# Atlanta Households' Willingness to Increase Urban Forests to Mitigate Climate Change

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# Urban Areas & Climate Change

- Urban areas have highest concentration of population, industries, and infrastructure; and are also likely to face the most severe impacts of climate change
- Public opinion studies suggest that the public's concern over climate change has coincided with economic cycles (Scruggs & Benegal, 2012)
  - Highest levels of worry were in 2000 and 2007
  - Lowest levels of worry were in 1997, 2004, and 2011

# Urban Forests

- Urban forests – forests or collections of trees growing within a city, town or suburb
- 130 million acres (53 million ha) or America's forests located in cities and towns (parks, street trees, landscaped boulevards, gardens, river and coastal promenades, greenways, wetlands, nature preserves, shelterbelts, and working trees at industrial brownfield sites)

# Broader Context

- Market based approaches toward the development of urban forest carbon projects in the United States
  - Capacity and interest in suppling carbon emission offsets
  - Quality of forest carbon offsets
  - Efficient assessment of urban carbon tree planting potential with remotely sensed data
  - Urban forests and carbon markets
  - US Mayors' role in addressing climate change through urban forests (US Conference of Mayors Climate Protection Agreement)
  - Atlanta households' role in addressing climate change by supporting urban forestry

# Research Questions and Assumptions

**Research Questions**

- What mitigation method will be used?
- Will residents support the policy?
- Are they willing to pay to mitigate the problem?

**Previous Findings**

- Educated and higher income residents in areas with high tree canopy have a greater demand for urban forests than other residents (Zhu and Zhang, 2008)
- Women are more willing to pay for climate change mitigation than men (Lee and Cameron, 2008)
- African-American residents are less likely to perceive benefits of urban forests than their Caucasian counterparts (Elmendorf et al., 2005)
- Belief that climate change is caused by humans (Heath and Gifford, 2006)
- Relationship between where residents receive climate change news and desirability for increasing urban forests for climate change mitigation

# Study Area

- U.S. urban areas have highest concentration of population
- Atlanta is ranked 40$^{th}$ most populous of U.S. cities with 420,003 people (in the actual boundaries of the city) in 2010
- U.S. Census projected that the Atlanta population will be 562,260 by 2020 (nearly a 34 percent increase over 10 years)
- Atlanta Metro Area is known for urban sprawl because of the growth in population (Miller, 2012)
- Atlanta is currently listed as nonattainment area under EPA air quality standards (pollution exceeding federal requirements)

# Methods

- Survey Construction and Implementation
  - Modified Tailored Design Method (Dillman 2009) for mail questionnaires consisting of 38 questions in four sections mailed in fall of 2013
  - Many “questions” are statements followed by a 5-point Likert scales
- Missing Data Analyses
  - Nonresponse Data Analysis
  - Data Incompleteness
- Tree Canopy Analysis
  - i-Tree Canopy used to estimate tree cover

# Methods: Modeling Approach

- Respondents were asked how much they were willing to pay to increase urban forests to mitigate climate change for their household annually for five years using an open-ended bidding process
- Respondents were asked follow up questions if a zero WTP amount was entered. The zero bidders were then classified as legitimate zero bidders or legitimate protest bidders

# Results: Survey Response and Tree Canopy Estimates

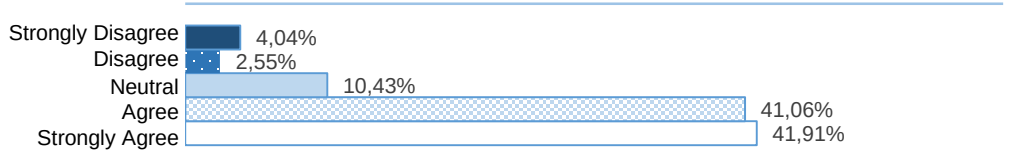
- Survey response
  - 5,500 surveys distributed
  - 1,021 returned with bad addresses
  - 4 opted out of survey
  - 470 completed (10.5% response rate)
- Tree canopy estimates
  - 2.5 to 67.6 percent (±3%) – Census tracts
  - 36.6 percent (±0.8%) – Atlanta overall

