

**Urban Forestry at a Crossroads:
Development of an Emerging Profession**

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ABSTRACT (ACADEMIC)

While the practice of managing trees in and near human settlements has been around for most of human history, urban forestry has only been organizing as a discrete profession since the mid-1960s. As a relatively new profession, urban forestry lacks much of the structure and organization seen in other professions. This study will contrast urban forestry against other professions to identify strategies for improving recruitment into urban forestry, collaboration with other professions, and career opportunities.

Civil engineers, landscape architects, and urban planners (the allied professions) work together to plan and manage the urban environment, but urban foresters report difficulties integrating into or collaborating with this group diminishing their ability to influence urban forest management decisions. Allied professionals were surveyed on their usage of professional support mechanisms (e.g., certification) and their perception of professionalism in urban forestry. We found they are heavily invested in processes and functions that support practitioners and regulate their professions via certification, and the adoption of similar mechanisms by urban forestry would likely facilitate improved social capital.

Enrollment in urban forestry degree programs is too low and diversity of practitioners is unrepresentative of the urban areas served. Over 1,000 life and natural science-oriented college students at 18 U.S. universities were surveyed on their perceptions of urban forestry as a career. Aside from the wealthiest students displaying lower interest in urban forestry than others, we

found no demographic characteristics (i.e., race, gender, socio-economic status, residential setting growing up) that would preclude urban forestry from recruiting a greater diversity of students. Poor awareness of urban forestry seems to be the greatest obstacle to improved recruitment outcomes.

Regularly probing the career opportunities of a profession for weaknesses and deficiencies is a tool of self-improvement commonly seen in other professions. We analyzed 151 job postings to assess typical salary, job duties, and requirements of education and certifications. We also interviewed 17 successful candidates to those positions to compare reality against written postings. A dearth of entry-level positions is likely deterring potential recruits. Employers were not posting 40% of the duties urban foresters were performing. Experience as an arborist was accepted in lieu of education as an urban forester in about half of positions, though a degree was required to reach the highest paying jobs.

ABSTRACT (PUBLIC)

Urban forestry is the management of trees in the built environment to maximize the benefits they provide and reduce the risk they pose. These urban trees are found throughout our towns and cities, on public and private property, in parks and along streets. The urban forest produces a value or defers costs that we can quantify in real dollars. Maximizing this potential return-on-investment requires professional expertise.

While the practice of managing trees in and near human settlements has been around for most of human history, urban forestry has only been organizing as a discrete profession since the mid-1960s. As a relatively new profession, urban forestry lacks much of the structure and organization seen in other professions. This study will contrast urban forestry against other professions to identify strategies for improving collaboration with other professions, recruitment into urban forestry, and career opportunities.

Civil engineers, landscape architects, and urban planners (the allied professions) work together to plan and manage the urban environment, but urban foresters report difficulties integrating into or collaborating with this group diminishing their ability to influence urban forest management decisions. Allied professionals were surveyed on their usage of professional support mechanisms (e.g., certification) and their perception of professionalism in urban forestry. We found they are heavily invested in processes and functions that support practitioners and regulate their professions via certification, and the adoption of similar mechanisms by urban forestry would likely facilitate improved integration into this group.

Enrollment in urban forestry degree programs is too low and diversity of practitioners is unrepresentative of the urban areas served. Over 1,000 life and natural science-oriented college students at 18 U.S. universities were surveyed on their perceptions of urban forestry as a career.

Aside from the wealthiest students displaying lower interest in urban forestry than others, we found no demographic characteristics (i.e., race, gender, socio-economic status, residential setting growing up) that would preclude urban forestry from recruiting a greater diversity of students. Poor awareness of urban forestry seems to be the greatest obstacle to improved recruitment outcomes.

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1.0 – INTRODUCTION

While the practice of managing trees in and around human settlements to reap the benefits provided by them has existed for most of human history (Miller et al., 2015), urban forestry as an organized profession is a recent development. Benefits of the urban forest are numerous and well-documented (Nowak et al., 2002; McPherson et al., 2005; Peper et al., 2007; Nowak et al., 2013), and urban foresters are professionals trained to maximize the benefits of urban trees while minimizing the risk they pose. Society is increasingly demanding access to nature in the urban environment (Romolini et al., 2016), of which urban trees are significantly important. However, urban forestry is a relatively new profession, emerging only in the last 50 years (Jorgensen, 1967, 1993; Kenney, 2010). Thus, there is virtually no literature examining urban forestry as a profession and much uncertainty exists regarding the effectiveness of the current organization and structure of the profession.

As a profession, urban forestry overlaps with arboriculture and has always relied on that profession for structure and organization. Many people today would argue that arboriculture and urban forestry are synonyms referring to the same discipline, or that they represent different points on the same continuum of caring for trees. Regardless, at least some professionals who identify primarily as urban foresters are consistently dissatisfied with significant parts of the organization and structure of their profession (O'Herrin et al., 2014, 2015; O'Herrin et al., 2016). This study focuses on urban forestry as a profession discrete from arboriculture.

We define urban forestry as the planning and management of populations of trees where people live, work, and recreate to maximize benefits produced while minimizing risk they pose. We define arboriculture as the selection, cultivation, and management of individual trees, shrubs,

and woody vines primarily for amenity and risk management purposes. Arboriculture is a critically important tool used by urban foresters, and thus urban forestry promotes arboriculture by increasing demand for it; a mutually beneficial relationship. However, professional support mechanisms for arborists exceed those available to urban foresters.

In addition to considering how arboriculture professionals are provided for by their respective professional societies, we can look toward other professions that are older and better established than urban forestry for ideas and guidance on how to improve. There is often a running dialogue on self-improvement in the literature of many other professions. This is part of a continual effort to evaluate one's own profession for areas of improvement, implement changes, and assess the impacts of those changes. Similar efforts at self-reflection and self-improvement are absent from the urban forestry literature thus far.

Urban forestry is new especially compared to related disciplines that also impact the urban environment such as the allied professions of civil engineering, landscape architecture, and urban planning (hereafter referred to as the 'allied professions'). We call these professions 'allied' because, aside from arboriculture, they are the professions that urban foresters anecdotally report they most commonly work with and who have a large potential impact on trees when planning and managing the urban environment. Social Capital Theory provides a framework to help us understand how these professions and others are structured and interpret the value of processes and functions therein designed to promote the profession and support professionals. Urban forestry currently has little structure at all, and adopting structure similar to these other professions may foster increased social capital between urban forestry and other professions, directly addressing problems reported by urban foresters such as inconsistent results

when trying to collaborate with allied professionals (O'Herrin et al., 2014, 2015; O'Herrin et al., 2016).

Other results of the absent structure in the profession are that urban foresters report that their job skills and responsibilities are poorly understood by colleagues and employers, they feel the profession of urban forestry is not well respected, and mechanisms for professional support and advancement are either unclear or unavailable (O'Herrin et al., 2014, 2015; O'Herrin et al., 2016). Additionally, this absence of structure in urban forestry likely contributes to the poor public recognition reported by urban foresters (O'Herrin et al., 2014, 2015; O'Herrin et al., 2016). Public image directly impacts professionals and the profession, from recruitment and education to collaboration with other professions. Although demand for nature in urban environments is increasing, urban forestry is rarely known to the public and urban foresters are often overlooked.

