Business Outlook of Private Urban Forestry in the Northeast-Midwest Region of the United States

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Abstract. Background: Urban forestry is a crucial sector of the green industry and increasingly a tool used to address ecological and sociopolitical challenges in urban landscapes. Along with a number of public agencies and nonprofit organizations, various private industry types are directly involved in the development and management of urban trees and landscapes. The main purpose of this study is to evaluate the outlook of private green industry businesses on their urban forestry activities in the Northeast-Midwest region of the United States. Methods: Based on a survey of private businesses involved in the green industry in late 2020, we developed an empirical model by incorporating industry types, business metrics, and issues related to urban forestry perceived by private businesses. Results: Results from an ordered logistic regression model suggest that nursery and florist's supplies merchant wholesaler businesses are less likely than other businesses to have a positive outlook on urban forestry activities. We found that survey respondents who reported a higher percentage of urban forestry employees had a higher likelihood of a positive outlook of their business. Conclusion: Many respondents referenced how COVID-19 has been an overall deterrent to economic growth, implying that the state of their business depends on the recovery of the economy. The findings provide useful policy and management insights on how private businesses perceive the future outlook of urban forestry. These study results benefit the private sector and public agencies involved in urban forestry for better planning and programming in the Northeast-Midwest region of the United States.

Keywords. COVID-19 Pandemic; Green Industry; Ordered Logistic Regression; Urban Forestry.

INTRODUCTION

The green industry is comprised of the businesses and activities involved in the creation, distribution, and services associated with landscape architectural design, garden supplies and equipment, and ornamental plants in urban and semi-urban settings. It includes both woody and nonwoody vegetation in public and private urban parks, streets, greenways, and other similar sites in urban and semi-urban regions. Although the academic literature defines green industry as revolving around the production and establishment of urban-greening products such as shade trees and ornamental plants (Hall et al. 2005; New Hampshire Landscape Association 2022), many governments and private organizations interpret the green industry as pertaining to environmentally sustainable economic growth (World Green Economy Council 2021; United Nations Industrial Development Organization 2022). Both the United Nations Industrial Development Organization (UNIDO) and World Green Economy Council argue that public

investment in "green" encourages private investment to promote greenery and natural urban-forest ecosystems in human-urban landscapes. Similarly, services and products provided by this industry have an increasing impact on the lives of consumers and private businesses in urban and suburban settings. The green industry not only makes substantial economic contribution to national and regional economies (Hall et al. 2020) but also has a positive influence on private property values through strategic landscaping and greenery (Hardy et al. 2000; François et al. 2002). Green industry products, such as shade trees and ornamental plants, also enhance the aesthetic appeal of retail environments, encouraging consumers to choose those businesses that have vegetation and shade trees over those that do not (Wolf 2004b).

The term "urban forestry" appeared in the literature in the United States as early as 1894 but evolved throughout the 1960s as a socioeconomic approach to growing trees in urban environments (Templeton and Goldman 1996; Konijnendijk et al. 2006). It incorporates

the establishment, conservation, protection, and maintenance of trees in cities, suburbs, and other developed areas (Parajuli et al. 2022). While there are a number of public agencies and nonprofit organizations directly involved in urban-forest development and management in cities and towns, various private industry types provide substantial economic impacts in the regional economy with their primary businesses involved in urban forestry–related activities. A number of private industries involved in urban forestry are often incorporated wholly or in part into the green industry (Parajuli et al. 2022). Examples of these businesses include landscaping and tree care firms, commercial nursery products retailers and wholesalers, nursery tree producers, and landscape designers.

Several past studies explored the economic, socioecological, and hedonic property value of the green industry including urban tree canopies and green landscapes (Hardy et al. 2000; François et al. 2002; Crompton 2004; Brethour et al. 2007; Nowak et al. 2007; Donovan 2017; Hall et al. 2020). Parajuli et al. (2022) estimated that in 2018, urban forestry in the Northeast and Midwest states supported over 357,200 jobs with a total contribution of $34.7 billion worth of economic activities to the regional economy. Hall et al. (2020) also highlighted the economic significance of the green industry in the United States, estimating that in 2018, the industry had a total economic contribution of $348 billion in industry output by supporting over 2.3 billion jobs in the national economy. Several studies have demonstrated the impact of the green landscape on increased property values based on hedonic values of homes and other properties (Hardy et al. 2000; François et al. 2002; Crompton 2004). Further, the presence of shade trees in urban areas is estimated to reduce energy usage significantly (Brethour et al. 2007; Nowak et al. 2007; Donovan 2017). In short, the private sector has a vested interest in managing and expanding urban-forest landscapes throughout the developed areas in the United States.

Several studies reported an expansive economic growth of private urban forestry within the green industry over the years (Hall et al. 2005; Hodges et al. 2011; Palma and Hall 2016; Hall et al. 2020). The growth of the industry is also impacted by municipalities creating plans to increase their urban forests and canopy cover (National Urban and Community Forestry Advisory Council 2015; O'Neil-Dunne 2019;

USDA Forest Service 2021b). These plans require employees who are trained and knowledgeable in vegetation management and landscaping and architectural design. The interaction of different sectors throughout the green industry shows the interconnectedness of these businesses and how the success of one sector can influence the success of another.

The COVID-19 pandemic (hereafter "the pandemic") has deeply affected every sector of the global economy, and green industry businesses are no exception. The lockdowns and other restrictions during the pandemic reportedly increased the importance of urban greening and landscaping, which could bring long-lasting impacts, altering the green industry significantly. Based on an early survey of green industry members' perceptions, the Tree Care Industry Association (2021) reported that the major issue for tree care businesses during the pandemic was recruiting and retaining qualified employees to sustain their business, and about 54% of respondents considered adding new revenue streams. Ugolini et al. (2020) also evaluated the effects of isolation on individuals and their desire to explore green spaces in select European countries, with respondents missing being outdoors in their urban forests. Pérez-Urrestarazu et al. (2021) reported that respondents having indoor plants were more likely to have positive emotions while confined at home throughout the COVID-19 lockdown. It can be inferred that the pandemic underscores human interactions with outdoor nature and its associated benefits, which could eventually influence the market and outlook of related businesses and industries.

