EXECUTIVE SUMMARY

Understanding
the regulatory environment of climate change and the
impact
of community design on greenhouse gas emissions.



ATLANTA REGIONAL COMMISSION

Prepared by:
David D'Onofrio
Air Quality and Climate Change
Principal Planner
Atlanta Regional Commission
40 Courtland Street NE
Atlanta, GA 30303
ddonofrio@atlantaregional.com
404.463.3268

Preface

Actions and opinions on climate change are evolving quickly. The Supreme Court ruled, in 2007, that the Environmental Protection Agency (EPA) is mandated under the Clean Air Act to regulate greenhouse gas emissions[1]. The Office of the President has developed a climate action plan that strives to reduce greenhouse gas emissions and prepare America for the impacts of a changing climate.[2]

A survey conducted in October 2013 by Pew Research found that 67% of Americans believe there is evidence the planet is warming with a plurality (44%) believing the causes are mostly manmade.[3] Among scientific circles the debate over climate change is less evenly split. As of January 2013, 97% of published climate papers take the position that climate change is happening and that humans are the cause.[4] Scientists have overwhelmingly come to the consensus that people are impacting the world we live in by changing the chemical structure of the atmosphere.

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Whether or not Congress enacts federal climate change action based on the advice of the scientific community remains to be seen. While Congress debates comprehensive action, other branches of the federal government, states, regions and cities across the United States have begun to investigate their greenhouse gas emissions and are devising plans to reduce their contribution to climate change. Regions that take steps to understand their greenhouse gas emissions, and provide their communities with policy options, are taking a seat at the climate change national table. These communities will help to inform federal policy on the issue in the future.

This Executive Summary is designed to succinctly present the information from ARC's paper Understanding the Regulatory Environment of Climate Change and the Impact of Community Design on Greenhouse Gas Emissions. First, the Executive Summary briefly explains the expected impacts of climate change on the Atlanta region. Then, the Executive Summary is designed to focus on the results of a study conducted by ARC staff to develop a basic greenhouse gas inventory from residential electricity usage and automobile travel at a neighborhood level. This work contains the most detailed analysis related to climate change and planning-level decisions undertaken by ARC.

Climate Change Impacts in the Atlanta Region

When considering the costs of climate change it can be more expensive to do nothing than to take actions to mitigate the causes and adapt our systems today. Globally rising greenhouse gas levels impact regional climate around the world in different ways. The US EPA has developed a comprehensive summary of expected impacts related to climate change over the next 80-100 years by region. Much of this information is highlighted in the third National Climate Assessment.

Some of the key expected impacts for the Southeastern United States include:

Changing Weather Patterns

- 4°F – 9°F increase in average annual temperatures
- An increase in the number of days per year with high temperatures over 90°F
- Less frequent but more intense precipitation events Impacts on Public Health
- An increase in temperature related health effects, such as heat stroke and death
- Worse summer air quality which impacts asthma and cardiovascular disease
- Increased risk of water and food-borne disease
- Worsened seasonal allergies

Water Resource Availability

- Warmer temperatures increase evaporation from reservoirs, depleting surface water supplies
- Increased precipitation intensity will impact cycles of drought and flood in the region

Impacts on Transportation Infrastructure

- More frequent heat waves may require more investment in road and rail maintenance
- An increase in extreme precipitation events can lead to washed out roads and damage to transportation infrastructure

Economic Impacts

- Warmer temperatures reduce the allowable take-off weight for air freight cargo, reducing payloads
- Cycles of drought/flood can impact forestry and agriculture impacting the cost of food and consumer products
- Warmer temperatures increase the likelihood of agriculture pest outbreaks
- An increase in health care costs associated with heat-related illness

Greenhouse Gas Inventory Study

Previous efforts by ARC to quantify greenhouse gas emissions focused at a regional level, with little detail about how community characteristics impact emissions directly. This study calculates the Atlanta region's contribution to climate change, as measured by carbon dioxide (CO_2) emissions produced by our transportation and household energy use, at a community scale. Combined, transportation and electricity generation (for all purposes, not just household use) account for approximately 60% of United States greenhouse gas emissions. If a community decides that climate action makes sense for them, by better understanding what demographic, design and transportation patterns lead to higher CO_2 emissions, planners, citizens and decision-makers can make more informed decisions on how to shape our communities in the future.