# Results: Sociodemographic Characteristics

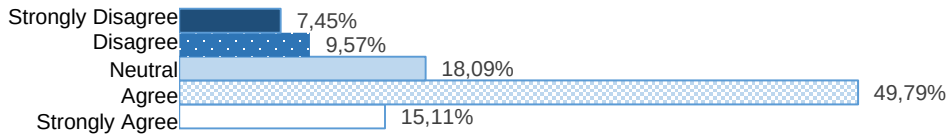
| Sociodemographic Characteristics | 2010 Census | Unweighted Survey | Weighted Survey |
|---|---|---|---|
| Households | 179,459 | 470 | 468 |
| Average Household Size | 2.18 | 2.13 | |
| Households with Individuals 65 years or older | 17.8% | 16.4% | |
| Female persons | 50.2% | 47.9% | 51.8% |
| | | | |
| White alone | 38.4% | 71.7% | 39.8% |
| Black or African American alone | 54.0% | 22.2% | 54.4% |
| Other (includes American Indian and Alaska Native alone, Asian, and Two or More Races) | 5.3% | 5.8% | 5.8% |
| Hispanic or Latino, percent | 5.2% | 5.1% | 6.2% |
| | | | |
| Bachelor's degree or higher | 46.1% | 76.4% | 44.8% |
| Median household income | $45,946 | $87,500 | $42,500 |

# Results: Beliefs and Attitudes

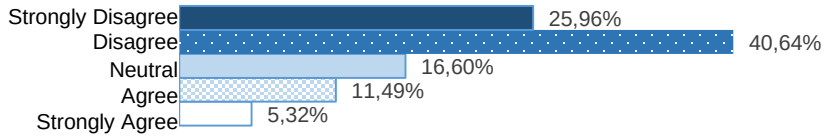
Concern with the effects of climate change



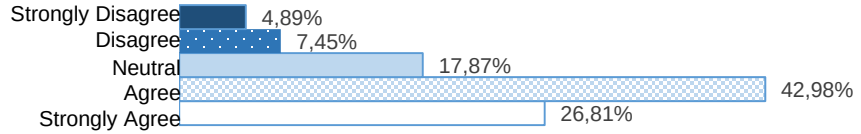

Belief that daily activity contributes to increase of GHG and adds to climate change



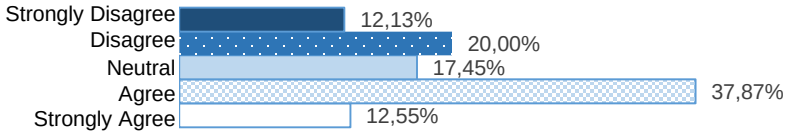

Belief that human activity does not have effect on climate change



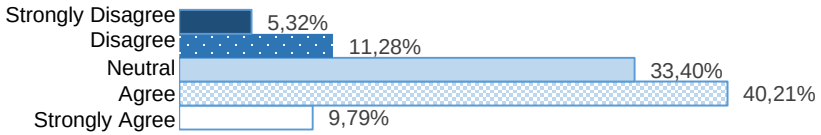

Belief that action should be taken on climate change




Not enough information on climate change and more research needed

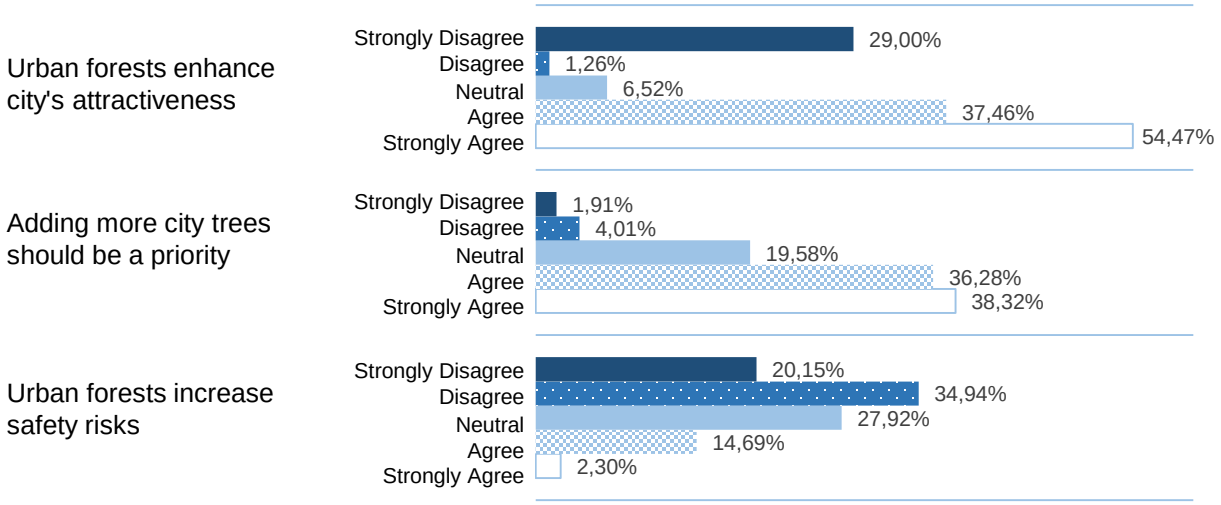



Climate change will be reduced if fossil fuel usage is reduced




*Respondents' Level of Agreement with Climate Change Statements, Weighted (n=470)*

