NATURE-BASED SOLUTIONS FOR CITY RESILIENCE: EVALUATING THE BENEFITS OF URBAN TREE CANOPY IN AUSTIN, TEXAS

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ABSTRACT

As cities around the world continue to feel the impacts of weather extremes, Nature-Based Solutions (NBS) serve as credible and recognized tools for enhancing the livability and economic opportunities within cities. This thesis assesses the co-benefits of increasing Urban Tree Canopy (UTC) in Austin, Texas, through the ability to sequester and store carbon emissions and lower land surface temperatures (LST) via shading and evapotranspiration. This research uses a spatial analysis approach with ArcGIS Pro to identify where extra tree canopy would be most beneficial to the environment, community members, businesses, and stakeholders, supporting the 'Natural Systems' objectives within Austin's Climate-Equity Plan (ACEP). Initial steps included a 100-article meta-analysis to compare Austin UTC alongside other cities, derive carbon and thermal estimations, and identify the most common tree characteristics used to quantify tree benefits. Next, the City of Austin's priority index, composed of environmental, health, vulnerability, and investment inputs, was used to identify 30 high-priority neighborhoods in Austin's Eastern Crescent. These areas consist of high LST, low canopy coverage, and increased social vulnerability. By integrating land use and tree canopy data, along with NASA's ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS) imagery, the study estimates potential carbon storage and sequestration from planting in residential parcels and public Rights-of-Way (ROW), in addition to estimated reduced LST. Estimates indicate that planting 267,000 trees over 17 square miles in highest-priority neighborhoods would store 15,000 tons of carbon and capture 725 tons per year. Further, a forecasted 17% increase in canopy would lower LST by 4.28°F, providing substantive thermal relief to heat-stressed neighborhoods. Such measures would boost citywide canopy cover from 41% to 47.3%, markedly moving ACEP's 50% canopy goal forward while considering city resilience. The findings support integrating UTC expansion into citywide policy frameworks, emphasizing tree preservation, species selection by ecoregion, equitable placement, and sustained maintenance. Ultimately, this thesis demonstrates how targeted UTC expansion can simultaneously achieve climate mitigation, heat adaptation, and resilience in rapidly urbanizing regions like Austin.

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