Automobile CO_2 Emissions

Transportation accounts for approximately 28% of our national greenhouse gas emissions. Cars, trucks and buses burn fossil fuels, like gasoline and diesel, in their engines and release CO_2 in their tail-pipe exhaust.

ARC maintains a transportation model that simulates daily travel of individuals in a 20 county area of metropolitan Atlanta. ARC staff ran the transportation model for the year 2010 and looked at automobile trip distances by each individual's home community. This method lets us assign CO_2 emissions to the home community of the trip-taker instead of the locations that the trip passes through. Longer and/or more frequent trips result in more CO_2 emissions.

Residential Electricity CO_2 Emissions

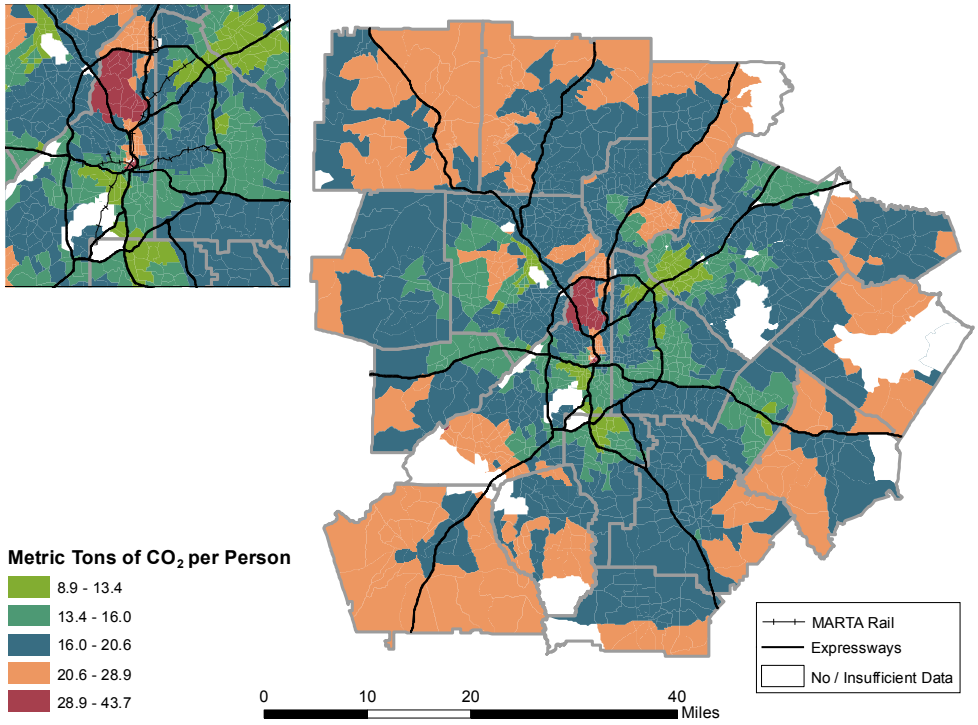
A key component of Atlanta's total CO_2 emissions comes from the burning of fossil fuels to provide our households with electricity. These CO_2 emissions are associated with the energy we use to heat and cool our living space, power our electronics and light our residences.

Southern Company, Georgia Power's electric holding company, provided ARC with total annual energy use in kilowatt-hours (kWh) for the year 2010. This database was provided for 178 zip codes in a 19 county area of the Atlanta region.