# Results: Beliefs and Attitudes




*Respondents' Level of Agreement with Urban Forest Statements, Weighted (n=470)*

# Results: Beliefs and Attitudes

- The attributes of urban forests that respondents valued most (weighted):

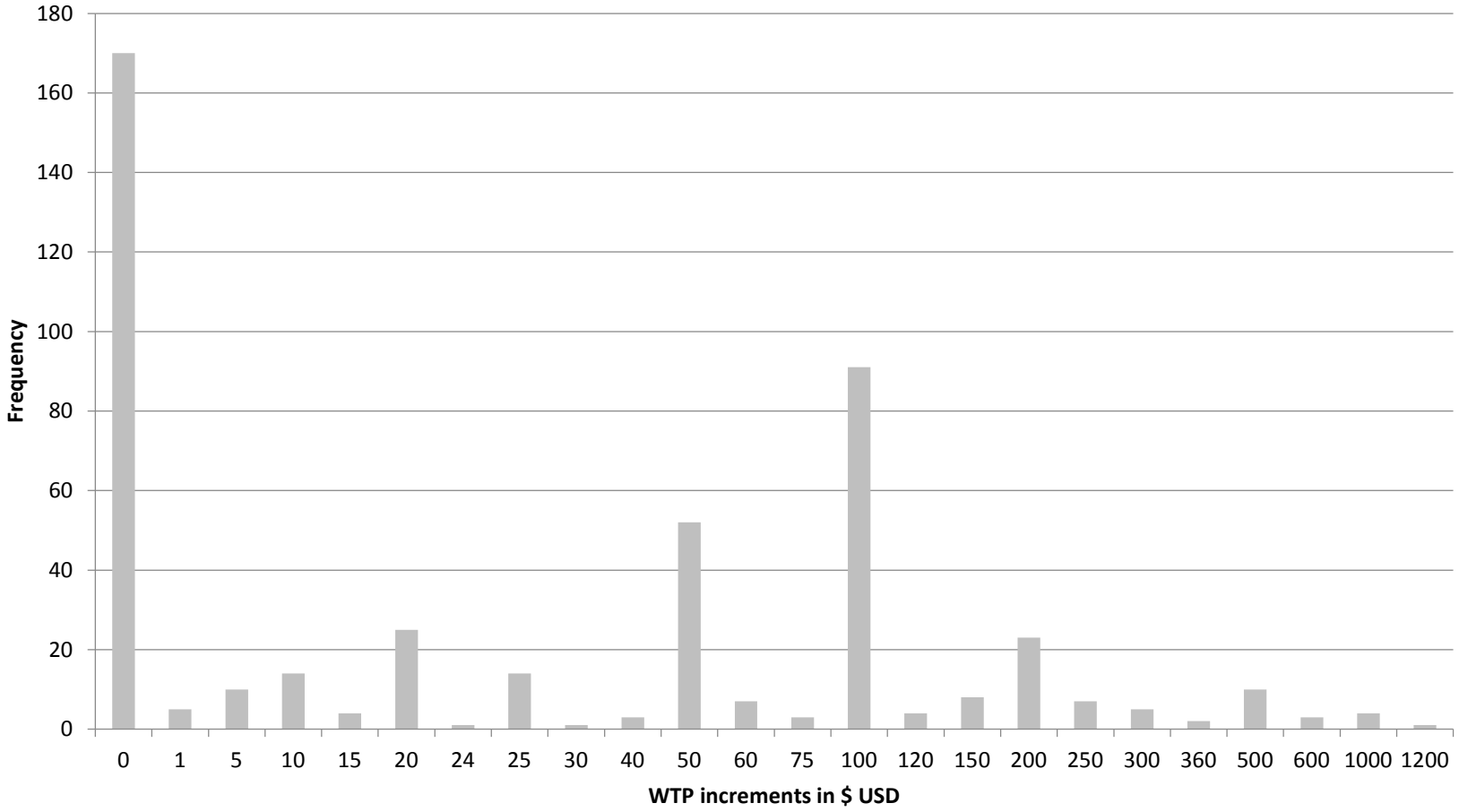
| | |
|---|---|
| Cleaner Air/Water | 79% |
| Wind Control | 68% |
| Heat Reduction | 64% |
| Aesthetic Beauty | 63% |
| Wildlife Habitat | 57% |