As with the public at large, we assume that most pre-college and college students have never heard of urban forestry at all. Urban forestry has no proactive, coordinated initiative to recruit students into urban forestry degree programs and the urban forestry profession. Enrollment in many urban forestry degree programs is low compared to adjacent natural resource programs. Urban forestry degree programs are almost always units within these natural resource programs, especially as an emphasis of forestry degree programs. The lack of broad public knowledge about urban forestry coupled with the lack of active recruitment efforts means that most urban forestry students are migrating from traditional forestry degree programs, rather than a broader audience.

Thus, a student must first be attracted to a career in a traditional natural resources field before they are ever exposed to urban forestry as a career option. Neither the public perception

nor the reality of a career in traditional natural resources is representative of a career in urban forestry, and so this predicament greatly limits recruitment into urban forestry. There is no literature on recruiting students into urban forestry, yet active recruitment could assist in creating a consistent pipeline of new, trained professionals. Social Cognitive Career Theory offers a framework that may help us understand how students perceive urban forestry as a career path once they are introduced.

When considering potential career paths in any given field, students today are often presented with a comprehensive picture of what a typical career may look like, including job placement prospects, salary, work environment, and duties. These details contribute to their existing impression based on public image and personal experience. However, too little is known about career opportunities in urban forestry to outline potential career paths or goals to perspective recruits/students, further adding to a public image of disorganization and unprofessionalism. This also makes it impossible to know if there are systemic deficiencies that should be addressed.

The structure and organization of urban forestry as a profession has rarely been critically examined and there is certainly no sustained conversation on the topic. There is difficulty among urban foresters in even reaching agreement on who urban foresters are or what urban forestry is (O'Herrin et al., 2014, 2015; O'Herrin et al., 2016). Therefore, we focused on major issues with the organization of urban forestry as a profession that present impediments to sustained growth. Goals of this research were to understand how students perceive urban forestry as a career choice, outline career opportunities in the profession, and understand the perceptions of urban forestry as a profession held by allied professionals.

1.1 Objectives and Organization

This dissertation is organized into six chapters. The first chapter provides an outline for this dissertation and identifies some major problem areas when examining the structure and organization of urban forestry as a profession discrete from all others. Chapter two is a literature review of studies that examined the structure and organization of other professions. Chapters three through five are designed to be stand-alone manuscripts that will be submitted for peer review publication. The final chapter summarizes study findings from the preceding chapters, as well as their implications for the future of urban forestry as a discrete profession.

The third chapter presents results from a survey of allied professionals. The main objective of this study was to determine usage in the allied professions of professional support mechanisms which we define as processes or functions (e.g., certification and continuing education) that advance professions and support practitioners, students, educators, and others. Social Capital Theory was used as a framework to understand how the allied professions work together to plan and manage the urban environment. Questions were asked to determine if adoption of similar professional support mechanisms by urban forestry would benefit the profession and improve collaboration with the allied professions.

The fourth chapter presents results from a content analysis of urban forestry job postings and interviews with several of the successful candidates who filled those job postings. The main objective of this study was to identify career opportunities in urban forestry and any possible barriers to access to these positions. Postings were analyzed to determine typical salaries, minimum requirements of education and certifications, and job duties as represented by the 43 knowledge areas of the Body of Knowledge developed by members of the Society of American Foresters in 2014.

The fifth chapter presents results from a survey of life and natural science-oriented college students enrolled at 18 institutions across the Eastern U.S. The main objective was to identify potential deterrents to improved recruitment into urban forestry. Social Cognitive Career Theory was used as a framework to understand how students consider pay and prestige, and personal interest and job satisfaction, when considering career choice. Questions were also asked to determine how important professional support mechanisms are to students in career choice. These results are considered in the context of urban forestry to identify and eliminate potential deterrents to improved recruitment into the profession.

The sixth chapter is the dissertation conclusion. This chapter summarizes what was learned about urban forestry as a profession by examining other professions, surveying other professionals and potential recruits, and analyzing available jobs. The implications of this research are discussed relative to long-term strategic planning for the sustained growth and improvement of the profession.

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2.0 – LITERATURE REVIEW

This section first examines the idea of professions and professionalism, including providing historical perspective. It then dissects the organization of modern professions, especially amongst the allied professions of civil engineering, landscape architecture, and urban planning. Examples from these professions and others are contrasted against what currently exists in urban forestry. Lastly, this section describes the two social science theories used in this research: Social Capital Theory and Social Cognitive Career Theory.

2.1 Understanding Professions

As our communities become more urban and less rural (United Nations, 2012), society is increasingly demanding access to nature in the urban environment (Romolini et al., 2016). Urban foresters are professionals trained to plan and manage trees in this environment; however, the profession lacks structure and organization. Reflecting on one's own profession to identify strengths and weaknesses is commonly seen in the literature of other, more well-established professions, both to address specific issues and more generally, through routine assessment. However, professional self-reflection of either variety is nearly absent from the urban forestry literature.

Urban forestry meets the definition of a 'profession' per Bayles (2003) who synthesized many schools of thought on the topic 'what is a profession?' Bayles believes that a profession requires extensive training of a significantly intellectual nature and provides a service to society (Bayles, 2003). Urban forestry is primarily an intellectual endeavor in training and education, and in practice; though arboriculture is critically important to urban forestry, urban foresters do not usually spend a significant amount of time performing arboriculture tasks themselves. Urban

forestry provides a service to society that is increasing in demand and the ethic of public service is inherent in its application. It is a discipline that strives to maximize the benefits trees provide to humans where they live, work, and recreate.

Freidson (1994) spent decades studying professionalism and professions and, unlike Bayles (2003), believes every researcher must define 'profession' for themselves because there is no strong consensus. Thus, we offer the following definitions:

- Profession: an occupation that requires at least a four-year degree to practice
- Professionalization: a group of workers striving to improve their position
- Professionalism: exhibiting the qualities of a professional, mainly competency, responsibility, and ethical behavior.

Understanding the history of professions in the U.S. is important because many current trends in the structure and organization of professions are as old as the idea of professions itself. Land surveyors are argued to have been the first profession in the U.S., as their services were in great demand in the 1780s by a new country trying to settle the North American continent in an organized manner (Hughes, 1987). Ordinances granting authority to surveyors to determine the legal right to ownership of real property added stability and built trust in the new nation's government (Hughes, 1987). Aside from surveyors, professions did not emerge and form in the U.S. until the mid-1800s when the Federal government started to license medical doctors after the number surged during the Civil War (Hamowy, 1979).

Civil engineers were also organizing into a professional group around the 1850s (Wisely, 2002). Landscape architects started to organize in the 1890s (Campbell, 2015), and urban

planners in the 1900s (Scott, 1969; Jernigan, 2013). These three allied professions all emerged initially by branching off from existing professions. This coincided with the City Beautiful movement of the 1890s and 1900s, which consisted of efforts to improve the quality of life in cities through increased planning and management of the urban environment (McKinney, 2010; Rose, 1996). This was a reaction to the devolving quality of life generated by the post-Civil War urbanization and industrial expansion of American cities (Rose, 1996; Hopper, 2000; Wisely, 2002; McKinney, 2010; Jernigan, 2013; Campbell, 2015). The City Beautiful Movement was the beginning of the union between civil engineers, landscape architects, and urban planners to plan and manage the urban environment. The current leading professional societies for these three professions all have their roots during this time.