The main purpose of this study is to evaluate the outlook of private green industry businesses on their urban forestry activities within the Northeast-Midwest region of the United States. Based on a survey of green industry businesses in late 2020, we developed an empirical model by incorporating industry types, business metrics, and issues related to urban forestry perceived by private businesses. It is worth noting that perceived positive outlook plays an important role in business growth and direction in the future. Conversely, the associated negative word of mouth can adversely affect future investment decisions. This study provides a necessary context for policy makers and industry advocates to create informed decisions that could affect the future success of businesses involved in urban forestry in the study region.

MATERIALS AND METHODS

Study Region and the Survey

This study is part of a broader project focusing on economic contribution analyses of urban and community forestry in 20 Northeast-Midwest states and Washington DC in the United States (Figure 1). The online survey was distributed by the University of Wisconsin Survey Center (UWSC). The 16-question instrument began with an eligibility question to determine if private businesses were active in 2018 in any of the study areas. Respondents were allowed to skip questions and permitted to exit the survey and return to finish at any point until the deadline or until they reached the final screen and submitted their survey. Survey administration included an initial email invitation with a Qualtrics (Qualtrics XM; Seattle, WA, USA) hyperlink, followed by 3 email reminders, following the approach of Dillman et al. (2014). No incentives were offered. The Institutional Review Board (IRB) at North Carolina State University reviewed and approved the survey instrument and the administration procedure as exempt for human subject research as outlined in the Code of Federal Regulations.

Email contacts of private businesses involved in the green industry were purchased from Exact Data (Chicago, IL, USA)(Exact Data 2022), which compiles businesses' contact information according to North American Industry Classification System (NAICS) codes. Each industry type has an individual NAICS code that corresponds to specific business characteristics of that industry. For this study, we obtained 27,143 email contacts across 21,921 different companies involved in landscaping services (NAICS 561730); nursery and florist's supplies merchant wholesalers (NAICS 424930); farm and garden equipment wholesalers (NAICS 423820); nursery, greenhouse, and tree production (NAICS 111421); nursery and garden supplies stores (NAICS 444220); and landscape architectural services (NAICS 541320) in the study region. Approximately 600 responses were recorded in Qualtrics, but 224 of them were partially completed. The paired 2-sample T-test (Peck et al. 2012)
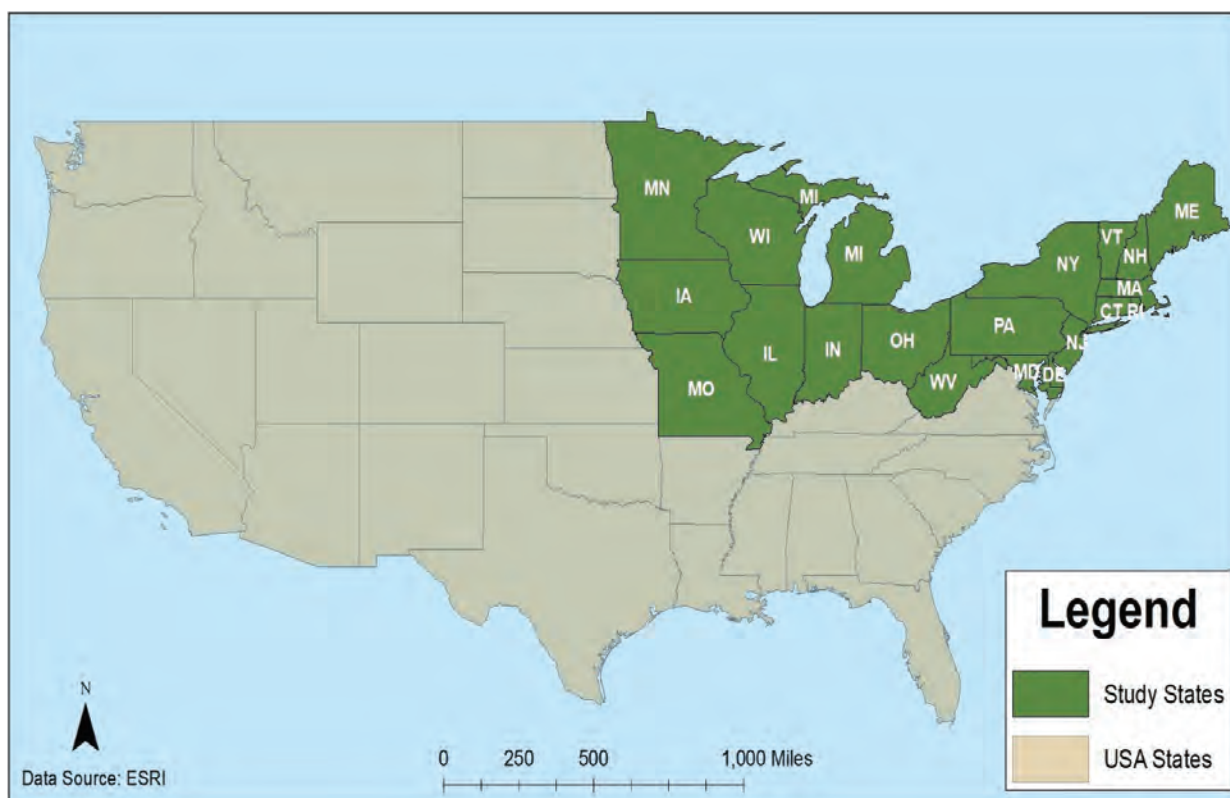

Figure 1. Map depicting Washington DC and the 20 states involved in the study, including Connecticut, Delaware, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia, and Wisconsin.

between the first 10% and the last 10% of responses indicates that non-response bias might not be a major issue. We compared the full-time employment and total sales in dollars of the early versus late responders, and the *T*-statistics for both variables were statistically insignificant.

