residential | Commercial | Industrial | Transportation | Waste | Other

Name of Residential Building or Group
Duke (Scope 2)

Record Controls

Insert | Select | Delete

Report

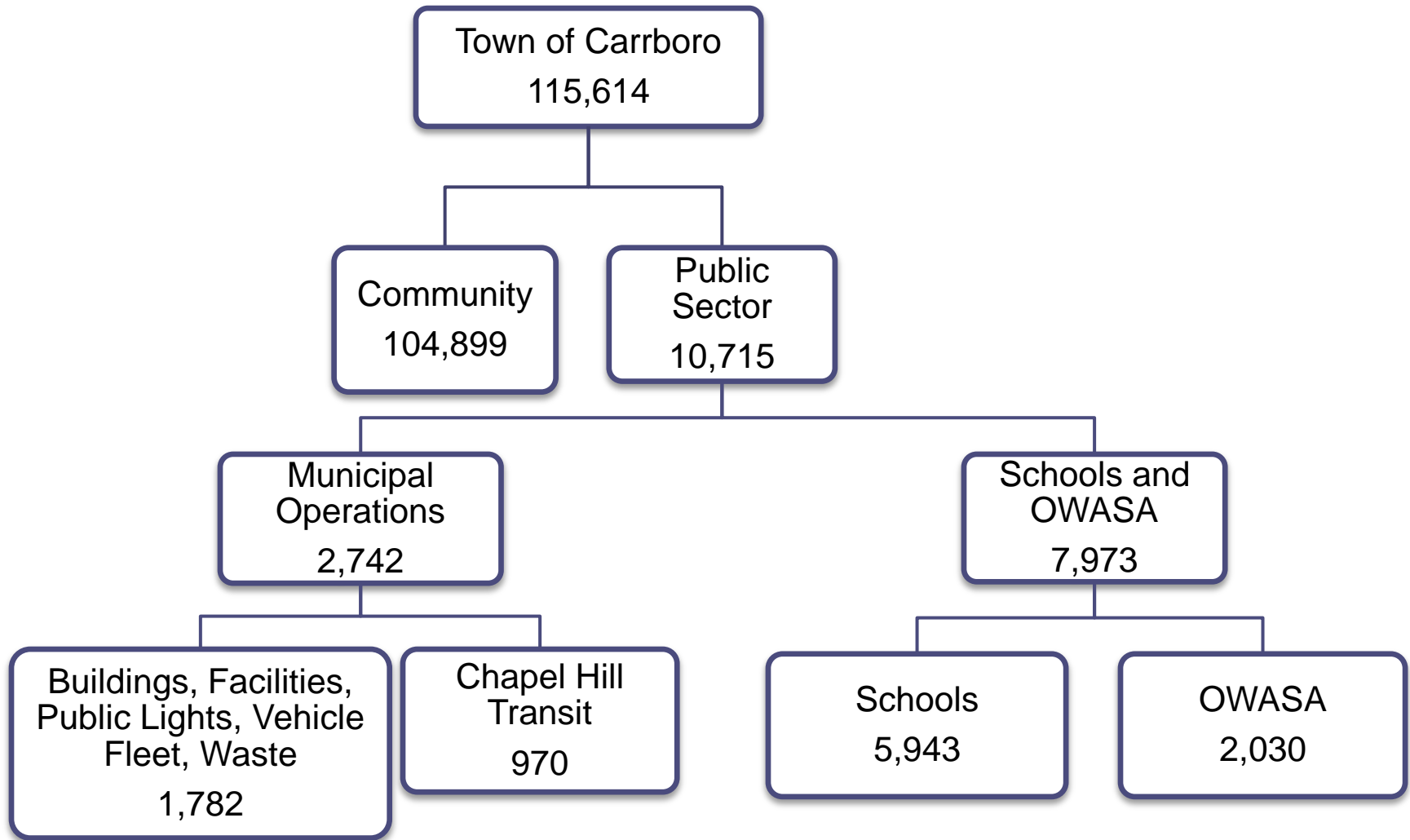
Assistants | Categories | Indicators | Coefficients

Forecast Builder

Fuel Type	Units	Energy Use
Electricity (Grid Average)	(kWh)	72,023,412
Commercial Coal	(tons)	0
Fuel Oil (#1 2 4)	(US gal)	0
Kerosene	(US gal)	0
Landfill Gas or biogas	(MMBtu)	0
Natural Gas	(therms)	0
Propane	(US gal)	0
Stationary Gasoline	(US gal)	0
Stationary LPG	(US gal)	0
Wood 12 pct moisture	(tons)	0