A professional society is a group of professionals organizing to advance their station in a variety of ways. This includes regulation - the administration and control of access to practice and assessing competency of practitioners (Bayles, 1986; Gorman, 2014; Monteiro, 2015), and also setting ethical norms that protect the public and the profession (Perlis and Shannon, 2012; Kasule, 2013). This can also include representation and advocacy of practitioners (Matthews, 2012) and providing opportunities for collaboration, networking, and academic exchange (Institute of Medicine et al., 2005; Kasule, 2013). There is a professional society for almost every profession imaginable – members of the American Society of Association Executives represent over 10,000 unique organizations (American Society of Association Executives, 2016).

Regulation of a profession usually includes setting standards of practice, bar to entry, and certification of competency, and in cases of professional self-regulation is administered by an organization composed of professionals, very commonly a professional society or an affiliate (Gorman, 2014; Monteiro, 2015). Professional self-regulation is a defining characteristic of

professionalism, maintaining professional autonomy and instilling public confidence (Bayles, 1986). The alternatives are regulation by government, which is undesirable as it shows the profession cannot be trusted, or going without regulation, which communicates unprofessionalism (or irrelevancy). Self-regulation communicates that a group of professionals care enough about their work and are organized enough to manage themselves in a manner that is consistently ethical and with regard for the public interest. Urban forestry is currently unregulated, communicating that the profession is disorganized and possibly irrelevant.

Self-regulation is often achieved through professional certification (the assessment of practitioner competency) which is often administered by a professional society. This is just one of many processes or functions that advance professions and support practitioners, students, educators, and others, which we will refer to as professional support mechanisms. The next section examines professional support mechanisms commonly seen in modern professions, especially the allied professions of civil engineering, landscape architecture, and urban planning.

2.2 The Organization of Professions

Every profession is organized differently, but what is typical or common among the allied professions? Professional support mechanisms are the processes and functions used to provide structure and organization to a profession. Here we examine typical professional support mechanisms found in the allied professions and contrast this against the status of those same mechanisms in urban forestry, beginning with the professional society itself.

2.2.1 Role of the Professional Society

Figure 2.1 depicts a simplified schematic of the role played by modern professional societies in many professions. The professional society is at the top of the chart, but this should

not be thought of as a hierarchical chart, and the professional society should not be thought of as ‘in charge’ but rather ‘responsible for.’ What is omitted from this simplified schematic are the many feedback loops that are required for this system to operate, especially inputs into the professional society itself including volunteer service and membership dues. Those inputs come directly from members, among other sources, in a quasi-democratic system of governance – a peer process. Board members orchestrate these voluntary service roles and are especially influential. For example, the American Society of Landscape Architects (ASLA) is governed by a board of trustees, each of whom is a volunteer member elected to represent their regional chapter at the national level (Lent, 2015).

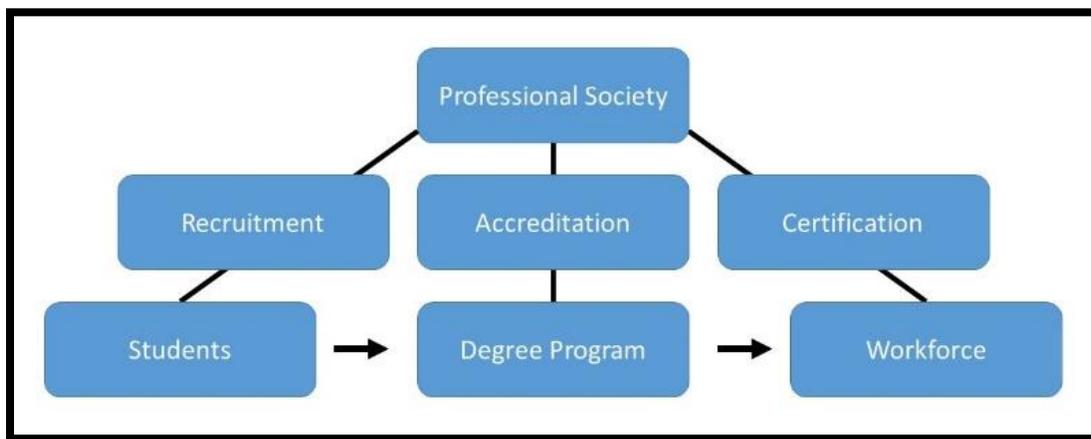


Figure 2.1: Flow chart of the administration of a profession. The professional society is at the top of this chart, but this should not be thought of as a hierarchical chart and the professional society should not be thought of as ‘in charge.’

Professional societies continually collect data on members (both employers and employees) and clients in a semi-rigorous process called ‘industry research.’ The intent is to maintain a current understanding of workforce conditions including demand for practitioners, needs of employers, and the needs of clients. This information is considered proprietary and is often unpublished as professional societies compete against each other for members. Rather, it is

used as feedback to adjust services offered by the professional society to best serve members and the public.

2.2.2 Role of Professional Society in Urban Forestry

We argue that urban forestry currently has no professional society solely focused on its needs. Urban foresters report membership in the Society of Municipal Arborists, the Society of American Foresters, and the Tree Care Industry Association; however, the International Society of Arboriculture (ISA) seems to be the most popular professional society amongst urban foresters. The ISA has served this role since urban forestry began to organize as a profession about half a century ago. However, the mission of the organization and services offered are clearly directed at arboriculture professionals (e.g., certification and continuing education). Urban forestry has a need for similar services specifically tailored to it and which are normally offered by a professional society, yet are not currently being provided by the ISA.

About 25% (5,000 individuals) of the U.S. membership of ISA identify primarily as urban foresters (Skiera, 2016), which is more than likely sufficient to support tailored professional support mechanisms (Brauer, 2011; Brauer and Lewis, 2013; Brauer, 2015). Little more is known about the urban forestry workforce. This is partly because, in the workplace, urban foresters (formally educated in urban forestry or otherwise) have many different job titles, which makes tracking them difficult. If confounded with traditional foresters, the Bureau of Labor Statistics (BLS) may classify urban foresters into the Farming, Fishing, and Forestry occupation group or the Conservation Scientists and Foresters occupation group. If urban forestry is confounded with arboriculture, it may be classified into the Tree Trimmers and Pruners occupation group. None are probably sufficiently representative of urban forestry as a profession. This lack of identity results in a lack of knowledge of the workforce conditions of the

profession. Note that BLS occupation groups specifically exist for Civil Engineers, Landscape Architects, and Urban and Regional Planners.

2.2.3 Active Management of Public Image

Personal interest in a discipline evolves into interest in that field as a career, but this has to start with an awareness that a profession exists. Even the ASLA still sees a lack of awareness that landscape architecture exists as a career option as a major challenge to the profession, which impacts recruitment among other things (Lent, 2015). Urban foresters have consistently reported a similar lack of awareness and understanding of their profession (O'Herrin et al., 2014, 2015; O'Herrin et al., 2016). The awareness of a profession is directly reliant on the public image. ASLA 'absolutely manages the public image of the profession' and it is 'probably the top priority' (Lent, 2015).

