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Economic Contribution Analysis of Urban and Community Forestry in the Southern United States in 2019

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Abstract

As populations in developing areas continue to increase in recent years, urban and community forestry (U&CF) has received considerable attention due to the ecological, social, and economic significance of trees and green landscapes in urban and semi-urban settings. Based on a regional survey of private, public, and nonprofit businesses and agencies involved in U&CF, we first developed a complete profile of the U&CF sector in the southern United States (SUS) and then estimated the economic contribution of U&CF businesses and activities to the thirteen-state regional economy. We estimated that, in 2019, U&CF in the SUS contributed about $23.2 billion in value added with a total jobs support of over 349,200. Based on the current economic contributions and the number of cities and towns in each state, we also categorized thirteen states into four different tiers. Results not only underscore the economic significance of U&CF businesses and activities in the SUS, but also serve as a baseline to track future trends and performance of U&CF in terms of various business metrics.

Study Implications: With continuously growing populations in metropolitan cities and developed areas in the southern region, the scope and importance of urban and community forests has continued to increase in recent years as an appropriate strategy to mitigate impacts of urbanization and climate change. Our findings from the regional input-output model suggest that urban and community forestry (U&CF) is a significant economic contributor to the southern regional economy. These regional statistics not only serve as a baseline to track the size and performance of the U&CF sector in the region over the years, but also could be used to enhance existing policies and programs related to U&CF activities in rapidly growing metropolitan areas in the region. Governmental granting agencies could also use these economic metrics for a basis of fund allocation and distribution. Similarly, other sectors, such as public agencies and nonprofit organizations, may also find these results valuable to advocate for additional financial and technical support to sustain and expand U&CF programs in their jurisdictions.

Keywords: urban and community forestry, input-output modeling, landscaping, private businesses, arboriculture, green industry

Natural vegetation in the southern United States (SUS) is predominantly subtropical forest due to abundant precipitation, mild winters, and fertile soils (Perry et al. 2022). Furthermore, close to 76% of the region's population resides in urban areas, and the region has one of the highest urban tree cover densities per capita nationwide (Nowak et al. 2010) and the largest urban area growth (Nowak and Greenfield 2018). Population growth of the SUS during 2010–2020 was 10.2%—the highest of all national regions, and ten of the fifteen fastest-growing cities were in the SUS (U.S. Census Bureau 2021). If current trends continue, the SUS will have a high percentage of landscape transformed from rural to urban forests (Nowak et al. 2018). At the same time, climate change impacts such as heat waves and extreme tropical storms are predicted to increase in many parts of the SUS (USGCRP 2018). Therefore, it will be increasingly important to properly care for and protect existing trees and initiate programs to plant new trees as strategies to mitigate impacts of urbanization and climate change.

Research about the broad range of benefits provided by urban trees has expanded significantly over the last several decades and has helped provide justification for protecting and enhancing urban forests (Hull 1992; Nowak and Dwyer 2007; Seamans 2013). Urban forest accounting for services such as

