

## FLORIDA STATE UNIVERSITY

### *Reducing Residential Carbon Emission in Florida: Optional Scenarios Based on Energy Consumption, Transportation, and Land Use*

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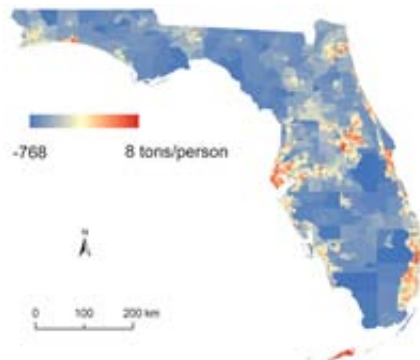
**Description:** In 2007 the Governor of Florida established targets for greenhouse gas (GHG) emissions, which mandate that the State of Florida aims to reduce emissions to 2000 levels by 2017 and to 1990 levels by 2025. To fulfill these goals, not only is the development of renewable sources of energy and fuel needed, but it is also necessary to achieve more sustainable energy/fuel consumption patterns. The objective of this project is to explore energy and fuel sustainability as well as CO<sub>2</sub> mitigation in Florida by investigating the household-level energy and transportation fuel consumption and by analyzing changes in land use. The project consists of three major steps: 1) calculating the baseline Florida CO<sub>2</sub> emissions from residential energy and fuel consumption as well as human land uses; 2) developing models of household behavior regarding various energy/fuel conservation and efficiency options based on a residential survey; and 3) forecasting energy/fuel demand and CO<sub>2</sub> emission levels in 2017 and 2025 throughout the state of Florida based on the scenarios created in step two. This project helps identify and determine the efficacy of various proposed practical energy incentives for household energy consumption reduction and carbon mitigation. It provides insights into the possible effectiveness of economic and policy tools for sustainable energy consumption and greenhouse gas reduction.

Budget: \$60,844

### Progress Summary

**Objectives for Current Reporting Period** include finishing the baseline carbon emissions estimation for Florida in 2000, conducting household survey on energy incentive behavior, and exploring modeling approaches that may be applied to building household behavior scenarios.

**Progress to Date:** We investigated the Florida carbon balance between household emissions and vegetation carbon assimilation (Zhao, Horner, and Sulik, journal manuscript submitted to *the Annals of the Association of American Geographers*). Household carbon emissions are composed of CO<sub>2</sub> released through residential consumption of energy and transportation fuels. Vegetation carbon



assimilation is measured as plant net photosynthesis using biophysical remote sensing techniques. We found that vegetation in Florida was able to offset the state's residential energy and transportation fuel related carbon emissions in 2000. The balance of household carbon emissions and vegetation carbon sinks, however, varied significantly across the state (Figure to the left). The consumption-based carbon emission sources tend to be spatially separated from vegetation carbon sinks. The urban and suburban densities were associated with the highest per capita energy consumption, whereas exurban densities were associated with the highest per capita transportation fuel usage.

Both exurban and rural densities were associated with significant vegetation carbon sinks.

We developed survey questionnaire for the investigation of household energy incentive behavior. This questionnaire includes 32 questions covering four major household socioeconomic and energy behavior aspects. These include the present household conservation/efficiency methods, household decisions on adopting alternative energy-saving approaches driven by incentives, housing characteristics, and household characteristics such as ownership, education level, and income level. We have been working on the sampling strategy. We decided to sample 400 residential households across Leon County as a pilot survey study. The mailing list has been acquired (Figure to the left shows an example of residential mailing locations in a residential neighborhood at the parcel scale).



We plan to test effectiveness of two survey modes – half of the residents will receive mail interviews and the other half postcard invitation to Internet survey. The survey framework is presently under the FSU Institutional Research Board (IRB) review. FSU Survey Research Laboratory will facilitate the conduction of

survey upon the IRB approval.

We have conducted literature review on energy sustainability and carbon mitigation in the new era of climate change, with a specific focus on synergy between energy and Geographic Information Science (Horner, Zhao, and Chapin, journal manuscript submitted to *the Annals of the Association of American Geographers*). Several research challenges have been identified, which include the spatially explicit modeling of energy consumption that take into account the complex nature of social networks and environmental heterogeneity. The agent-based models (ABMs) may help us to overcome these difficulties, and we plan to focus on developing an ABM of household energy consumption behavior towards energy conservation and efficiency incentives based on our survey results during the next research development stage.