Empirical Model

Our research hypothesis integrated 2 well-established management theories (Gimeno et al. 1997; Kotler 1997) to explore the factors that determine perceived market outlook of private green industry businesses. The satisfaction theory (Kotler 1997; Mbachu and Nkado 2006) posits that the human feeling that depicts a sense of achievement or disappointment results from the comparative analysis between expectations and the perceived performance of a product. Likewise, according to the threshold theory (Gimeno et al. 1997), decisions to exit or stay in business are not strictly made on financial performances. Rather, general human capital pertinent to training, education, and entrepreneurial experience (among others) plays an important role in such decision making. Within the broader umbrella of these theories, we postulated that perceived economic outlook would serve as a proxy for expectations and likely depend upon performance matrices such as business longevity, industry types, supply chain, labor market dynamics, and the perceived state-of-business environment. Therefore, the empirical model utilized in this study evaluates the factors explaining the private-business outlook of urban forestry activities of businesses active in the green industry within the study area. These factors include industry types, job type, years in business, business structure, and percentage of jobs in urban forestry. Other explanatory variables attempt to quantify how businesses' perception of issues related to inadequate research and development (R&D), inadequate supply chain, workforce recruitment, and employee retention impact their outlook. The empirical model is presented below, where the "outlook" variable denotes perceptions of private green industry businesses regarding their future prospects in urban forestry, which was recorded in a 5-point ordinal scale: (1) extremely bad, (2) somewhat bad, (3) neutral, (4) somewhat good, (5) extremely good.

outlook = *f* (landscaping, nursery_supply, nursery_tree, nursery_stores, architecture, jobs, longevity, uf_jobs, corporate, r&d, supplychain, recruitment, retention)

The question in the survey instrument was framed as, "How would you describe the future outlook of urban forestry for your business?" Table 1 details each of the explanatory variables. Other explanatory variables are described below.

Business Types

The binary variable *landscaping* denotes businesses related to private landscaping services (NAICS 561730); *nursery_supply* denotes businesses related to nursery supplies wholesalers (NAICS 424930); *nursery_tree* denotes businesses related to nursery and tree production (NAICS 111421); *nursery_stores* denotes businesses related to nursery retail stores (NAICS 444220); and *architecture* denotes businesses related to landscape architectural services (NAICS 541320). Respondents indicated a value of 1 for business types they represent or 0 otherwise.

Business Metrics

The numerical variable *jobs* characterizes the average number of people employed full-time, part-time, and seasonally by private green industry businesses. The total number of jobs varied from 1 to 650. The questionnaire also asked the year respondents established their business (*longevity*), which ranged from 2 to 156 years in operation. Further, the survey requested respondents to identify the percentage of their employees that are active in urban forestry activities (*uf_jobs*). This variable attempted to capture the potential correlation between the employment in urban forestry and the overall outlook of the urban forestry business. Lastly, the survey asked respondents to indicate if they were structured as a corporation (*corporate*). The binary variable *corporate* represents the organizational structure of the private company, 1 being a corporate business or 0 otherwise.

Issues Affecting Urban Forestry Business

Respondents were asked to identify their perceptions of several common issues facing businesses in urban forestry. As such, we were able to assess if these perceived issues had any impact on their outlook. For example, the questionnaire asked respondents if inadequate research and development (*r&d*) and inadequate supply chains (*supplychain*) between related industries were issues influencing their business in urban forestry activities. In addition, we inquired if respondents realized any difficulty in recruiting

Table 1. Variables used in the model explaining the future outlook of the private business involved in urban forestry (UF) activities.

Variable	Description	No. of observations	Mean
outlook	Categorical variable (how respondents described the future outlook of their business in UF): 1 – extremely bad, 2 – somewhat bad, 3 – neutral, 4 – somewhat good, 5 – extremely good	377	3.67
landscaping	Binary variable: 1 – business engaged in landscaping services (NAICS 561730), 0 – otherwise	450	0.50
nursery supply	Binary variable: 1 – business engaged in nursery supplies wholesalers (NAICS 424930), 0 – otherwise	450	0.02
nursery tree	Binary variable: 1 – business engaged in nursery and tree production (NAICS 111421), 0 – otherwise	450	0.10
nursery stores	Binary variable: 1 – business engaged in nursery retail stores (NAICS 444220), 0 – otherwise	449	0.08
architecture	Binary variable: 1 – business engaged in landscape architectural services (NAICS 541320), 0 – otherwise	450	0.16
jobs	Numerical variable: the sum of full-time, part-time, and seasonal employees	388	32.33
longevity	Numerical variable: years in active business	396	35.25
UF jobs	Percentage of total jobs in UF activities	381	30.61
R&D	Categorical variable (how respondents rated the impact of the issue about inadequate research and development on their business): 1 – none, 5 – a great deal	380	1.78
corporate	Binary variable (representing the corporate organizational structure of the business): 1 – corporation, 0 – otherwise	381	0.39
supply chain	Categorical variable (how respondents rated the impact of the issue about supply chain on their business): 1 – none, 5 – a great deal	380	1.80
recruitment	Categorical variable (how respondents rated the impact of the issue about workforce recruitment on their business): 1 – none, 5 – a great deal	381	3.28
retention	Categorical variable (how respondents rated the impact of the issue about retaining employees on their business): 1 – none, 5 – a great deal	380	2.54

(*recruitment*) or retaining an adequate workforce (*retention*). These issues were represented by categorical variables asked on a 5-point ordinal Likert scale according to the perception of the severity of the issue: (1) not at all, (2) a little, (3) some, (4) quite a bit, and (5) a great deal.

Estimation Procedure

As we have an ordinal-scale dependent variable, we utilized the ordered logistic regression technique to evaluate the factors explaining the outlook of urban forestry activities among private businesses involved in the green industry. The ordered logistic regression model estimates a score that is a linear function of the included independent variables and the defined cut points (Torres-Reyna 2008). The cut points vary depending on the study performed and are threshold parameters for the possible outcomes, which indicate interpretations of the given variable outputs (Williams 2021). In this study, the cut points are the probabilities of a negative or positive outlook on urban forestry activities.