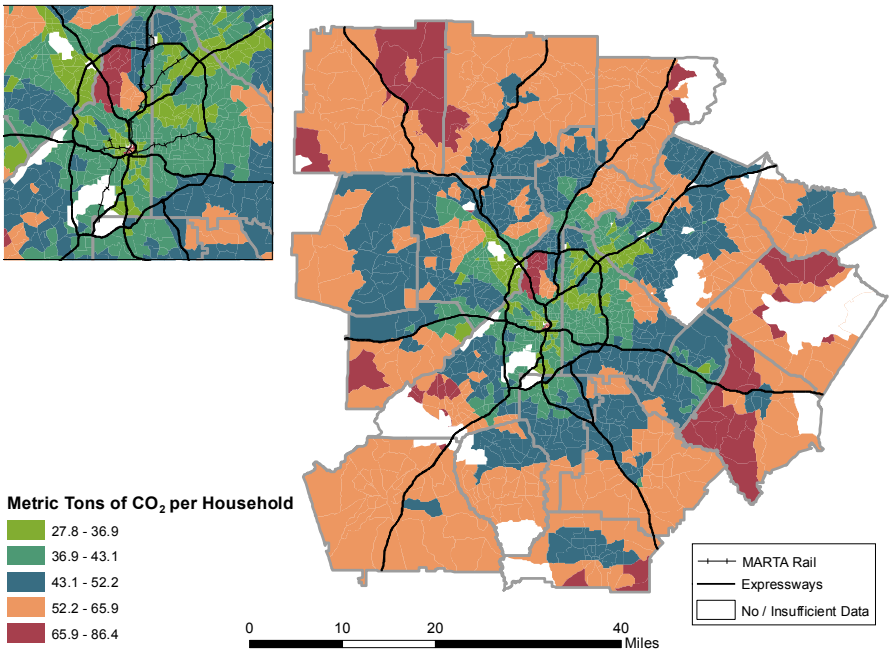
Combined CO_2 Emissions

Emissions from transportation and residential sources were then summed on a per person and per household basis. Maps 1 and 2 illustrate the per person and per household combined CO_2 emissions on a neighborhood level for the Atlanta region. Emissions are driven by household energy use, with automobile emissions accounting for 15% of the regional household value. Areas closer to the center of the region tend to have the lowest per household emissions. CO_2 emissions per person are more dispersed due to demographic trends towards having more people per household in families in the suburban communities outside the core of the region.

Map 1 – Annual Combined CO_2 Emissions per Person



Map 2 – Annual Combined CO_2 Emissions per Household



Greenhouse Gas Emissions by Neighborhood Characteristics

The developed emissions inventories were then compared with United States Census Bureau data on neighborhood characteristics and design, such as: number of housing units per multifamily development, age of household structures and average number of bedrooms per household. Looking at neighborhood design and household characteristics helps us to better understand the patterns found in the emissions inventories. Using geographic informationsystems (GIS) and statistical software, we can examine which aspects of certain neighborhoods correlate to communities with lower or higher CO_2 emissions. This information can be helpful to citizens, planners and policy makers in communities that wish to target greenhouse gas reductions as part of a sustainability program.

Table 1 breaks out the neighborhood level key indicators with regard to their impact on CO_2 emissions in the region. Transportation and residential emissions are correlated to key indicators separately, due to differences in the geographies of measurement. The table includes information on whether the indicator primarily impacts automobile or residential emissions and the direction of the correlation of the indicator and CO_2 emissions. In other words, whether you should expect a decrease or an increase in the CO_2 emissions per household if you increase the indicator's presence in the community. A ▲ indicates an increase in the indicator would lead to an increase in CO_2 emissions while a ▼ indicates that an increase in the indicator would lead to a decrease in CO_2 emissions. For example, the amount of multi-family housing is negatively correlated with residential CO_2 emissions; therefore an increase in multi-family housing relates to a decrease in residential CO_2 emissions per household in that community.

There are many positive co-benefits to building climate-smart communities beyond curtailing global climate change. Many of the planning-related strategies addressed in this paper have been tied to building better communities in numerous different metrics.