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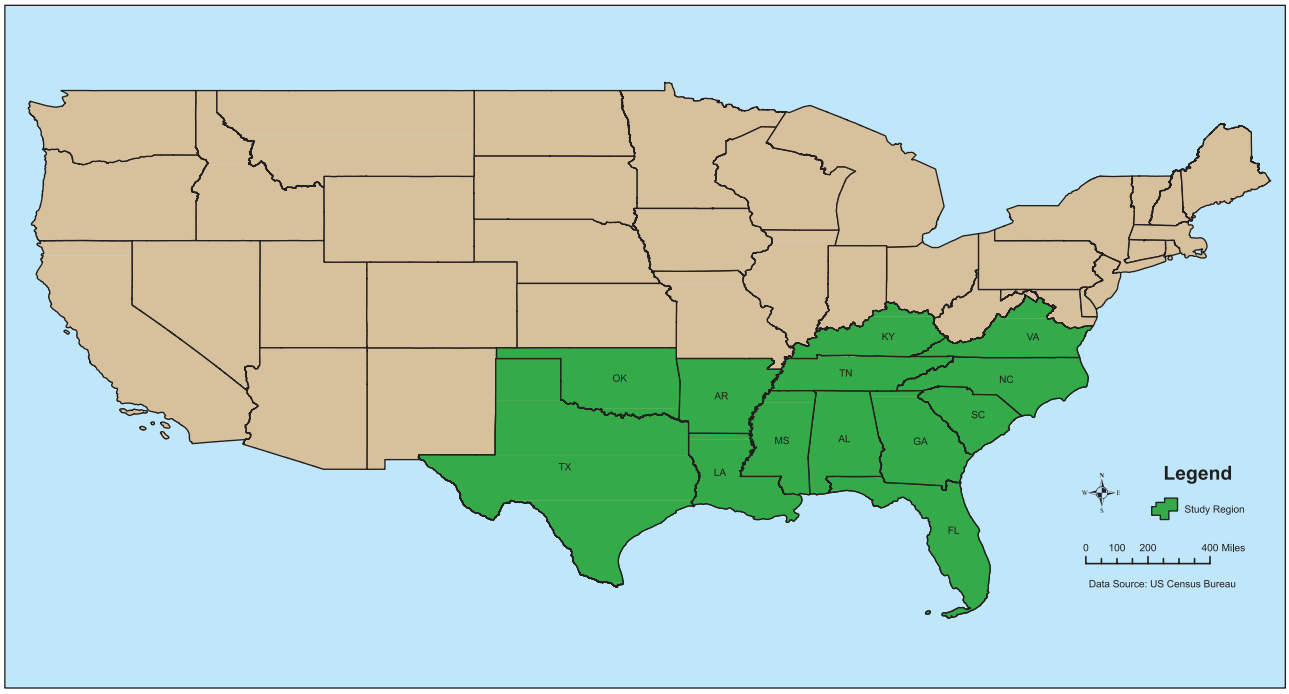

Figure 1 Map depicting thirteen states from the Southern United States included in the study.

carbon sequestration, urban heat island reduction, and stormwater interception has the potential to inform urban forest governance (Berland et al. 2017; Kuehler et al. 2017; Nowak 2006; Pincetl 2010; Shao and Kim, 2022; Tan et al. 2016). According to Nowak and Crane (2002), over 144.5 million tons of carbon were stored in urban forests of the SUS region. Moreover, the COVID-19 pandemic spotlighted the importance of urban and community forestry (U&CF) to human well-being, such as for mental health, and its management to facilitate safe, socially distant opportunities for communities (Campbell et al. 2022; Grima et al. 2020; Rajoo et al. 2020; Wolf et al. 2020).

Challenges in U&CF are widespread and include political, social, economic, and labor difficulties, in addition to biological and technological issues in tree care practices (Johnson 1982, Ordonez et al. 2019). Public tree managers may be tasked with managing for ecosystem services but may not have the necessary funding or political support to do so when competing with other municipal services (Driscoll et al. 2015; Elmendorf et al. 2003). Poor knowledge dissemination in communities, a lack of public understanding about the benefits of trees, and poor community participation in urban forestry goals are also issues for U&CF (Driscoll et al. 2015; Grado et al. 2013; Treiman and Gartner 2004). Reporting the environmental and social benefits and the economic contribution of U&CF management can help communicate the overall value of U&CF in terms of monetary benefits, as presented by various studies (e.g., Templeton and Goldman [1996] and Templeton et al. [2011] in California, Hodges and Court [2019] in Florida, Texas A&M Forest Service [2019] in Texas, Georgia Tech [2021] in Georgia, and Parajuli et al. [2022] in the Northeast-Midwest region), as well as other socio-ecological benefits (Dwyer et al. 1992) that are generally of importance to businesses and organizations in measuring service-related impacts of their investments in U&CF.

Based on a regional survey of private, public, and nonprofit businesses and agencies involved in U&CF, this study developed a complete profile of the U&CF sector in the SUS and estimated the economic contribution of U&CF businesses and activities to the thirteen-state regional economy in the SUS. These estimated regional contribution numbers underscore the economic significance of the U&CF sector and inform the general public, economic development professionals, and policymakers about the relevance of U&CF in local and regional economies. As a regional study that uses a peer-reviewed methodological procedure (Parajuli et al. 2022) to estimate the economic contribution analysis, this study also serves as a baseline to assess future trends and performance of U&CF businesses and activities in terms of various business metrics in the SUS. The baseline presented in this study is particularly timely due to planned rising investments by the federal government in U&CF such as those associated with the Infrastructure and Inflation Reduction Acts (American Forests 2022; Chizmar et al. 2021; The White House 2022). Further, the SUS represents a key case study due to its rapid urbanization in terms of rising urban population, urban land growth, and urban tree cover along with anticipated impacts related to climate change.

