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Research Proposal

I. Rationale

The objective of this experiment is to investigate the role of tree canopy loss in areas of environmental justice versus Tree City USA. Environmental justice is the notion of providing equitable distribution of environmental risks and benefits to all people regardless of race, color, or income. This ensures that all communities experience equal development, implementation, and enforcement of environmental laws and policies. The environmental justice program largely aims to combat environmental discrimination. Historically, areas primarily comprised of minority groups are more likely to contain environmentally hazardous sites such as waste disposal, energy production facilities, toxic waste, and transportation infrastructures (Holifield). This research is intended to look at the tree canopy in environmental justice areas and how ecosystem benefits suffer due to tree loss. In addition, these areas would be compared with Tree City USA participants which is an initiative, driven by the Arbor Day Foundation, to implement environmental solutions by regulating tree canopy in communities. This research hopes to determine if the environmental justice program is successful at providing equitable environmental regulation of tree canopy compared with programs that provide tree regulation.

Trees in urban areas have been found to provide a plethora of environmental, social, economic, and human health benefits for a community. Some of which include: reduced risk of having a low birthweight baby and reduced stress levels (Donovan et al. 2011, Grahn et al. 2010), reduced runoff water which helps to regulate the sewage system (McPherson et al, 2005), reduced rates of obesity, type 2 diabetes, high blood pressure, asthma, and better social better recorded social unity (Ulmer et al, 2016). While benefits of forestry in urban areas prove to be

immeasurably vital, many communities throughout the USA are facing several factors that threaten tree canopy. There has been an average net loss of 36 million trees in the USA annually (Nowak, 2018). Some of this can be attributed to dendrophobia, which is the fear of damage to residential and commercial areas caused by falling trees (Fountain), invasive insect damage, the loss of trees to the development of commercial and residential areas, natural aging of trees, and increasing occurrence of extreme storms (Conniff, 2018). This research is intended to see if there is tree canopy loss in areas heavily associated with environmental discrimination. It is predicated that environmental justice areas would see greater tree canopy loss and less ecosystem benefits due to less implementation of government environmental policies.

II. Research Question:

How do environmental justice communities compare to Tree City USA communities in terms of tree canopy and ecosystem benefits?

III. Hypothesis:

If an area is heavily regulated in terms of environmental protection, then it will see less tree canopy loss and greater ecosystem benefits.

IV. Expected Results:

The expected results would show that compared to the Tree City USA towns, environmental justice areas would yield both lower percentages of tree canopy decrease overtime and carbon dioxide levels. Also, Tree City USA areas are predicted to see greater ecosystem benefits from the trees in its area. Areas that are deemed Tree City USA towns would likely experience greater

environmental care and protection programs that prevents prematurely cutting trees and replacing trees that died of circumstances beyond human control.

V. Procedure:

The experiment will use computer imaging and GIS to test the hypothesis. To determine the tree canopy change throughout Long Island, Google Earth imaging will be used to document the change of tree canopy in a specific area from the years 2001 and 2018. To do this, a random sampling of points will be generated throughout the towns through GIS. An observer will then record the presence of tree canopy the points occupied. A minimum of 1000 points will be selected for each area of study. Each point was documented by two observers to ensure validity and sites where there was discrepancy were revisited by a different observer. After tree canopy is documented, sites where a change of tree canopy between the image's start date in 2001 and end date of 2018 will be isolated. These sites will then be put into a program called iTree Design to quantify the benefits lost or gained due to tree canopy change. iTree design allows one to place a tree in its location in relation to a chosen house and the program reveals the ecosystem benefits that the house would save in dollars provided by the tree. The five criteria the program measures are stormwater runoff, winter energy, summer energy, carbon dioxide, and air quality. iTree Design requires its user to identify the species of tree used, and since it is difficult to determine through an aerial google image, this research instead will measure the tree's DBH (diameter at breast height) and determine its likely species based on the average ecosystem benefits produced by each species of trees for a given size. Additionally, to determine each tree's DBH, this research will measure the tree's average diameter of canopy to determine the likely diameter of the tree's trunk. Then, the tree's DBH will be estimated from a model derived by analyzing street

trees in Boston where DBH is amply recorded. By calculating its average DBH and ecosystem services provided by each species of tree, an average tree for a given size can be determined that would produce typical tree benefits. To compare towns on Long Island, two environmental justice areas determined by the government, and two Tree City USA will be compared. Each of the towns picked will have both similar population, size, and impervious surface percentage.

VI. Risk and Safety

To perform the experiment there is minimal risk involved. This experiment will be conducted through computer imaging.

VII. Data Analysis

The data from the experiment will be analyzed through GIS and the program iTree Design. iTree Design reveals quantitative economic values of ecosystem services provided by a specific tree based on 5 criteria including stormwater runoff, winter energy, summer energy, carbon dioxide, and air quality. GIS will be used to further analyze the relationship between environmental discrimination and tree canopy by mapping out ecosystem benefits provided by trees in specific areas.

VIII. Discussion of Results and Conclusions

Once the data and the results are analyzed, based on the statistical test, conclusions will be able to be drawn. If the results indicate that there is a statistically significant decrease in tree canopy in areas with environmental discrimination, then it could be concluded that the type of energy a community generally adopts does have a role in regulating tree canopy. These

conclusions will provide a further understanding of the extent of the environmental discrimination problem and how effective government measures are at regulating tree canopy.

IX. Bibliography

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Post Research Summary:

No changes were made.