Other professions also struggle with public image. Y. ten Hoeve et al. (2013) examined the public image of nursing, specifically their professionalism as perceived by and visibility to the public, and how it affects their position in healthcare organizations relative to other professionals (e.g., M.D.s, administrators, technicians). Nursing has also struggled to recruit men into the profession, a deficiency largely perceived to result from public image (Meadus, 2000; Strong Anthony, 2004).

Zugazuga et al. (2006) examined literature on the public image of social workers and found media portrayals to demoralize practitioners; their own study confirmed that social workers perceive themselves to be portrayed negatively (misrepresented) in various forms of media. They tasked the National Association of Social Workers (a professional society) with the responsibility for leading an effort to improve the public image of the profession; Rank and

Hutchison (2000) also tasked national leaders with responsibility for representing the profession to the public. Despite being one of the oldest professions in human history and boasting a high status in society and high pay rates, lawyers are still concerned with the public image of their profession (Herron, 1989; Galanter, 1997). These three studies exemplify the importance that professions place on public image and how they manage it.

The professional society assumes responsibility for the difficult task of maintaining a positive image in the eyes of the public in a rapidly changing society as well as representing the profession on behalf of their members. ASLA views this as their primary mission (Lent, 2015). This includes tracking legislative bills and amendments with potential impact on a profession, managing social media and internet resources, managing public relations and news media, and distributing relevant information to the press. The common theme in these tasks is that the professional society represents its members in ways and at a magnitude that individuals could not accomplish alone.

2.2.4 Active Management of Public Image in Urban Forestry

Urban foresters report that they frequently encounter confusion among the public regarding the scope and aim of urban forestry (Steed and Fischer, 2007; Mincey et al., 2010; O'Herrin et al., 2014, 2015; O'Herrin et al., 2016). Further, the terms urban forestry and urban and community forestry both tend to be used interchangeably, which adds to confusion, especially among laymen. 'Urban' implies only the densest dwellings and initial reactions to 'urban forestry' are often the impression of an oxymoron. 'Community forestry' has been associated with a separate land-use/natural resources planning practice associated with developing countries and unrelated to urban forestry since the 1970s. Both or either of these terms may be poor choices. In addition to confusion over the title, urban foresters are generally

unable to agree on the definition of urban forestry (O'Herrin et al., 2014, 2015; O'Herrin et al., 2016). Lack of both a common title or definition makes connecting and networking difficult. More importantly, from the perspective of the public, it obfuscates the profession of urban forestry.

The ISA has done an excellent job bringing the term 'arborist' into common language in the United States over the last 30 years and improving the public image of 'tree workers.' This largely resulted from promoting the usage of the ISA Certified Arborist family of credentials among both practitioners and clients/homeowners/the public. Urban foresters have benefited from this to an extent as they are often conflated with arborists. Hauer and Peterson (2016) found 31% of communities (local government) of any size had a certified arborist on staff – whether these are arborists or urban foresters is unclear. The ISA does promote urban forestry to the public through their Trees Are Good campaign (www.treesaregood.com), which educates the public on the benefits of trees and the need for qualified professionals to care for trees, benefiting both arborists and urban foresters. ISA has also produced a variety of literature intended for engineers, planners, and landscape architects, regarding the importance of trees and proper tree management (Skiera, 2016).

2.2.5 Active Recruitment into Professions

In addition to managing the public image in general, marketing is often more targeted toward different audiences for different reasons. For example, homeowners are often targeted by the ISA as this is an important source of business for arborists. Understanding how students perceive urban forestry as a potential career path and marketing to the accordingly could also be very important.

Sanfey et al. (2006) sought to understand how medical students perceive careers in surgery compared to other specializations (e.g., general practice) in an attempt to address falling rates of enrollment in surgery. They found that rather than pay rates, students were influenced by role models (lack of female role models in surgery) and life-style considerations/work-life balance (e.g., ability to have a family, males and females both). We hypothesize that personal interest and job satisfaction are as important or more important to life and natural-science oriented students than pay level and prestige.

Banken (2013) sought to understand student perceptions of landscape architecture as a career to increase enrollment in a degree program. They found that 34% of students had discovered landscape architecture as a career through their own independent research, indicating that landscape architecture maintains a robust web presence. Additionally, 34% of students discovered the profession through family and friends (word-of-mouth recommendations), indicating the profession's public image directly affects recruitment into the profession. We assumed that students do not know what urban forestry is, so we are unable to ask them how they discovered urban forestry as a career. However, we are examining the importance of several aspects of the student's family's perceptions of careers on student career choice.

Mukattash et al. (2015) sought to understand Jordanian student perceptions of pharmacology as a career path to ensure the profession continues to result in high rates of student satisfaction while facing new challenges as a result of rapid expansion and increasing diversity. They found that many students were pursuing pharmacology as a 'plan B' only after failing to get into medical school and overall these pharmacology students ranked 'medicine' above 'pharmacy' as a career. Despite this, students were still satisfied with their second choice and had a positive career outlook, as pharmacology still boasts high prestige and positive public

image overall. However, the authors note that this ‘pharmacology - plan B’ phenomenon is prevalent in other Middle Eastern countries, and even a study in the U.K. found that 25% of pharmacology students did not select pharmacology as their first choice. The authors noted this as a potentially significant problem to the profession moving forward, possibly affecting recruitment, job satisfaction of practitioners, or competency of practitioners. These are things that affect and are in turn affected by public image.

Marketing towards potential recruits (pre-college students) is represented in Figure 2.1 as ‘Recruitment’ and takes on a different form in every profession. Universities often engage in recruitment themselves, as may local/regional chapters of professional societies, but the professional society often plays a large role by creating materials and literature (Banken, 2013; Lent, 2015; Roach, 2015; Skiera, 2016). The ASLA operates a part of its website devoted to ‘career discovery’ hoping to gain the interest of pre-college students. The American Society of Civil Engineers (ASCE) reaches out to pre-college students through similar means and provides resources for teachers and professional engineers to spark interest in K-12 students in their local area.

Professional societies even target students with marketing initiatives even after they have chosen a university degree program. Biggers et al. (2008) examined why a concerning number of students were dropping out of a computer science degree program after freshman year, showing how other professions pay attention to the pipeline of professionals through college and even beyond. Many landscape architecture programs have ‘professional practice courses’ that educate students on topics such as professional licensure (mandatory certification), professional membership and service, starting a private practice, and other topics about working in the industry (Lent, 2015). The intent is to cultivate a relationship early between students and the

professional society. The American Planning Association (APA) offers a Five-Year Early Career Membership Program to help students integrate into the industry upon graduation and build their professional network (Roach, 2015), showing how a comprehensive approach includes delivering the student from college to the member-serving society.

2.2.6 Active Recruitment into Urban Forestry

There is no national, coordinated recruitment strategy for urban forestry. The ISA encourages local chapters to actively recruit by reaching out to students in area schools (Skiera, 2016). Typical programs include kids tree climbing events at ISA-sanctioned tree climbing championship events, tree-planting events associated with Arbor Day, and cooperative programs with the Future Farmers of America (Skiera, 2016). Urban forestry educators are not organized into any kind of cohesive group, either through the ISA or the SAF which offers accreditation of urban forestry degree programs by two means. Thus, it is unknown how individual degree programs recruit, if they do.