Methods and Materials

Surveys

We conducted six regional online surveys, one for each U&CF sector, across the thirteen-state region (figure 1) to separate contributions specific to U&CF industries from the broader green industries and to quantify contributions of the U&CF activities in public and nonprofit agencies. We piloted the survey instruments with a small sample of respondents representing each U&CF sector. The NCSU Institutional Review Board approved and exempted all

the survey instruments and the administration procedure (IRB-23973). We used the online Qualtrics platform with an emailed recruitment invitation. Email contacts of private businesses involved in the green industry were purchased from Exact Data, a private marketing firm, which compiles the contact information of businesses by their North American Industry Classification System (NAICS) codes. The state agency U&CF coordinators from the thirteen southern states assisted us in the collection of emails associated with public agencies and other groups in the study region. The survey was administered from July to December 2021 using the tailored design method of Dillman et al. (2014): the initial email invitation with a Qualtrics link was followed by three email reminders with no incentives. Table 1 presents a breakdown of sample sizes and responses received from each U&CF sector.

Urban and Community Forestry in the Southern United States

Various private U&CF business activities are integrated into the broader green industry in the United States (Hall and Dickson 2011; Hall et al. 2020; Templeton and Goldman 1996). As in Hodges and Court (2019) and Parajuli et al. (2022), we used our regional surveys to develop a complete profile of the U&CF sector in the SUS. Based on the regional survey of private businesses, we extracted the U&CF portion of the green industry in the SUS and compared it with the private U&CF in the Northeast-Midwest region of the US to explore the peculiarities of U&CF in the SUS. Similarly, we estimated the number of U&CF jobs supported by local governments in the SUS using our regional survey of cities and counties in the region. Furthermore, we estimated the average number of jobs employed by higher-education institutions, investor-owned and cooperative utilities, and nonprofit organizations in the SUS.

Economic Contribution Analysis

We applied the empirical approach developed by Parajuli et al. (2022) to evaluate the economic contribution of U&CF industries and activities in the SUS. We estimated several business and economic metrics representing economic contribution such as employment, labor income, value added, industry output, and local, state, and federal tax collections from the U&CF sector. The IMPLAN software, an input-output regional economic modeling system, is used to estimate indirect and induced effects in the regional economy stemming from direct economic activities in U&CF related industries. The 2019 state-level IMPLAN models from the thirteen states were aggregated to develop a regional input-output model with a trade flows specification and social accounts for households. Parajuli et al. (2022) presented the detailed step-wise methodological procedure, and the employment profile of each U&CF sector in the SUS is available on request. Based on the number of towns and cities by various population categories in each state, we highlighted the economic scope as well as prospects of U&CF in the thirteen-state study region.

Results

Detailed economic contribution results including employment, labor income, value added, and total economic output obtained from our regional IMPLAN modeling framework are presented in Table 2. We estimated that in 2019, U&CF in the thirteen-state region supported over 349,200 total jobs in various businesses and activities in the regional economy. In terms of direct employment, the private sector accounted for the largest workforce in U&CF with over 88% of the total U&CF direct jobs in the region. Local governments (municipal and county) comprised nearly 25,000 U&CF jobs, and utility companies exceeded 5,000 employees working in U&CF. Higher education institutions, nonprofit organizations, and state agencies were the smallest U&CF employers. The overall social accounting matrix multiplier associated with employment was estimated to be 1.55, which indicates that each job in U&CF in the region resulted in an additional 0.55 jobs in other sectors of the economy. Meanwhile, the social accounting matrix multipliers associated with industry output by investor- and cooperative-owned utilities and the private sector were the highest multipliers, observed at 2.13 and 2.09, respectively, which convey the significance of the groups to other economic sectors.

Table 3 presents the state-level U&CF details in the SUS including the number of cities and towns by their population size and the corresponding total economic contributions of U&CF in each state. Our regional survey suggests that a community with over 10,000 population within its jurisdiction could support about ten U&CF jobs, on average, in these thirteen southern states. Moreover, due to the higher number of taxpayers, larger cities usually have more resources at their disposal for potential U&CF activities. Based on the current economic contributions and the number of cities and towns with populations of at least 10,000, we categorized thirteen states into four different tiers. Tier I states include Texas and Florida, and Georgia, North Carolina, and Virginia were categorized in Tier II. Alabama, Oklahoma, South Carolina, and Tennessee were ranked in Tier III, and Tier IV includes Arkansas, Kentucky, Louisiana, and Mississippi. States

Table 1. Summary statistics for an online survey distributed to urban and community forestry businesses and organizations in the southern United States from July to December 2021. With our additional efforts, we received responses from all thirteen state forestry agencies.