The ordered logistic regression is useful in analyzing the positive or negative relationship of the data to the question but does not give the proper magnitude of the relationship. The odds ratio estimates change the estimated coefficients to odds ratio, also known as probabilities (Szumilas 2010). The odds ratio facilitates interpretation of the magnitude of an independent variable's ability to explain variation in the

dependent variable. The odds ratio model in this study describes the probability of a positive outlook on urban forestry activities and the magnitude with which the probability occurs.

Unlike binary or multinomial logit regression models, the ordered logistic regression model relies on the proportional odds or parallel regression assumption, which means the relationship between every possible pair of outcome groups should be the same. This assumption requires the coefficients for each dependent variable category to be consistent, or have parallel slopes, across all the levels. Because the relationship between each pair of the dependent variable levels is the same, there will be 1 set of coefficients, or 1 model. The generalized model for an ordinal dependent variable with M categories can be written as (Williams 2021):

$$P(Y > j) = \frac{\exp(\alpha_i + X_i\beta_j)}{1 + [\exp(\alpha_i + X_i\beta_j)]}, j = 1, 2, \ldots\ldots, M - 1$$

The Brant test (Brant 1990) is a common way to evaluate the parallel regression assumption in ordered logit models. The null hypothesis of this chi-square test is that there is no significant difference in the coefficients between the logistic regression models. If its probability is greater than the assumed alpha level, then the data set satisfies the probability of odd assumption, i.e., we expect nonsignificant P-value. If the test rejects the null hypothesis, the proportional

odds assumption, the main underlying assumption of the ordered logistic regression is violated. Under that condition, the generalized ordered logistic regression can be applied (Peterson and Harrell 1990; Lall et al. 2002). As the likelihood-ratio test of proportionality of odds across response categories suggested that the proportional odds assumption is violated, we estimated a generalized ordered logistic model using the *gologit2* command in STATA (StataCorp LLC; College Station, TX, USA). We applied the *autofit* option in a generalized ordered logistic model which identifies the partial proportional odds model that fits the data best using an iterative process (StataCorp LLC 2022). We also included the *gamma* option in the *gologit2* function that yields an alternative but equivalent parameterization of the partial proportional odds model as stated by Peterson and Harrell (1990) and Lall et al. (2002). This option also offers a variable-specific testing of proportionality assumption.

RESULTS

Green Industry in the Northeast-Midwest Region: Descriptive Statistics

The number of responses from the private-industry group varied depending on business type (Figure 2). Those businesses involved in landscaping services constituted the majority of the completed surveys, with 54% of the responses (Figure 2). Landscape architectural services represented 17% of the responses, followed by 11% from those in nursery and tree
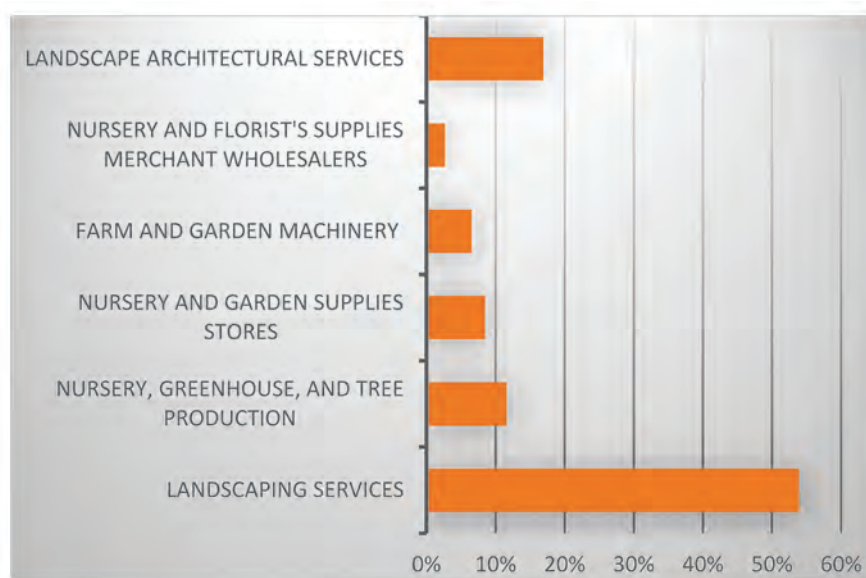

Figure 2. Percentage of survey responses by industry type.

production. Nursery supplies stores and wholesalers had the least amount of representation in the survey with 8% and 3% of the responses, respectively.

Of the businesses surveyed, those related to nursery and tree production as well as farm and garden supplies sectors reported the highest number of employees on average, including full-time, part-time, and seasonal employees (Table 2). On average, landscaping services employed approximately 40 total employees, 25 of which were full-time, 2 part-time, and 13 seasonal. Nursery and florists' supplies merchant wholesalers had the lowest employment numbers, with approximately 6 full-time employees, 4 seasonal employees, and 1 part-time employee.

Table 2 also presents the average percentages of employees in each business type involved in urban forestry–related activities. The survey results suggest that private landscaping and tree care providers employed the largest percentage of workers in urban forestry (43%). Approximately a quarter of nursery and florist merchant wholesalers and nursery and tree production employees performed work in urban forestry–related activities. The following business types had 20% or less of employees performing work in urban forestry: nursery and garden supplies stores; farm and garden equipment wholesalers; and landscape architectural services.

Average total annual sales and urban forestry–related sales also varied by business type (Table 3). Farm and garden equipment wholesaler businesses reported the highest average annual sales in total ($2.5 to $5 million) and in urban forestry–related sales ($439,500 to $879,000). The surveyed nursery and garden supplies stores followed closely behind with annual average total sales of $1 to $2.5 million and annual urban forestry–related sales averaging $235,900 to $589,750. Businesses related to landscaping services, on average, had the highest percentage (44%) of urban forestry–related sales, followed by nursery and florist merchant wholesalers (32%) and nursery and tree production (31%).