Notes Regarding Residential Building or Group Data

Energy Consumption	(ekWh)	72,023,412
Equivalent CO ₂ Production	(tonnes)	37,292
NO _x Production	(lbs)	177,610
SO ₂		



*all values in units of MTCDE

Results - Community

Carrboro Community Greenhouse Gas Emissions in 2009 Summary Report

	CO ₂ (tonnes)	N ₂ O (kg)	CH ₄ (kg)	Equiv CO ₂ (tonnes) (%)		Energy (ekWh)
Residential	52,840	791	1,723	53,121	50.6	132,742,895
Commercial	18,368	293	515	18,469	17.6	42,044,924
Industrial	55	1	1	55	0.1	160,874
Transportation	31,008	1,730	1,472	31,576	30.1	127,522,340
Waste	0	0	79,886	1,678	1.6	
Total	102,271	2,814	83,597	104,899	100.0	302,471,033

Results - Community

Carrboro

Community Greenhouse Gas Emissions in 2009 Report by Source

	CO ₂ (tonnes)	N ₂ O (kg)	CH ₄ (kg)	Equiv CO ₂		Energy (ekWh)
				(tonnes)	(%)	
Diesel	5,133	15	16	5,138	4.9	20,559,834
Electricity	61,061	1,065	1,279	61,418	58.6	118,617,773
Food Waste	0	0	36,921	775	0.7	
Gasoline	25,875	1,715	1,456	26,438	25.2	106,962,506
Natural Gas	10,201	19	960	10,227	9.7	56,330,920
Paper Products	0	0	40,899	859	0.8	
Plant Debris	0	0	1,018	21	0.0	
Wood or Textiles	0	0	1,048	22	0.0	
Total	102,271	2,814	83,597	104,899	100.0	302,471,033

Results - Public Sector

	2005 MTCDE (ICLEI)	2009 MTCDE (Our Study)	Change in MTCDE	% Change
Buildings and Facilities	541	555	14	2.6%
Vehicle Fleet	636	676	40	6.3%
All Sources (excluding streetlights)	1,177	1,231	54	4.6%

	2005 Energy Use (kWh) (ICLEI)	2009 Energy Use (kWh) (Our Study)	Change in Energy Use (kWh)	% Change
Buildings and Facilities	1,374,055	1,434,458	60,403	4.4%
Vehicle Fleet	2,566,091	2,920,777	354,686	13.8%
All Sources (excluding streetlights)	3,940,146	4,355,235	415,089	10.5%