Sector surveyed	Contacted	Opted out or invalid email	Not contacted	Survey responses*	Adjusted response rate
Private businesses	14,543	1,580	12,963	384	3.0%
Public (county & city government)	2,277	329	1,948	332	17.0%
Higher education institutions	346	35	311	77	24.8%
Nonpublic utility companies	208	18	190	50	26.3%
Nonprofit organizations	285	19	266	92	34.6%

*Including partial completes.

Table 2. Economic contribution of urban and community forestry in the southern United States in 2019; reported in 2019 dollars.

Sector	Employment (jobs)	Labor income (million $)	Value-added (million $)	Industry output (million $)
Direct effect				
Private sector	194,935	7,655.33	10,251.37	18,611.32
Municipal government	19,530	714.45	857.93	1,581.37
County government	3,972	145.31	174.48	321.62
State agencies	58	2.12	2.55	4.70
Higher education institutions	910	33.29	39.98	73.68
Nonprofit organizations	669	29.74	33.88	57.90
Investor-owned & cooperative utilities	5,045	184.56	221.62	408.50
Total	225,119	8,765	11,582	21,059
Total effect				
Private sector	309,016	13,715.77	20,881.68	38,916.59
Municipal government	25,332	1,041.61	1,423.05	2,711.45
County government	5,152	211.84	289.42	551.45
State agencies	75	3.09	4.23	8.05
Higher education institutions	1,180	48.53	66.31	126.34
Nonprofit organizations	881	41.71	54.57	99.28
Investor-owned & cooperative utilities	7,597	320.50	462.62	871.43
Total	349,233	15,383	23,182	43,285
SAM multiplier				
Private sector	1.59	1.79	2.04	2.09
Municipal government	1.30	1.46	1.66	1.71
County government	1.30	1.46	1.66	1.71
State agencies	1.30	1.46	1.66	1.71
Higher education institutions	1.30	1.46	1.66	1.71
Nonprofit organizations	1.32	1.40	1.61	1.71
Investor-owned & cooperative utilities	1.51	1.74	2.09	2.13
Total	1.55	1.76	2.00	2.06

Table 3. State-level urban and community forestry in southern states: the number of cities and towns by their population size and state-level economic contributions of urban and community forestry.

	Number of cities and towns by their population size					Total economic contribution*				Tier**
Population size/state	2,500-9,999	10,000-49,999	50,000-99,999	100,000-499,999	>500,000	Total U&CF jobs	Total Value added (million $)	Total labor income (million $)	Total Output (million $)	
AL	91	51	5	5	0	12,090	453	641	1,260	III
AR	76	29	8	1	0	10,519	381	581	1,102	IV
FL	103	111	36	21	1	88,177	3,681	5,550	10,355	I
GA	122	73	11	6	1	29,018	1,260	1,892	3,426	II
KY	87	33	2	1	1	10,530	493	810	1,375	IV
LA	69	29	3	4	0	8,689	324	499	949	IV
MS	45	39	2	1	0	6,573	210	318	643	IV
NC	145	66	11	8	1	30,887	1,286	1,900	3,527	II
OK	84	36	5	3	1	8,910	349	515	991	III
SC	63	34	4	3	0	14,222	540	792	1,507	III
TN	85	45	8	4	2	17,274	745	1,088	1,966	III
TX	295	171	28	35	6	66,097	3,082	4,529	8,116	I
VA	46	27	6	7	0	22,549	1,087	1,577	2,669	II

*Total economic contributions in 2019 estimated from state-level models; reported in 2019 dollars.
** The four tiers were created based on the current economic contribution as well as the number of cities and towns with over 10,000 population.

ranked in Tier III and IV have a greater potential in expanding U&CF, although the current size of U&CF in this states, in terms of economic contributions is limited. Continued growth in urban land and population increases potential and opportunities for U&CF to offer multiple ecosystem services to urban dwellers in the SUS (Endreny 2018).

