Response of Chicagoland Urban Foresters' to Climate Change Drought, and Flooding

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Abstract

The purpose of this research is do determine whether or not urban foresters within the Chicagoland area are responding to climate change, and if so, what are they doing to mitigate or adapt to climate change. This research specifically seeks to analyze what best management practices, as defined in Clark et al. (1997), that urban foresters within the Chicagoland area are implementing to combat drought and flooding, the greatest effects of climate change in the Midwest.

A survey was created to information regarding urban forest management practices regarding drought and flood as well as the current state of urban forest management within the Chicagoland Area

The survey was distributed to 492 urban foresters within the entire state of Illinois and Northwest Indiana in collaboration with the Community Tree Program of the Morton Arboretum in Lisle, IL. Seventy individuals completed part or all of the survey. Results show that there are some significant differences in the management actions of urban foresters who experienced climate change related drought and flooding and those who did not. The majority of urban foresters who experienced drought or flooding answered yes to the question, "Climate Change affects the survival and well-being of the urban forest."

Figure 1: Socio-ecological approaches in Chicago. Lewis et al. 2014

Background

Urban centers are particularly susceptible to the effects of climate change. Urban areas experience the urban heat island effect. The urban heat island effect makes urban centers hotter than their more rural counterparts. Industry and commercial business create excess heat that contributes the overall natural temperature of a city. The urban heat island effect is exacerbated by climate change and can lead to unhealthy atmospheric conditions from pollution and significantly worse flooding and drought from lack of permeable surfaces (Clark et al. 1997).

The city of Chicago and the surrounding Chicagoland area is responsible for the production of an estimated 103 million metric tons of greenhouse gases per year (Hayhoe 2008). In order to offset these emissions, a socio-ecological approach should be considered. The creation and maintenance of urban forests are a beneficial and economically viable approach. "Urban forestry is the art, science, and technology of managing trees, forests, and natural systems in and around cities, suburbs, and towns for the health and well-being of all people" (Kusnierz et al. 2010). Urban forests within the continental United States sequester about 700 million tons of carbon (Nowak et al. 2002).

Although urban forests provide innumerous benefits to cities and urban centers, they can still be negatively impacted by climate change themselves. In the Midwest, climate change is predicted to account for hotter drier summers and longer, mild wild winter. Research regarding urban forest practitioner response to climate change is limited.

Respondent Demographics

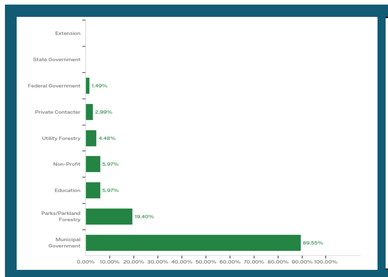

Figure 2: Sector of managed urban forest and the percentage of urban forester respondents that work there.

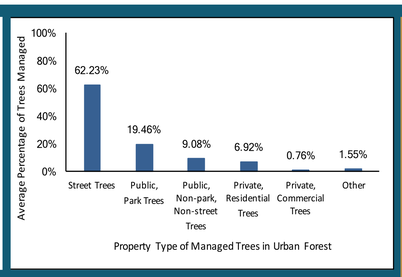

Figure 3: Average percentage of trees managed on various types of property by urban forester respondents.

Target Survey Respondents Confirmed

The survey distributed to urban foresters also asked urban foresters to provided a general area of where the trees that they manage are. The survey asked, "In what zip-code do you do most of your work with the urban forest?" and "If you work primarily in more than one zip-code, please describe the geographic location(s) where you work. (e.g. city, county, etc)." From these questions, only one responder did not manage trees in an urban forest within the Chicagoland area. The one outlying response was not included in the final data analysis.