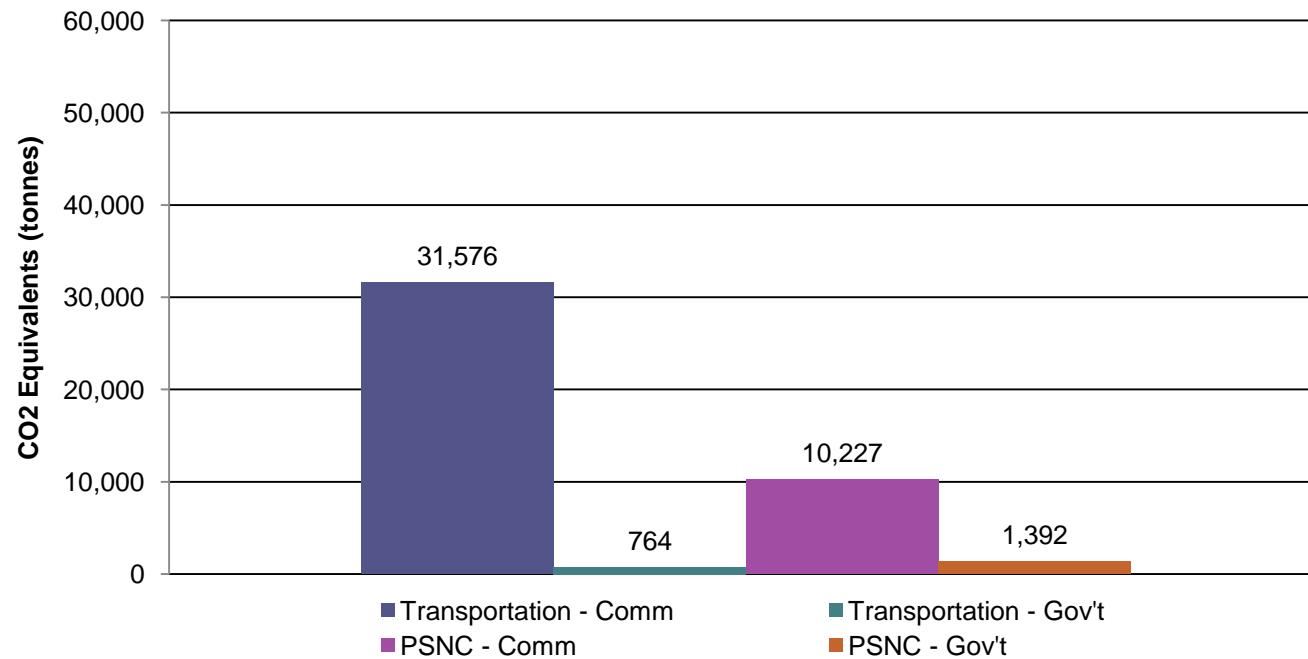
Results - Public Sector

	2005 Energy Costs (ICLEI)	2009 Energy Costs (Our Study)	Change in Energy Costs	% Change
Buildings and Facilities	\$77,405	\$82,279	\$4,874	6.3%
Vehicle Fleet	\$124,317	\$161,110	\$36,793	29.6%
All Sources (excluding streetlights)	\$201,722	\$243,389	\$41,667	20.7%

Growth Indicator	2005	2009	Change	% Change
Population	18493	19891	1398	7.56%
Municipal Land Area (sq. miles)	5.72	6.425	0.705	12.33%
Road Length (miles)	67.72	74.22	6.5	9.61%
Duke Streetlight Wattage (Watts)	136,300	154,900	18,600	13.65%