The same two issues that urban foresters report cause them frustration as practitioners are challenges to recruiting into urban forestry (O'Herrin et al., 2014, 2015; O'Herrin et al., 2016). The first is poor name recognition and a lack of awareness of urban forestry. Additionally, urban foresters have trouble agreeing on a definition of urban forestry amongst themselves, so communicating why someone should pursue it as a career can be difficult. Both are issues of professional identity and may deter potential recruits as both suggest urban forestry is not a cohesive profession with clear opportunities for advancement.

Arboriculture and urban forestry practitioners are not diverse relative to the U.S. population (Kuhns et al., 2002, 2004; Howden and Meyer, 2011; Humes et al., 2011), and

especially relative to the urban areas that the profession focuses on. There are numerous benefits of a culturally diverse and culturally competent workforce, such as better-tailored service, that urban forestry may be missing (Cohen et al., 2002; Herring, 2009). Traditional forestry is also not diverse relative to the U.S. population or compared to other natural resource disciplines (Howden and Meyer, 2011; Humes et al., 2011; Sharik et al., 2015). Historically, urban forestry emerged as a profession and degree program from traditional forestry (Jorgensen, 1967, 1993; Kenney, 2010). The two have often shared resources and degree accreditation by the Society of American foresters (Society of American Foresters, 2016), and thus likely shared in recruitment. This close association with traditional forestry, with connotations of rural living, and even the use of the word ‘forestry’ in the name urban forestry may deter potential non-white and/or female recruits.

Sharik et al. (2015) listed a concern that traditional forestry does not represent the gender and ethnic/racial diversity of the broader population as one reason to study enrollment trends. Previously, Sharik and Frisk (2011) had examined student motivations for pursuing careers in traditional forestry, resulting in valuable insights into strengths and weaknesses of forestry as a career as perceived by students. However, that study only surveyed current students representing the limited diversity in traditional forestry, thus offering little new insight into motivations of non-white students.

Agronomy has similarly been challenged by achieving diversity in the workforce. Talbert and Larke (1995) found that minority students pursuing education in agriculture were from non-rural and non-farm backgrounds and perceived major barriers to entry including lack of non-white role models and persistent, historical connotations between agriculture and slavery. They recommended K-12 education about food and agriculture science to initiate students and garner

interest before entering college. The authors also suggested that recruitment efforts emphasizing non-traditional topics such as ecology and urban horticulture may be effective for enticing non-white students. Vincent (2012) also studied why non-white students pursue education and careers in agriculture and cited three types of barriers: personal interest, family support, and structural inducements (e.g., connection to a professional in the field). Wiley (1997) conducted an educational workshop on food and agriculture science for high-achieving minority high school students and found it positively influenced their perceptions of agriculture as a career.

Outley (2008) surveyed college students who identified as a minority enrolled in agriculture or natural resources programs to determine factors influencing their career choice and their perceptions of agriculture and natural resources as a career choice. They found that major influences were the participants' family (specifically their mother), knowing a professional in the field, and personal interest/concern for the environment. Perceptions included positive career outlook, positive previous experiences related to careers in the field, and previous jobs/internships in the field.

2.2.7 Accreditation of Degree Programs

The professional society is the steward of the Body of Knowledge (BoK) which is the essence of a profession (Brauer, 2011). The BoK is a living document that represents the most recent, best understanding of the knowledge required to be a professional in each discipline. It may be used to form the foundation of professional certification, align curricula with practice, and inform degree accreditation standards. The professional society facilitates regularly updating the BoK, which demarcates the boundaries of professional knowledge (Brauer, 2011).

Accreditation of university degree programs itself is a communication tool used to inform students about universities that have passed minimum standards of quality set by the profession (Bollag, 2005; Clarke and Prichard, 2012; Gaston, 2014). The content of accreditation standards is often based on a BoK, though it may have a different name (Planning Accreditation Board, 2006; Patil and Codner, 2007). Employers seeking to fill entry-level positions may utilize degree accreditation as a minimum requirement because a student who has graduated from an accredited program meets some minimum level of competency (Kavanagh and Drennan, 2008; Vlasses et al., 2013). This is commonly seen in traditional forestry positions at all levels, which often require an individual's degree to be accredited by the Society of American Foresters. Accreditation may be managed by a separate organization from the professional society, such as the Planning Accreditation Board, which is affiliated with, but separate from, the APA (Planning Accreditation Board, 2006; Roach, 2015). Despite this, the relationship between the two must be strong since they seek to serve the same individuals, and certification often requires an accredited degree.

2.2.8 Accreditation of Urban Forestry Degree Programs

Urban forestry degree programs may currently acquire accreditation through the Society of American Foresters through two possible categories – an emphasis within traditional forestry, or a specialized urban forestry category (Society of American Foresters, 2013). Even the latter still relies heavily on traditional forestry curricula, which has proven to be a formidable obstacle to degree programs without access to those traditional forestry course offerings. There is no literature examining accreditation of urban forestry degree programs. Bullard (2015) provides an example of how to realign the curricula of one traditional forestry degree program to match what society currently needs and desires from foresters within the confines of Society of American

Foresters accreditation standards. They also made evidence-based recommendations to improve those standards.

Since the specialized urban forestry accreditation was first offered in 2007, only two programs have achieved this recognition. This probably speaks more to the dearth of urban forestry degree programs in the U.S.A. than anything about the new urban forestry-specific accreditation. In 2014, the University of Nebraska and the Nebraska Forest Service partnered on a grant from the National Urban and Community Forestry Council to develop an urban forestry degree program at that university. In reviewing the location and nature of competing urban forestry degree programs in the United States, they found six ‘leading’ programs and seven programs with lower enrollment (UN-Lincoln, 2015). Our own review recently found 10 degree programs advertising a bachelor’s of science in urban forestry online, in addition to the proposed program at University of Nebraska – Lincoln. Although accreditation is an important professional support mechanism seen in other professions, including the allied professions, we do not not directly examine accreditation of degree programs, curricula, or degree programs themselves.

2.2.9 Certification of Practitioners

Whereas accreditation is the quality assurance of degree programs, certification is the quality assurance of individuals and can also be thought of as a communication tool informing public, peer, and employer that the credential holders has passed minimum standards of competency (Hale, 2000; Adams et al., 2004). Bruce et al. (2012) found that, for interior designers working for non-interior design firms, holding the National Council for Interior Design Qualification certificate resulted in increased promotions, responsibilities, and prestige. The authors concluded that the certificate communicated to non-interior designers that the certificate

holder took their profession seriously and were in good standing with other professionals in their field.

Content of certification examinations is usually based on a BoK, thereby aligning university curricula and workforce realities (Brauer, 2011). Certification of individuals conveys professionalism to those who set policy and budgets, both the professionalism of individuals and of the profession itself. Certification is very common among many different professions, though it is not required for an occupation to be considered a profession (Bayles, 2003). Certification may also serve as a minimum qualification for hiring decisions – an individual who is certified meets some minimum level of competency (Hale, 2000; Brauer, 2011; Brauer and Lewis, 2013; Brauer, 2015). Certification and licensure (mandatory certification) also protect professionals and professions through preservation of reputation by providing the public a means to distinguish imposters from qualified professionals (regulation).

Certification is often administered by a professional society. The message conveying the importance of certification is directed at both employers and employees. For example, the American Institute of Certified Planners designation is the primary certification used by planners and is frequently listed as a preferred requirement on job postings (Roach, 2015). Marketing of certification is very important because certification is a voluntary process. The ASLA markets their certification to potential participants even though it is required for many aspects of professional practice (Lent, 2015).