The average number of years each business type had been operating ranged from 28 to 46 years (Figure 3). On average, farm and garden machinery companies in the study region had been in business for over 50 years. Nursery supplies wholesalers follow closely with 40 years on average of active business. Landscaping services were in the business, on average, 30 years, with landscape architectural services being in the business the least amount of time, averaging 28 years.

Respondents' perceived outlook on the future of urban forestry activities varied depending on business type (Figure 4). Landscaping services (3.87) and

Table 2. Average employment in private businesses.

Business type by NAICS	No. of useable responses	Average employees (full-time, part-time, and seasonal)	UF-related employees (%)
Landscaping services (561730)	223	40	43
Nursery and tree production (111421)	48	61	23
Nursery and garden supplies stores (444220)	35	24	19
Farm and garden equipment wholesalers (423820)	27	59	16
Nursery and florist merchant wholesalers (424930)	11	11	28
Landscape architectural services (541320)	70	12	20

Table 3. Average annual sales of surveyed businesses by business type.

| Business type by NAICS	No. of useable responses	Average annual sales ($)	UF-related sales (%)
Landscaping services (561730)	223	500k to 1 million	44
Nursery and tree production (111421)	48	500k to 1 million	31
Nursery and garden supplies stores (444220)	35	1 million to 2.5 million	24
Farm and garden equipment wholesalers (423820)	27	2.5 million to 5 million	18
Nursery and florist merchant wholesalers (424930)	11	500k to 1 million	32
Landscape architectural services (541320)	70	250k to 500k	25
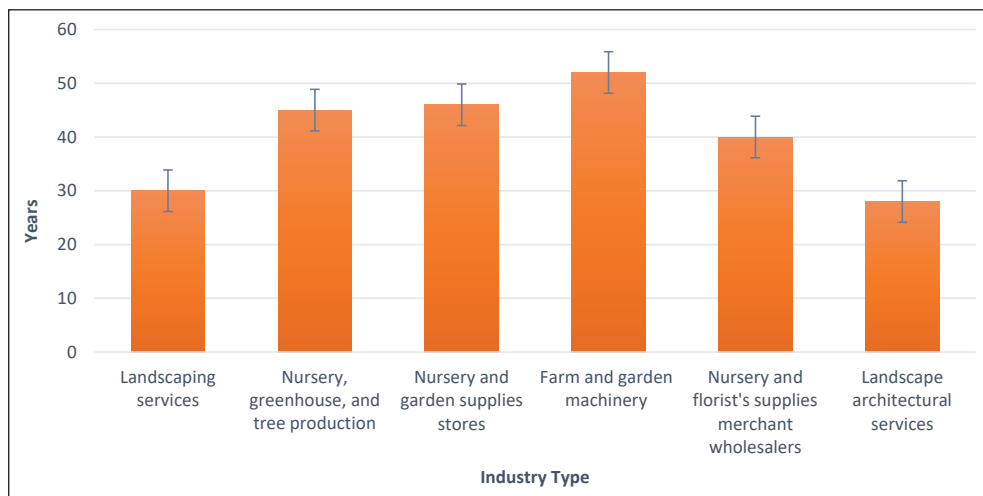
Figure 3. Average years in business by industry type within the green industry.
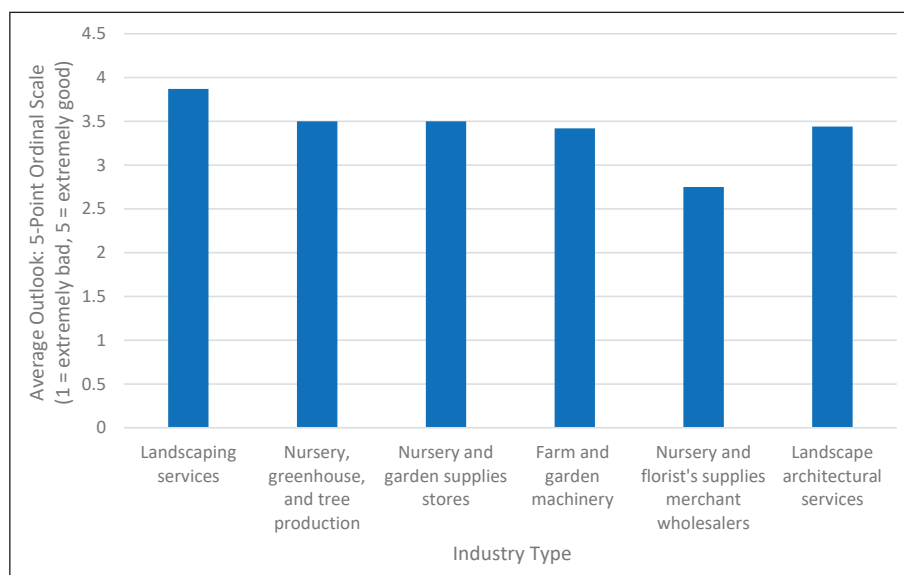

Figure 4. Future outlook of urban forestry activities by industry type: (1) extremely bad, (2) somewhat bad, (3) neutral, (4) somewhat good, (5) extremely good.

landscape architectural services (3.44) had an average outlook between "neutral" and "somewhat good." Both nursery and tree production (3.50) and nursery stores (3.50) also had an average outlook between "neutral" and "somewhat good." Nursery supplies wholesalers (2.75) had the least-positive outlook in their urban forestry activities, with an average between "somewhat bad" and "neutral."

We asked respondents their perceptions on the impacts of 5 issues presented on a 5-point ordinal scale. Based on the business type, respondents from landscaping services (3.69); nursery, greenhouse, and tree production (3.35); and nursery and garden supplies stores (3.14) rated difficulty in recruiting workforce as between "some" and "quite a bit" of an issue impacting urban forestry activities (Table 4). Meanwhile, the other 3 business types rated the severity of the issue as more than "a little" but less than "some." In addition, respondents associated with landscape architectural services stated that difficulty in retaining

Table 4. Average severity of issues influencing urban forestry (UF) activities by industry type (1 – not at all, 2 – a little, 3 – some, 4 – quite a bit, and 5 – a great deal).