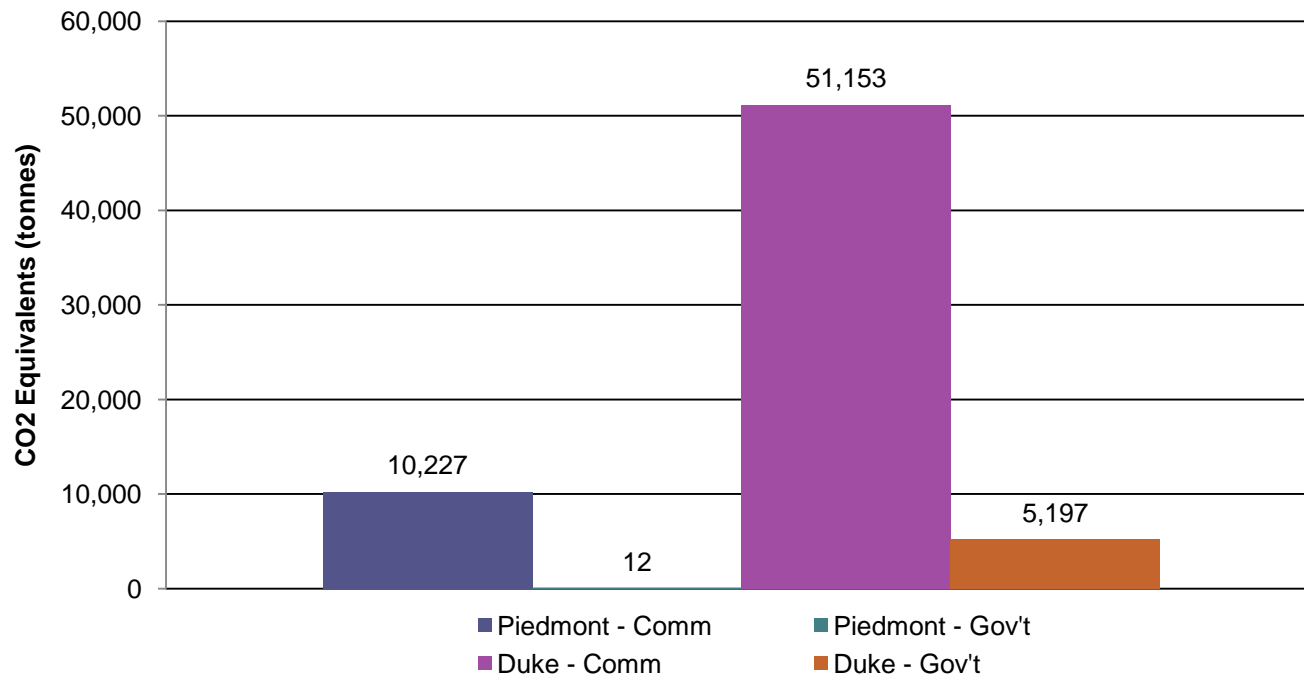
Results - Scope 1

Scope 1 GHG Emissions



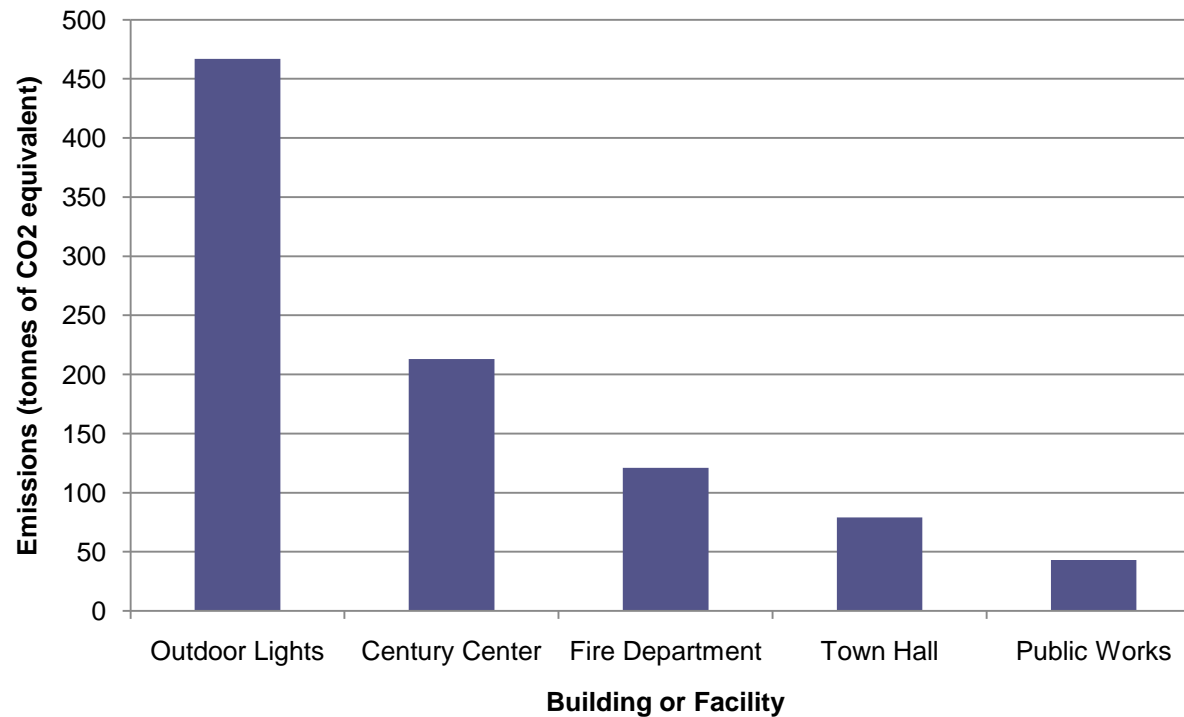
Results - Scope 2

Scope 2 GHG Emissions



Results - Emissions by Building

Municipal Electricity-Related Emissions (Scope 2)



Comparison - Backcasting

- 350 refers to atmospheric concentration of CO₂ equivalents, in parts per million
 - Scientific postulation of a safe level
- In 2005, global CO₂ concentration was 379 ppm
- Backcasting requested by Town of Carrboro
 - Not feasible



Comparison - Municipal

Carrboro Municipal 2009 Emissions vs. Chapel Hill Municipal 2005 Emissions

	Population (Year)	MTCDE	CO ₂ e/person (kg)
Chapel Hill	49,543 (2005)	8,173	165
Carrboro	19,891 (2009)	1,782	90

	Pools	Community Centers	Community Parks	Neighborhood Parks
Chapel Hill	3	3	3	7
Carrboro	0	1	1	6