Discussion and Conclusions

Because several cities in the SUS have experienced swiftly rising population growth in the last decade or so (US Census Bureau 2019) along with urban land growth and tree cover (Nowak and Greenfield 2018), understanding the regional economics of U&CF is critical to communicating the significance of U&CF industries and activities in addition to assessing the growth of the sector over time. Using the approach developed by Parajuli et al. (2022), we estimated that, in 2019, U&CF in the thirteen southern states supported about 349,200 full- and part-time jobs in various private, public, and nonprofit businesses and activities. Despite these employment figures, U&CF still faces critical workforce shortages both regionally and nationally. Workforce initiatives supported by the USDA Forest Service through the Vibrant Cities Lab suggest that there is an annual need for about 8,300 additional tree industry workers nationwide (Vibrant Cities Lab 2022). Likewise, the provisions outlined in the Infrastructure and Inflation Reduction Acts will likely require a larger workforce to implement planned goals in U&CF (American Forests 2022; Brown 2022; Chizmar et al. 2021; The White House 2022). These workforce shortages and forthcoming demands for U&CF services with a growing number of cities and towns over 10,000 population suggest that the employment and economic impacts of U&CF are poised for strong growth.

Compared with similar previous studies (Hodges and Court 2019; Texas A&M Forest Service 2019; Thompson et al. 2021), our estimated metrics in this study are consistently on the higher end. For instance, Texas A&M Forest Service (2019) reported that U&CF in Texas supported over 57,600 jobs with a value added of $1.6 billion, whereas we estimated that U&CF in Texas during 2019 supported about 66,100 total jobs with a total value added of $4.5 billion. Our findings of greater economic contributions are not surprising given the extensive scope of U&CF businesses and activities that we included in our modeling; our usage of a primary survey and the IMPLAN 2019 dataset; our use of the economic contribution analysis method (Parajuli et al. 2018) and the analysis-by-part approach for all public, non-profit, and higher education institutions; and the time differential between the studies in terms of data years combined with rising populations and economic growth.

Our results indicate that the public sector contributed approximately 30,500 jobs to the SUS regional economy, which is minimal compared with the private sector and aligns with other studies (Hodges and Court 2019; Parajuli et al. 2022). Despite the smaller share in terms of total economic contribution, the public sector is still critical to implementing U&CF, especially in underserved and vulnerable communities. Activities such as tree planting, care, and management are important for the maintenance of public green spaces and trees (Hodges and Court 2019), which often provide benefits such as shade, aesthetics, and well-being (Campbell et al. 2022; Donovan 2017; Hardy et al. 2000; Rajoo et al. 2020; Wolf et al. 2020). These activities are often performed by urban foresters and other professionals working in municipal and county governments (American Forests 2021), underscoring the importance of the U&CF investments and employment opportunities provided by the public sector.

Despite their limited economic contributions currently, Tier III and IV states such as Alabama, Tennessee, and Oklahoma, which have higher numbers of cities and towns with at least 10,000 populations in their jurisdiction, could focus on expanding their U&CF programs, as our study suggests that U&CF in these communities could support at least ten direct jobs in their local economy. Many large cities have limited growth potential due to lack of space. Therefore, much of the future population growth is likely to occur in small and medium cities, particularly suburbs near larger cities. These communities experiencing rapid population and economic growth will require assistance with capacity development, resources, and knowledge transfer. This also suggests that small- and medium-sized municipalities in the SUS could give a higher priority in budget allocation and overall planning for U&CF activities. Given the economic significance of U&CF to the local and state economies, allocating a larger share of the municipal budget to U&CF programs could have larger multiplier effects on underserved communities.

Finally, the results of our analysis suggest important implications for policymakers and managers engaged with U&CF at state and regional levels. For instance, these regional numbers not only serve as a baseline to track the size and performance of the U&CF sector in the SUS, but also could be used to enhance existing policies and programs related to U&CF activities in growing metropolitan areas or to develop new policies and U&CF management plans and strategies in the SUS. Despite the substantial contribution of U&CF to local, state, and federal taxes, U&CF programs are chronically underfunded by local governments, typically only receiving 0.5% of the annual budget in municipalities (Hauer and Peterson 2016). Limited underfunding more likely leads to poor implementation and management of urban forests, which then could have serious impacts on the wellbeing of local communities. Moreover, the value of the public sector's investment in U&CF and its economic ripple effects will likely be a point of greater examination in the future as communities and municipalities seek cost-effective ways to manage and plan for the effects of climate change.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of this paper in Journal of Forestry.

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