Table 1 – Key Neighborhood Indicator's Impact on CO_2 Emissions

Key Indicator	Description	Transportation Focused	Residential Focused	Strength of Relationship to per Household CO_2 Emissions*
More multi-family housing	The amount of multi-family housing in community		✔	▼▼
More people per household	The average number of people living in a household		✔	▲
Larger size of household	Physical size of a residence as measured by bedroom count		✔	▲▲
Older age of property	The age of a residence		✔	▼
Higher population density	The number of people per square mile	✔	✔	▼▼
Higher Walkability Index	Measure of the walkability of a community	✔		▼▼
Higher Multimodal Access Index	Measure of how many transportation options to employment exist in a community	✔		▼▼▼
Higher Jobs Housing Balance of Community	The ratio of the number of jobs to the number of housing units	✔		▼
Longer distance to Regional Activity Centers	The proximity of a community to major employment centers	✔		▲▲
More miles of Transit Ridden per Day by the Community	The relative amount of distance people in a community travel by transit	✔		▼▼
More distance to GRTA Express Park & Ride	The proximity of a community to GRTA park and rides	✔		▲

* The number of ▲ or ▼ signs denotes the strength of the relationship from 1 to 3 symbols for weak, medium and strong based on the size of the correlation coefficient. See Appendix 2 for more details, including the calculated correlations.

Key Findings

CO_2 emissions are directly related to the types of communities we have built. Planners, citizens and decision makers that have greenhouse gas emissions reduction as a policy goal for their communities should consider evaluating the presence of the key indicators in their communities.

Residential

The most important residential indicators of CO_2 emissions are (in order):

- Presence of multifamily housing
- Size of the residences
- Density of housing
- Number of people per household

Transportation

The most important transportation indicators of CO_2 emissions are (in order):

- Multimodal accessibility
- Transit share
- Distance to regional activity centers
- Population density
- Neighborhood walkability

Closing & Future Work

With improved knowledge of planning and development decisions that have led to the patterns of CO_2 emissions found throughout the Atlanta region, planners, policy-makers and citizens can make more informed decisions for future growth. Communities with sustainability goals that include greenhouse gas mitigation should consider the key findings presented in this report when drawing up future changes to land use and transportation plans. CO_2 emissions should be included as an important component of any future planning work.

There is still much more work to be done to prepare the Atlanta region for the expected impacts of climate change in the coming decades. While the debate continues in Congress on what, if anything, to do about the changing climate, the Atlanta region should continue to analyze its vulnerability to climate change and explore additional greenhouse gas reduction and adaptation measures. By exploring these options now and gathering useful information, ARC can help inform future federal policy and prepare for the possibility of eventual national CO_2 action.

Endnotes

1 US Environmental Protection Agency. (2013). Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act. *Climate Change.* Retrieved on March 31, 2014, from http://www.epa.gov/climatechange/endangerment/

2 The White House. (2013). The President's Climate Action Plan [pdf]. *President Obama's Plan to Fight Climate Change.* Retrieved on March 31, 2014, from http://www.whitehouse.gov/share/climate-action-plan

3 Pew Research. (2014). Climate Change: Key Data Points from *Pew Research*. Pew Research. Retrieved on March 31, 2014 from http://www.pewresearch.org/key-data-points/climate-change-key-data-points-from-pew-research/

4 Cook, J., Nuccitelli, D. et al. (2013). Quantifying the Consensus on Anthropogenic Global Warming in the Scientific Literature. *Environmental Research Letters*, 8(2), 1-7.

5 Carter, L. M., J. W. Jones, L. Berry, V. Burkett, J. F. Murley, J. Obeysekera, P. J. Schramm, and D. Wear, 2014: Ch. 17: Southeast and the Caribbean. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 396-417. doi:10.7930/J0NP22CB.

6 US Environmental Protection Agency. (2014). Climate Change Indicators in the United States, 2014 [pdf]. Climate Change. Retrieved on February 5, 2014, from http://www.epa.gov/climatechange/ghgemissions/sources.html

7 US Environmental Protection Agency. (2013). Sources of Greenhouse Gas Emissions. *Climate Change*. Retrieved on March 28, 2014, from http://www.epa.gov/climatechange/ghgemissions/sources.html