Business type by NAICS	Difficulty in recruiting workforce	Difficulty in retaining employees	Inadequate supply chains	Inadequate R&D	Public perception and value of trees
Landscaping services (561730)	3.69	2.79	1.75	1.75	2.55
Nursery and tree production (111421)	3.35	2.60	2.05	1.90	2.79
Nursery and garden supplies stores (444220)	3.14	2.79	2.00	1.85	2.39
Farm and garden equipment wholesalers (423820)	2.83	2.13	1.52	1.35	1.39
Nursery and florist merchant wholesalers (424930)	2.56	2.00	1.56	1.56	2.67
Landscape architectural services (541320)	2.39	1.77	1.86	1.96	3.12

employees was less than "a little" (1.77) of an issue impacting urban forestry activities. The remaining 5 business types rated difficulty in retaining employees between "a little" and "some" of an issue (Table 4).

Further, respondents associated with nursery, greenhouse, and tree production (2.05) and nursery and garden supplies stores (2.00) rated inadequate supply chains as "a little" of an issue. Each business type agreed that inadequate R&D is between "not at all" and "a little" of an issue affecting their urban forestry activities (Table 4). Finally, the majority of business types rated public perception and value of trees as between "a little" and "some" of an issue (Table 4). The outliers—farm and garden machinery (1.39) and landscape architectural services (3.12)—reported public perception and value of trees as less than "a little" and more than "some" of an issue impacting urban forestry activities, respectively.

Ordered Logistic Regression Model: Business Outlook of Private Urban Forestry

Table 5 presents the ordered logistic regression results obtained from the full (unrestricted) and reduced-form models. Only statistically significant explanatory variables are incorporated in the reduced-form model. In our restricted model, an insignificant test statistics (P-value = 0.56) suggests that the restricted generalized ordered logistic model does not violate the proportional odds assumption. Only one variable, *uf_jobs*, is found to have an issue with the assumption, which is addressed by alternative parameterization indicated by Gammas in Table 5.

In the restricted generalized ordered logistic regression model, most of the variables, except nursery supplies wholesalers (*nursery_supply*), were found to be positively associated with the likelihood of the perceived positive outlook for urban forestry business in the study region (Table 5). The estimated odds ratio value of 1.58 associated with landscaping services suggested that landscaping businesses are 58% more likely to have a positive business outlook on urban forestry activities compared to other industry types. However, nursery supplies wholesalers were found to have an 82% less positive outlook of their urban forestry business. Larger companies, in terms of the number of employees (*jobs*), were found to have a more positive business outlook on their urban forestry activities. Likewise, the estimated odds ratio value corresponding to the corporation structure variable (*corporate*) indicated that businesses structured as corporations are 43% more likely than companies with other organization structures to have a positive business outlook on urban forestry activities. Similarly, the odds ratio result of 1.22 associated with the variable "inadequate research and development" (*r&d*) indicated that private businesses which identified the issue of inadequate research and development

Table 5. Ordered logistic regression results in unrestricted (full) and restricted (reduced) models highlighting the factors explaining the outlook of the private green industry on the urban forestry (UF) business.

Variable	Full ordered logistic model (N = 346)		Restricted generalized ordered logistic model (N = 349)		
	Coefficient (standard error)	P-value (P > [z])	Coefficient (standard error)	P-value (P > [z])	Odds ratio
landscaping	0.17 (0.31)	0.58	0.46 (0.22)	0.04	1.58
nursery supply	−1.96 (0.72)	0.00	−1.73 (0.67)	0.01	0.18
nursery tree	−0.37 (0.42)	0.38			
nursery stores	−0.17 (0.46)	0.72			
architecture	−0.26 (0.38)	0.49			
Log (jobs)	0.14 (0.09)	0.11	0.13 (0.08)	0.09	1.15
Log (longevity)	−0.18 (0.15)	0.24			
UF jobs	0.02 (0.01)	0.00	−0.01 (0.01)[a]	0.17	0.98
corporate	0.37 (0.22)	0.09	0.36 (0.21)	0.09	1.43
R&D	0.25 (0.13)	0.05	0.20 (0.12)	0.08	1.22
supply chain	−0.10 (0.13)	0.43			
recruitment	0.08 (0.11)	0.46			
retention	−0.06 (0.12)	0.63			
The likelihood ratio test of proportionality of odds	67.64	0.00	12.54	0.56	

[a] The Gamma function in the generalized ordered logistic regression produces 4 Gamma coefficients for the variables that deviate from proportionality. So, *UF jobs* has Gamma 2 value of 0.02 (0.01), Gamma 3 value of 0.04 (0.01), and Gamma 4 value of 0.04 (0.01). All 3 Gamma estimates are statistically significant.

in urban forestry are 22% more likely to have a positive outlook on their business. Meanwhile, higher Gamma estimates for the variable representing the percentage of jobs in urban forestry (*uf_jobs*) were found to be positive and significant, which implies that private businesses with a higher percentage of employees dedicated to urban forestry are more likely to have a positive outlook of their urban forestry business.

DISCUSSION AND CONCLUSIONS

Private urban forestry is a substantial sector in the green industry and will continue to grow as communities and cities recognize the environmental and socioeconomic benefits of access to green space in developed areas. With its growing recognition and relevance, there is an increasing need for urban-forest development and management services. Our findings indicate a varying outlook of the businesses involved in urban forestry in the study region. Our results also suggest that those who reported a higher percentage of employees engaged in urban forestry activities had an estimated higher likelihood of a positive outlook, leading us to the conclusion that those who invest in urban forestry revenue streams have an increased likelihood of having a positive outlook on the future.