# Results:
# Climate Change News Outlets, weighted

| Source | Percentage |
|---|---|
| ABC/CBS/NBC | 52% |
| Newspapers/Magazines/Journals | 43% |
| NPR | 41% |
| The Weather Channel | 41% |
| Surfing the Internet | 40% |
| Other Cable News | 32% |
| Family/Friends/Word of Mouth | 20% |
| Fox News | 20% |
| AM/FM Radio | 17% |

# Analysis: Willingness-to-Pay

**Distribution of Willingness-to-Pay to Plant Additional Urban Trees (per household per year over a five-year period)**



# Analysis: Sample Weights

| Sex | Education Level | # black adults | (a) % black Census | (b) % black survey | (c) black weights (b)/(c) | (d) # other adults | (e) % other Census | (f) % other survey | (g) other weights (e)/(f) | (h) # white adults | (i) % white Census | (j) % white survey | (k) white weights (i)/(j) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Male | Less than Bachelor's Degree | 18 | 18.16 | 3.85 | 4.7216 | 3 | 1.40 | 0.64 | 2.1840 | 18 | 5.80 | 3.85 | 1.5080 |
| Male | Bachelor's degree or higher | 17 | 4.98 | 3.63 | 1.3710 | 10 | 1.89 | 2.14 | 0.8845 | 178 | 16.19 | 38.03 | 0.4257 |
| Female | Less than Bachelor's Degree | 31 | 22.03 | 6.62 | 3.3258 | 2 | 1.16 | 0.43 | 2.7144 | 11 | 5.26 | 2.35 | 2.2379 |
| Female | Bachelor's degree or higher | 47 | 6.06 | 10.04 | 0.6034 | 12 | 1.86 | 2.56 | 0.7254 | 121 | 15.21 | 25.85 | 0.5883 |
| | Totals | 113 | 51.23 | 24.15 | | 27 | 6.31 | 5.77 | | 328 | 42.46 | 70.09 | |

- A similar multivariate weighting strategy used to address nonresponse bias has been used in a previous study by Vaske and Donnelly (2007).

# Results: Factors Affecting WTP (weighted)

| Explanatory Variables - Significant | | | |
|---|---|---|---|
| Fox News | - | Age | - |
| Climate Change as a valued urban forest attribute | + | Household income | + |
| Support of balanced carbon emissions | + | Tree Canopy Cover | + |

# Results: Factors Affecting WTP (weighted)

| Explanatory Variables – Not Significant | | | |
|---|---|---|---|
| National Public Radio | ns | Wildlife habitat | ns |
| Newspapers/ magazines/ journals | ns | Noise/glare reduction | ns |
| CNN or MSNBC | ns | Recreation | ns |
| All other news sources | ns | Storm water | ns |
| Aesthetic beauty | ns | Wind Control | ns |
| Clean air/ clean water | ns | Future value | ns |
| Heat reduction | ns | Race | ns |
| Property value | ns | Education | ns |

ns = variables are not significant

# Weighted WTP Results

| Model | Household WTP | Aggregate WTP (all Atlanta households) | Aggregate WTP (10.5% Atlanta households) |
|---|---|---|---|
| Tobit including protest bids (n=436) | $57.41 | $9.72 million | $1.02 million |
| Tobit excluding protest bids (n=382) | $68.21 | $11.55 million | $1.21 million |

# Summary of Results

- What mitigation method will be used?
  - Urban forests may not be the best tool, given the low response rate
- Will residents support the policy?
  - Based on survey results, an estimated 10.5 percent of residents would support the use of urban forests as a tool for climate change mitigation
- Are they willing to pay to mitigate the problem?
  - WTP was between $9.72 to $11.55 million over 5 years to increase urban forests by 5% if aggregated over entire Atlanta population
  - WTP was between $1.05 to $1.22 million per year over a 5 year period if aggregated over 10.5% of Atlanta population

# Summary of Results

- Residents who resided in higher tree cover locations tended to be more willing to support increasing urban forests
- Level of education was not a significant variable
- Media preferences played a role in predicting the attitudes and preferences of climate change mitigation
- Responses from black residents were low, which could indicate a low level of topic salience