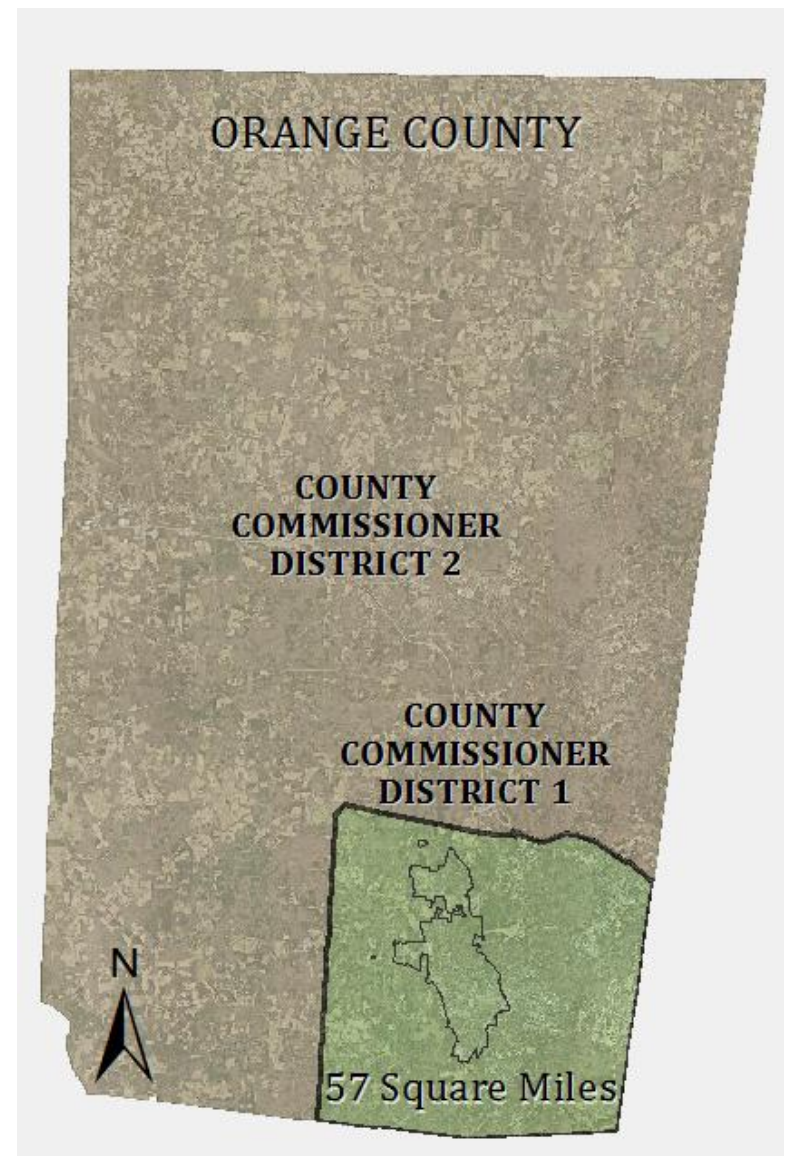
Carrboro is ~1/3 the size of Chapel Hill, and produces <1/4 the emissions, so *per capita* emissions are lower in Carrboro

Comparison - Public

- Forests offset 8066 lbs of CO₂ per acre per year

(SOURCE: EPA)

- Carrboro would need 50 square miles of forest to offset 2009 emissions



Discussion - Limitations

- Software Usability
 - CACP software was inflexible
 - No distinction between scopes
- Data Acquisition
 - Older records were generally unavailable
 - Utility correspondents were sometimes unresponsive
- Results interpretation
 - CACP generated fixed results

Discussion - Recommendations

- **Stationary Structures**
 - **Water use**
 - Low-flow showerheads, faucets and toilets
 - Conservation measures
 - Water heaters
 - **Appliances**
 - Energy Star
 - **Heating**
 - Programmable Thermostats
 - Insulation
 - **Lighting**
 - Compact Fluorescent Bulbs
 - LED streetlights
- **Programs and Policies**
 - **Waste**
 - Larger recycling containers
 - Pay as you throw (PAYT)
 - **Development**
 - Environmental Benchmarks for municipal contractors
 - Smart Growth
 - **Energy**
 - Energy Resource Center
 - Municipal competition for energy reduction
 - **DELTA intern could help administer these policies**

Conclusion

- Carrboro has taken a bold step towards recognizing the power of informed and engaged citizens
- GHG inventory establishes a clear procedure and baseline for future GHG emissions monitoring



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-
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Carrboro

Government Greenhouse Gas Emissions in 2009

Summary Report

	CO ₂ (tonnes)	N ₂ O (kg)	CH ₄ (kg)	Equiv CO ₂ (tonnes)	(%)	Energy (ekWh)	Cost (\$)
Buildings and Facilities	6,494	92	238	6,527	60.9	17,586,908	0
Streetlights & Traffic Signals	464	8	10	467	4.4	901,246	0
Water Delivery Facilities	1,931	34	41	1,942	18.1	3,788,276	0
Vehicle Fleet	759	14	16	764	7.1	3,291,996	0
Transit Fleet	958	6	7	960	9.0	3,843,962	0
Other Process Fugitive	0	0	2,648	56	0.5		
Total	10,605	153	2,960	10,715	100.0	29,412,388	0