Results: Experience vs Action vs Knowledge

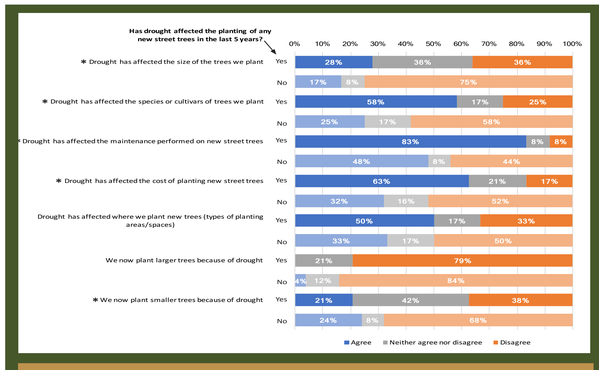

Figure 4: Urban foresters' response to the question, "Has drought affected the planting of any new street trees in the last 5 years?" and their agree-disagree response to specific management practices in relation to drought. Statements marked with an asterisk(*) denote significant (Fisher's exact test <0.05) differences in the distribution of agree-disagree responses between "Yes " and "No" answers.

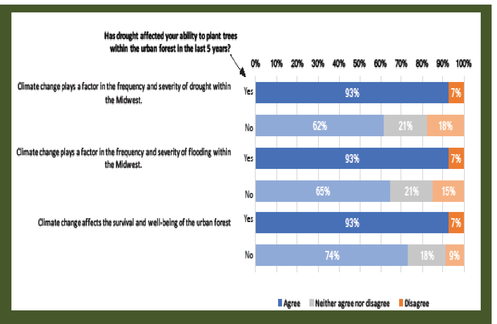

Figure 6: Urban forester's response to the question, "Has drought affected your ability to plant trees within the urban forest in the last 5 years?" and their agree-disagree response to questions about climate change affects on the urban forest.

Methodology

1. Create Survey
   a. Challenge
      i. Asking urban foresters about their response to climate change without allowing them to have any bias in answering these questions
   b. Solution
      i. Ask urban foresters about their response to more frequent drought and flooding, the most apparent effects of climate change on the Midwest
      ii. Urban foresters would be filling out the survey without bias because to someone that does not know about climate change, responding to a flood or drought may just be another day on the job
   c. Detail/Access
      i. Survey needed to gather as much data as possible without being too difficult or lengthy to fill out
   d. Question Sources
      i. Clark et al. (1997) Best management practices for a sustainable urban forest
      ii. Yale climate survey
2. Survey Administration
   a. Community Trees Program (The Morton Arboretum)
      i. Email list with 492 urban foresters throughout Illinois. Specifically, municipal urban foresters
      ii. Mission Statement
         1. Help communities, public and private landowners, land managers, tree professionals, and groups interested in trees to effectively manage and care for our urban and community forest.
   b. Recruitment email sent 3 times over the course of 3 weeks
      i. Survey open 9/26 – 11/1
      ii. The Tailored Design Method (Dillman 2014)
3. Data Analysis
   a. All analysis is currently done in Qualtrics
   b. Cross-tab analysis done in excel

References

Clark, J. S., et al (2015) The impacts of increasing drought on forest dynamics, structure, and biodiversity in the United States. Global Change Biology, (2016), 1-15.

Kusnierz, E. M., Dwyer, J. (2010) The Role of Our Urban Forest in the Chicago Metropolitan Region's Future. The Morton Arboretum, 4-39.

Lewis, D. L., Moseley, R. K., Hall, K. R., Hellmann, J. J. (2014) Conservation of Urban Biodiversity Under Climate Change: Climate-Informed Management for Chicago Green Spaces. Handbook of Climate Change Adaptation, 5.

Environmental Protection Agency (2016) "Climate Change: Basic Information." "Climate Impacts in the Midwest." EPA.gov. United States Environmental Protection Agency, 23 Feb. 2016. Web. 18 Mar. 2016.

Clark, J. R., Matheny, N. P., Cross, G., Wake, V. (1997) A model of urban forest sustainability. Journal of Arboriculture, 23 (1), 19-29.

Management Recommendations

Based on the significant differences in the distribution of agree-disagree responses to certain management practices in relation to experiencing/not experiencing drought and/or flooding, we recommend that urban foresters who have not/are not experiencing drought and/or flooding take notice of and use the management practices of urban foresters who have/are experiencing drought/flooding. Overall, whether or not urban foresters experienced drought/flooding, the majority agree that climate change plays a factor in the severity of drought and flooding in the Midwest. Climate change does not occur overnight so urban foresters who have not yet experienced climate change induced drought and flooding should adopt the management practices of those who have in order to be prepared for when climate change induced drought and/or flooding occurs.

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