2.2.10 Certification of Urban Forestry Practitioners

Urban foresters currently rely heavily on the expansive ISA Certified Arborist family of certifications, which certify competency in arboriculture and its specializations. There are almost

2,000 individuals globally who hold the Certified Arborist Municipal Specialist certification and 5,000 ISA members who primarily identify as urban foresters (Skiera, 2016). Arboriculture is an important component of urban forestry; however, these certifications were developed to certify competency in arboriculture, not urban forestry. And a delimitation of this study is that urban forestry is a profession discrete from all others.

We do not examine certification in urban forestry directly. However, we do consider it to be a very important professional support mechanism as a BoK and associated certification is how modern professions establish professional identity – something lacking in urban forestry. So, certification in urban forestry is included in our survey of allied professions regarding how they perceive professionalism in urban forestry.

2.3 Social Capital Theory

Social Capital Theory (SCT) provides a theoretical framework that allows us to examine usage of these professional support mechanisms in the allied professions and how those professionals perceive professionalism of urban forestry (Bourdieu, 1986; Coleman, 1988; Burt, 1993; Putnam, 2001; Putnam and Feldstein, 2003; Tzanakis, 2013). Social capital is the relationships, ties, and/or bonds between people and can be an asset to community-building. Formulations of theories on social capital date back to the 1980s but the most notable, current proponent of social capital is R.D. Putnam, whose psycho-social approach is an excellent fit for social science research attempting to quantify intangible concepts using constructs (intangible concepts) (Bourdieu, 1986; Coleman, 1988; Burt, 1993; Putnam, 2001; Putnam and Feldstein, 2003; Tzanakis, 2013).

Our application of Putnam's theory uses the constructs of social norms, trust, and reciprocity (information sharing) to understand a group. A 'group' in SCT works together toward a shared goal, which in this case would be the allied professions working together to plan and manage the urban environment. Norms are the accepted behaviors and expectations of others within a group and are represented by professional support mechanisms. Reciprocity is interactions between individuals within a group and is represented by sharing of information. Trust is established when others meet the cultural expectations of a group and streamlines transactions between individuals. It is the most difficult to measure and we only examine how trustworthy respondents believe their coworkers to be. Examining these three constructs may reveal how well the allied professions function as a 'group' and how norms (professional support mechanisms), reciprocity, and trust contribute to this. This may reveal obstacles to the creation of social capital between urban foresters and the allied professions, as well as highlighting the potential value of professional support mechanisms, such as certification, to urban forestry.

2.4 Social Cognitive Career Theory

Social Cognitive Career Theory (SCCT) provides a framework to examine how students perceive urban forestry as a career path. SCCT is one of the most comprehensive theories attempting to explain or predict career choice, and its utility in such analyses is well documented (Lent et al., 1994; Lent et al., 2000; Lent and Brown, 2006; Lent et al., 2008). SCCT is a complex model that operationalizes how an individual chooses a career, and suggests that individuals make this choice based on their perceived self-efficacy, outcome expectations, and personal goals (Lent et al., 1994, Leung 2008). Self-efficacy is the belief of one's own abilities to succeed. Outcome expectations is what an individual can expect the outcome to be from

associated behaviors. Personal goals provide the determination to engage in an activity or to produce a particular outcome.

Self-efficacy, outcome expectations, and goals are the result of an individual’s life experiences and background (Figure 2.2). In the upper left corner of the model is the Person Inputs including endowed/inherited traits such as race and gender, as well as physical abilities or limitations. In the lower left corner of the model is Background Contextual Affordances such as socioeconomic status, job and training opportunities, neighborhood and community influences, family values and expectations, availability of role models, etc. These two items, Person Inputs and Background Contextual Affordances, are the starting point of this model and have a huge impact on the Learning Experiences of an individual. Learning Experiences are the positive or negative emotional reactions an individual develops about a profession in the context of career choice.

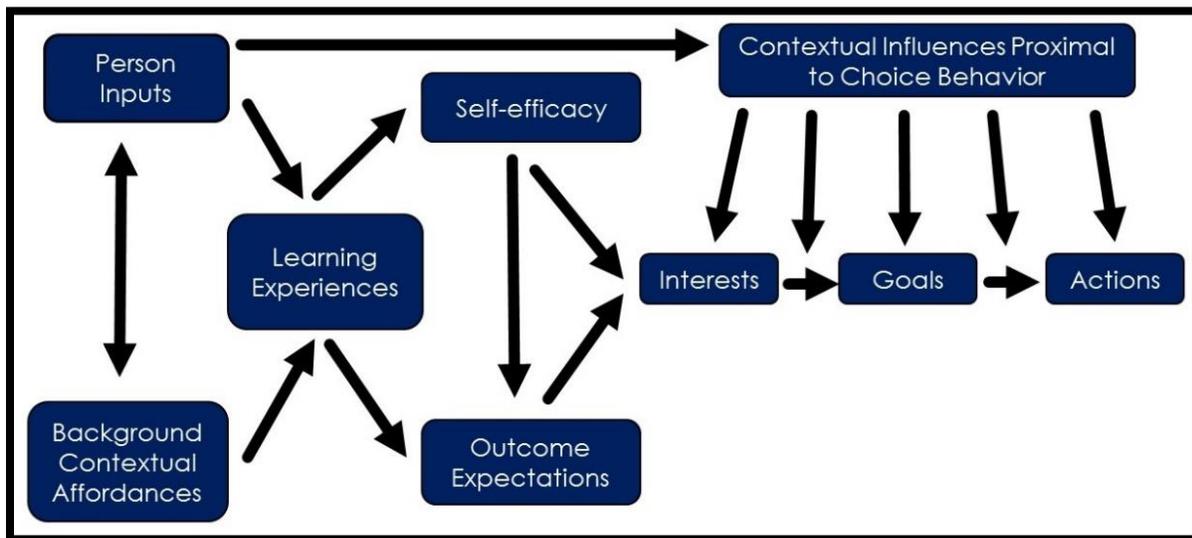


Figure 2.2: Flow chart depicting Social Cognitive Career Theory. Urban forestry has low name recognition and we assume students have never heard it. Thus, we will not pursue this model beyond Learning Experiences.

However, before any conscious choice ever enters the model, Learning Experiences play a critical role in how an individual subconsciously perceives a career path. This impression of a career path and what influences that impression is where a profession can hold the greatest influence, because this represents the first interaction between a career/profession and the individual. In this study, we assume that most students have never been exposed to urban forestry as a career and thus have no impression of it, so we pursue the model no further past Learning Experiences. Instead, we ask students what their previous knowledge of urban forestry was and were then shown a short video discussing urban forestry careers and ask them to answer questions to assess their new impression of urban forestry as a career. This allows us to overcome the poor public recognition of urban forestry to assess the profession for potential deterrents to improved recruitment.