Our study indicates that those businesses with a higher percentage of jobs dedicated to urban forestry activities are more likely to have a positive outlook to their future success. It would be beneficial for urban forestry to have increased promotion and visibility to encourage private-industry growth and participation in urban forestry planning, establishment, and maintenance. We recommend increased state or federal investment in urban forestry practices to help create an increased demand for private-industry services. Many cities have already begun to catalogue the status of urban forestry within their borders while also planning for increased future establishment (Elmendorf et al. 2003; Wolf 2004a; Nowak et al. 2007; Gibbons and Ryan 2015). If more government programs and urban forestry–establishment plans are created to encourage urban forestry as a solution to both environmental and socioeconomic issues, it could boost

private green industry growth and an improvement in the future of urban forestry success.

The negative outlook of urban forestry activities among those active in the nursery and florist's supplies merchant wholesalers is counterintuitive to the rise in urban forestry programs that utilize nursery stock and flowers (O'Neil-Dunne 2019). A recent study by Pérez-Urrestarazu et al. (2021) reported an increase in consumers preferring indoor plants throughout the pandemic, which are produced by the nursery and florist's supplies merchant wholesalers sector. The finding of a negative business outlook from our model may imply that the nursery supplies wholesalers have focused more on floriculture and other non-tree-related supplies during the pandemic and may have overlooked the urban forestry portion of their business. This finding warrants additional research to better understand the negative outlook on their business in urban forestry.

In addition, our results suggest that private green industry businesses which are larger in terms of the number of employees or invest more of their workforce in urban forestry are more likely to have a positive outlook on the future of urban forestry. These results seem logical considering the progression of urban forestry in the green industry (Hodges et al. 2011; Hodges et al. 2015; Hall et al. 2020). Specifically, urban forests are becoming a more integrated part of communities (Austin 2002), necessitating increased vegetation management. As a result, larger cities as well as smaller municipalities have created programs to educate and train young adults for occupations in urban forestry (Falxa-Raymond et al. 2013; Lindholst 2017), corresponding to increases in sales and revenue for green industry businesses performing urban forestry activities (O'Neil-Dunne 2019; USDA Forest Service 2021a).

The net benefits associated with corporations, decreased risk, and overall tax breaks may explain the positive perceived outlook of corporations compared to other organization-structured industries. While sole proprietorships, or individual ownerships, have no corporate business taxes and are relatively inexpensive to start up (O'Brien 2020), there are unlimited personal liabilities, making it difficult to obtain business financing for individuals. Many corporate businesses in the green industry engaged in urban forestry activities may have had the opportunity to take advantage of federal financial relief supports (CARES Act 2019-2020; FFCR Act 2019-2020) available to businesses impacted by the pandemic. Corporations

are more likely to tap into such programs when compared to individual arborists and LLCs.

Although respondents' indications of inadequate research and development were between "not at all" and "a little" of an issue (Table 4), the estimated positive coefficient from our ordered logistic model indicates that respondents highlighted the significance of inadequate research and development in urban forestry business. In terms of the other perceived issues related to urban forestry, Table 4 depicts that, on average, respondents perceived difficulty in recruiting and retaining workforce to be between "a little" and "some" of an issue. This finding suggests that training programs for those involved in urban forestry activities within the green industry would be beneficial to the future of urban and community forestry (Falxa-Raymond et al. 2013). Meanwhile, inadequate supply chain was rated between "not at all" and "a little" of an issue, which is encouraging as it infers that national programs created to encourage growth in the industry are effective (National Urban and Community Forestry Advisory Council 2015; USDA Forest Service 2021a).

Although the focus of this study is on private businesses, it is important to note the influence government agencies and nonprofit organizations could have on the success or failure of the green industry. To encourage the continued growth and benefits of urban forests, the Urban & Community Forestry Program in the United States Forest System (USFS) has created a cost-share grant program which requests plans for urban-forest establishment and resiliency all across the nation (USDA Forest Service 2021a). These programs eventually help foster the creation of private green industry jobs as government bodies sometimes contract the vegetation management and other related activities to local private businesses. Success of the green industry may not be wholly reliant upon government programs, but it could be a worthwhile area of research to explore how government programs influence the success of sectors within the green industry. Similarly, while our study did not focus on contract length, developing long-term contracts with the private sector could encourage stable growth in urban forestry. For example, municipal contracts with private green industry vegetation management services are a common way governments choose to maintain city vegetation (Lindholst 2017). Local communities and public agencies should consider long-term contracts with urban forestry businesses to encourage their business stability and growth opportunities.

While our survey administration procedure started prior to the pandemic, several respondents referenced the global health crisis while reporting their outlook on urban forestry activities. Many referenced the pandemic as an overall economic deterrent to economic growth, implying that the state of their business is dependent on how the economy recovers from the national lockdowns. Some responses indicated that the pandemic positively influenced the economic success of their businesses, while others still recognized the global health crisis would have long-term negative impacts on the fate of their business. The latter respondents would most likely agree with the 37% of the Tree Care Industry Association (TCIA) members who reported the economy will be "worse than now" in the near future (Tree Care Industry Association 2021). Following the previous substantial economic fluctuation, the Great Recession of 2007 to 2009, Hall and Dickson (2011) indicated that consumers were willing to purchase landscaping and home-renovation items to enhance their quality of life and well-being. Consumer willingness to purchase green industry products and services during and following major economic events could infer a positive prospect of urban forestry in the post-pandemic era.

A lower survey response rate in this regional survey is worth mentioning. A higher response rate is always preferable, but there has been a declining response rate over the last 30 years, and there has yet to be an agreed upon acceptable response rate throughout the scientific community (Cleary et al. 2021b). Low response rate may have been due to the region surveyed, but we cannot be sure as we did not follow up with the respondents asking for the reasons for not completing the survey (Cleary et al. 2021a). Over-surveying has been found to negatively affect the response rate (Manfreda et al. 2008), leading us to believe respondents may have been overstimulated and over-surveyed during the response window. Responding to this survey could have been a low priority for many businesses during the pandemic, when the entire world was grappling with the first wave of COVID-19.