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3.0 – PROFESSIONALISM IN URBAN FORESTRY AS PERCEIVED BY ALLIED PROFESSIONS

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3.1 Abstract

The allied professions of civil engineering, landscape architecture, and urban planning have been collaborating to manage the urban environment since the City Beautiful movement of the 1890s and today hold significant influence over urban forest management decisions. Urban foresters anecdotally report occasional difficulty influencing and integrating into this group. We conducted a survey of these professionals to determine how they use professional support mechanisms (e.g., certification, accreditation) and how they perceive urban forestry as a profession. Our data indicate that the allied professions are a cohesive group in the context of Social Capital Theory as they frequently collaborate toward a shared goal. We found no significant differences in their use of the constructs that contribute to creation of social capital (e.g., professional support mechanisms, information sharing, or trust of each other). They believe that use of professional support mechanisms lends credibility to a profession and they see these as prevalent in their own professions. However, they see these mechanisms as significantly less prevalent among urban foresters, with whom they work less often than any other profession we inquired about. They view urban forestry as important to managing the urban environment, but are inconsistently familiar with urban foresters and view the profession as lacking in structure and organization. Improving the formal structure and organization of urban forestry would likely increase social capital among urban foresters with these allied professionals, thereby increasing influence over management of the urban forest. This would also likely result in direct benefits to practicing urban foresters.

3.2 Introduction

While the practice of managing trees in and near human settlements has been around for most of human history, urban forestry only began organizing as a profession, discrete from arboriculture or traditional forestry, in the mid-1960s (Jorgensen, 1967, 1993; Miller et al., 2015). Urban forestry is thus a new profession compared to others that impact the urban environment such as civil engineering, landscape architecture, and urban planning (hereafter referred to as the ‘allied professions’). We call these professions ‘allied’ because, aside from arboriculture, they are the professions that urban foresters anecdotally report they most commonly work with and whom collaborate to manage the urban environment. They are also the professions that have the largest potential impact on urban trees and other urban natural resources, often unknowingly or inadvertently. However, urban foresters today report that their job skills and responsibilities are often poorly understood by these colleagues and that their profession is not well respected (O’Herrin et al., 2014, 2015; O’Herrin et al., 2016). How allied professionals perceive urban forestry as a profession likely influences acceptance of urban foresters in collaborative decision-making, resulting in significant effects on urban forest management.

The allied professions have been working together for over 100 years in the U.S. to create and manage the space where people live and work in the urban environment. This union was a direct result of the City Beautiful movement of the 1890s and 1900s, which sought to improve the quality of life in cities through increased planning and management of urban parks and greenspaces in the wake of post-Civil War urbanization and industrial expansion of American cities (Rose, 1996; Hopper, 2000; Wisely, 2002; McKinney, 2010; Jernigan, 2013; Campbell, 2015). Like the allied professions, urban forestry requires extensive education and training of a

significantly intellectual nature and provides a needed service to society, criteria commonly used to describe professions (Bayles, 2003; Day et al., 2016). However, urban forestry does not demonstrate the same level of support for its professionals as occurs in the allied professions.

The three allied professions emerged initially by branching off from existing professions. A new profession, discrete from the first, was created through processes or functions that advanced the profession, which we will refer to as professional support mechanisms. Professional support mechanisms can also be a tangible manifestation of professional regulation—the act of controlling who may identify as a particular type of professional. Together, professional regulation and support mechanisms provide structure and are as old as the idea of ‘professions.’ Self-regulation is common among professions based on the rationale that, due to the specialized knowledge necessitating the existence of the profession in the first-place, only a professional in a given discipline is truly able to determine the competency of another professional in that same discipline. Modern professional support mechanisms are both a product and a tool of accountability and are therefore powerful tools of communication (Brauer, 2011). We suspect that use of professional support mechanisms has helped build substantial social capital among the allied professions.

Social capital is the relationships, ties, and/or bonds between people and can be an asset to community-building (Bourdieu, 1986; Burt, 1993; Coleman, 1988; Putnam, 2001). Social Capital Theory (SCT) provides a framework to examine use of professional support mechanisms in the allied professions and how that use contributes to building social capital. Formulations of theories on social capital date back to the 1980s, but the psycho-social approach of R.D. Putnam is an excellent fit for social science research attempting to quantify intangible concepts using

constructs (Bourdieu, 1986; Coleman, 1988; Burt, 1993; Putnam, 2001; Putnam and Feldstein, 2003; Tzanakis, 2013).

This application of Putnam's version of SCT will use the constructs of social norms, trust, and reciprocity (information sharing) to understand a group. Norms are the accepted behaviors and expectations of others within a group and are represented by professional support mechanisms. Reciprocity is interactions between individuals within a group and is represented by sharing of information. Trust is established when others meet the cultural expectations of a group and streamlines transactions between individuals. It is the most difficult to measure and we will only examine how trustworthy respondents believe their coworkers to be. We are primarily concerned with how professional support mechanisms contribute to social capital between the allied professions, and the differences between those professions and urban forestry. This may reveal obstacles to the creation of social capital between urban foresters and the allied professions.

Determining if use of professional support mechanisms is consistent across the three allied professions could provide valuable guidance to urban forestry as it seeks to mature as a profession. Furthermore, uncovering disparities in professional support mechanisms may reveal obstacles to creating social capital between urban foresters and the allied professions. We conducted a web-based survey of allied professionals across the United States who plan and manage the urban environment to assess the structure of this group according to the Social Capital Theory constructs of social norms (professional support mechanisms), mutual trust, and reciprocity (sharing of information) (Putnam, 2001; Putnam and Feldstein, 2003). We were primarily interested in professional support mechanisms as the most tangible of these three concepts as this approach would be most likely to result in evidence-based recommendations on

adopting similar support mechanisms to improve the profession of urban forestry which could be implemented quickly.

Our research questions were: 1) Do civil engineers, landscape architects, and urban planners constitute a group in the context of Social Capital Theory as determined by social norms (usage of professional support mechanisms), mutual trust, and reciprocity (sharing of information). 2) If they do constitute a group, do they perceive urban foresters to be separate from that group as determined by perceptions of urban forestry as a profession (e.g., prevalence of norms compared against their own usage of norms). 3) If they do constitute a group, does their behavior (sharing information and trusting each other) indicate that urban forestry is on the periphery or included.

To understand how allied professions currently use professional support mechanisms, we performed a review of the professional support mechanisms offered today by the leading professional societies in the U.S. for the allied professions: the American Society of Civil Engineers, the American Society of Landscape Architects, and the American Planning Association. Details were confirmed through interviews with professional society employees (Lent, 2015; Roach, 2015). We also reviewed the limited amount of literature that specifically addresses the structure of modern professions (Freidson, 1994; Hale, 2000; Weeden, 2002; Bayles, 2003; Evetts, 2003; Brauer, 2011; Brauer, 2015; Tschirhart et al., 2012). This review revealed the following professional support mechanisms to be typical:

- active management of the public image of the profession (McClendon et al., 2003; American Society of Landscape Architects, 2007; Banken, 2013);

- active recruitment into the profession (Banken, 2013; American Society of Civil Engineers 2016),
- accreditation of professional degree programs (Gazvoda, 2002; Kelly, 2007; Sweet and Etienne, 2011),
- certification/licensure of practitioners (Bayles, 2003; Adams et al., 2004; Kelly, 2007; Brauer and Lewis, 2013),
- monitoring of workforce conditions and employment trends (Luker and Lyons, 1997; Mills and Treagust, 2003).