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Résumé. Contexte: La foresterie urbaine représente un secteur crucial de l'industrie verte et constitue un outil de plus en plus utilisé pour relever les défis écologiques et sociopolitiques des paysages urbains. Outre un certain nombre d'agences publiques et d'organisations sans but lucratif, divers types d'entreprises privées sont directement impliqués dans le développement et la gestion des arbres et des aménagements urbains. L'objectif principal de cette étude est d'évaluer les perspectives des entreprises privées de l'industrie verte sur leurs activités de foresterie urbaine dans la région Nord-Est-Midwest des États-Unis. Méthodes: Sur la base d'une enquête menée auprès d'entreprises privées impliquées dans l'industrie verte à la fin de 2020, nous avons développé un modèle empirique en intégrant les types d'entreprises, les paramètres commerciaux et les enjeux liés à la foresterie urbaine tels que perçus par les entreprises privées. Résultats: Les résultats d'un modèle de régression logistique ordonnée suggèrent que les entreprises de grossistes en fournitures pour pépinières et fleuristes sont moins susceptibles que les autres firmes d'avoir une vision positive des activités de foresterie urbaine. Nous avons constaté que les répondants à l'enquête ayant déclaré un pourcentage plus élevé d'employés en foresterie urbaine montraient une plus grande probabilité d'avoir une vision positive de leur domaine d'activité. Conclusions: De nombreux répondants ont fait référence à la manière dont la COVID-19 a été un frein à la croissance économique, laissant supposer que l'état de leur entreprise dépendait de la reprise de l'économie. Les résultats fournissent des indications utiles en matière de politique et de gestion sur la façon dont les entreprises privées perçoivent les perspectives en foresterie urbaine. Les résultats de cette étude seront utiles au secteur privé et aux organismes publics impliqués en foresterie urbaine pour une meilleure planification et programmation dans la région Nord-Est-Midwest des États-Unis.

Zusammenfassung. Hintergrund: Die städtische Forstwirtschaft ist ein wichtiger Sektor der grünen Industrie und wird zunehmend als Instrument zur Bewältigung ökologischer und sozialpolitischer Herausforderungen in städtischen Landschaften eingesetzt. Neben einer Reihe von öffentlichen Einrichtungen und gemeinnützigen Organisationen sind verschiedene private Wirtschaftszweige direkt an der Entwicklung und Verwaltung von Stadtbäumen und Landschaften beteiligt. Das Hauptziel dieser Studie ist es, die Aussichten der privaten Unternehmen der grünen Industrie in Bezug auf ihre Aktivitäten im Bereich der städtischen Forstwirtschaft im Nordosten und Mittleren Westen der Vereinigten Staaten zu bewerten. Methoden: Auf der Grundlage einer Befragung privater Unternehmen, die Ende 2020 in der grünen Branche tätig waren, haben wir ein empirisches Modell entwickelt, das Branchentypen, Geschäftskennzahlen und die von den privaten Unternehmen wahrgenommenen Probleme im Zusammenhang mit der städtischen Forstwirtschaft berücksichtigt. Ergebnisse: Die Ergebnisse eines geordneten logistischen Regressionsmodells deuten darauf hin, dass Baumschulen und Großhändler für Floristenbedarf weniger wahrscheinlich eine positive Einstellung zu Aktivitäten im Bereich der städtischen Forstwirtschaft haben als andere Unternehmen. Wir fanden heraus, dass die Befragten, die einen höheren Prozentsatz von Mitarbeitern in der städtischen Forstwirtschaft angaben, mit höherer Wahrscheinlichkeit eine positive Einstellung zu ihrem Unternehmen hatten. Schlussfolgerung: Viele der Befragten verwiesen darauf, dass COVID-19 das Wirtschaftswachstum insgesamt behindert hat, was bedeutet, dass der Zustand ihres Unternehmens von der Erholung der Wirtschaft abhängt. Die Ergebnisse liefern nützliche Erkenntnisse für Politik und Management darüber, wie Privatunternehmen die Zukunftsaussichten der städtischen Forstwirtschaft einschätzen. Die Ergebnisse der Studie kommen dem privaten Sektor und den öffentlichen Einrichtungen zugute, die sich mit der städtischen Forstwirtschaft befassen, um eine bessere Planung und Programmgestaltung in der Region Nordost-Mittelwesten der Vereinigten Staaten zu ermöglichen.

Resumen. Antecedentes: La silvicultura urbana es un sector crucial de la industria verde y una herramienta cada vez más utilizada para abordar los desafíos ecológicos y sociopolíticos en los paisajes urbanos. Junto con una serie de agencias públicas y organizaciones sin fines de lucro, varios tipos de industrias privadas están directamente involucradas en el desarrollo y la gestión de árboles y paisajes urbanos. El objetivo principal de este estudio es evaluar las perspectivas de las empresas privadas de la industria verde sobre sus actividades forestales urbanas en la región Noreste-Medio de los Estados Unidos. Métodos: Sobre la base de una encuesta de empresas privadas involucradas en la industria verde a fines de 2020, desarrollamos un modelo empírico incorporando tipos de industria, métricas comerciales y problemas relacionados con la silvicultura urbana percibida por las empresas privadas. Resultados: Los resultados de un modelo de regresión logística ordenada sugieren que los negocios mayoristas de suministros de viveros y floristerías tienen menos probabilidades que otros negocios de tener una perspectiva positiva sobre las actividades forestales urbanas. Encontramos que los encuestados que informaron un mayor porcentaje de empleados forestales urbanos tenían una mayor probabilidad de una perspectiva positiva de su negocio. Conclusión: Muchos encuestados hicieron referencia a cómo COVID-19 ha sido un elemento disuasorio general para el crecimiento económico, lo que implica que el estado de su negocio depende de la recuperación de la economía. Los hallazgos proporcionan información útil de políticas y gestión sobre cómo las empresas privadas perciben las perspectivas futuras de la silvicultura urbana. Estos resultados del estudio benefician al sector privado y a las agencias públicas involucradas en la silvicultura urbana para una mejor planificación y programación en la región Noreste-Medio de los Estados Unidos.