3.3 Methods

A web-based survey was distributed through professional societies (member-serving organizations), non-profit organizations, and private companies from February 1 to March 15, 2016. As organizations (Appendix A) were hesitant to distribute their membership lists, emails were distributed by those organizations directly to their members on our behalf; therefore, a response rate cannot be calculated. A recruitment letter was provided to the participating organizations asking for participation from professionals who ‘regularly collaborate to plan and manage the environment in towns and cities, including urban planners, landscape architects, civil engineers, and many other professionals.’

3.3.1 Construction of Survey Instrument

The survey instrument consisted of 111 questions, almost all of which were 5-point Likert scale questions ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Respondents self-reported their current profession, education, and the nature of their workplace/employer (e.g., government, non-profit, private) so that we could understand and describe typical members of the three allied professions (hereafter referred to as the ‘Group’). Respondents were asked

how familiar they were with their own profession as well as with urban forestry. They were also asked questions to determine their opinion (favorability) of their own profession as well as urban forestry.

Describing the Group. Social Capital Theory (SCT) is a pliable theory (Inkpen and Tsang, 2005; Chow and Chan, 2008; Billett, 2011); therefore, we adopted a SCT framework aimed at understanding and describing the Group as defined by three constructs: social norms, reciprocity (sharing of information), and mutual trust (Putnam, 2001; Putnam and Feldstein, 2003; Billett, 2011). Understanding the Group according to these three constructs lends context to their perceptions of urban forestry as a profession.

Norms. Norms are the accepted behaviors and expectations of others within a group and were separated into two categories. First, *professional support mechanisms* are functions or processes that support individuals within a profession (e.g., certification of individuals). Second, *attributes of a profession* are subjective qualities (less tangible than support mechanisms) associated with a profession (e.g., prestige, job satisfaction, the work is meaningful). Norms were presented in three separate contexts. First, respondents were asked their opinion on how much credibility these norms lend to a profession in abstract (any profession). Then they were asked how prevalent these norms were in their own profession as well as urban forestry.

Reciprocity. Reciprocity is interactions between individuals within a group and was determined by two series of questions. The first series asked respondents how often they worked with other types of professionals when planning and managing the urban environment. The second series asked respondents about sharing general information and specific information.

Trust. Trust is established when others meet the cultural expectations of a group; while trust streamlines transactions between individuals, it can be very difficult to measure. We were interested in gaining only a general sense of the level of trust present in the Group, which was determined by asking respondents about how they perceive the behavior of the colleagues they work with when planning and managing the urban environment.

3.3.2 Pilot Testing of Survey Instrument

National leaders in civil engineering, landscape architecture, and urban planning were consulted to ensure language (e.g., word choice) used to describe technical matters in the survey was clear and unlikely to create a bias. Then the survey was pilot-tested with approximately 40 allied professionals in December 2015. Respondents were asked for feedback regarding ease of use and general impression. The survey was reduced from 145 questions to 111 questions based on that feedback. The results were analyzed for internal consistency of 13 latent constructs (Table 3.1) representing norms, trust, and reciprocity with the use of Chronbach's alpha. The internal consistency results were acceptable with almost all Chronbach's alpha scores above 0.800, so only 6 of the 111 questions were modified slightly.

3.3.3 Analysis of Survey Data

We first used descriptive statistics to characterize four types of professionals: civil engineers, landscape architects, urban planners—previously referred to as the Group—and all other professionals. As we were interested in exploring and describing the core membership of the allied professionals established during the City Beautiful movement, these 'other' professionals were excluded from further analysis of the Group.

Table 3.1: Chronbach’s alpha, mean score, and variance of 13 constructs created from survey questions and used in analysis of data from a survey of perceived professionalism in urban forestry. Also included is a description of the construct and number of questions comprising each construct in parentheses. Scale 1 to 5 from least (1) to most (5). Only Group members are represented here (civil engineers, landscape architects, and urban planners), not all respondents.

Construct Name	Construct Description	Chronbach’s Alpha	Construct Mean	Construct Variance
Familiarity own	Familiarity with own profession (5)	0.736	4.60	0.55
Familiarity UF	Familiarity with Urban Forestry (5)	0.811	3.31	0.98
Favorability own	Favorability of own profession (5)	0.886	4.78	0.45
Favorability UF	Favorability of Urban Forestry (5)	0.916	4.55	0.66
Professional Support Mechanisms Abstract	Perceived credibility of professional support mechanisms in abstract (10)	0.839	4.31	0.53
Professional Support Mechanisms Own	Perceived prevalence of professional support mechanisms in own profession (10)	0.834	4.35	0.54
Professional Support Mechanisms UF	Perceived prevalence of professional support mechanisms in Urban Forestry (10)	0.926	3.31	0.58
Attributes of a Profession Abstract	Perceived credibility of attributes of a profession in abstract (9)	0.858	4.31	0.51
Attributes of a Profession Own	Perceived prevalence of attributes of a profession in own profession (9)	0.891	4.27	0.55
Attributes of a Profession UF	Perceived prevalence of attributes of a profession in Urban Forestry (9)	0.888	3.87	0.61
Reciprocity 1	Perceived frequency of sharing general information (3)	0.818	3.05	0.98
Reciprocity 2	Perceived frequency of sharing specific information (2)	0.758	4.27	0.68
Trust	Perceived trustworthiness of colleagues (6)	0.947	4.31	0.67

We again examined the internal consistency of the 13 latent constructs using Chronbach’s alpha. We then compared the mean scores of those constructs for each profession in the Group against each other using ANOVA and found no significant differences at $p < .05$. We therefore consolidated scores from the three constituent professions to describe one single core allied professionals group in the context of SCT. Construct scores were checked for normality, and where kurtosis was over 3.0 or skewness was over 2.0, we applied both parametric and non-parametric statistical analyses. In all cases, these tests agreed with each other. However, wherever kurtosis was over 3.0 the Wilcoxon Signed-Ranks test was used in place of paired

samples t-test and the one-sample Kolmogorov-Smirnov test was used in place of one-sample t-tests.

We checked correlation of the 13 constructs against each other using Spearman's rho. The different contexts of norms (e.g., opinion of norms in abstract compared *against* opinion of norms in urban forestry) were evaluated using paired t-tests. Additionally, we evaluated opinion of norms in abstract against a neutral opinion (score 3 on scale 1 to 5) using 1-sample t-tests. All analyses were performed using SPSS Statistics 23 (IBM Corp, Armonk, NY).

3.4 Results

There were 101 usable surveys returned, including 15 partially incomplete. A response rate could not be calculated as it was unknown how many individuals were sent emails that included the link or saw posts on social media promoting the survey.

3.4.1 Descriptive Statistics

Respondents self-reported into categories of professional affiliation fairly evenly across the core allied professionals group, which combined accounted for 83% of all respondents (Table 3.2). The majority of respondents in the 'other professionals' group were either arborists, natural resource managers, or ecologists. The most common work setting was government, accounting for two-thirds of all respondents.

Only 4% of respondents reported their highest level of education was below a bachelor's degree; over half of respondents had a master's/professional degree or higher. Only one individual who identified as an engineer did not have at least one degree in engineering. Similarly, only two landscape architects did not have at least one degree in landscape architecture. By contrast, 63% of those who identified as urban planners did not have any degree

in urban planning, including two individuals whose highest level of education was less than a bachelor's degree. This was significantly different than civil engineering and landscape architecture ($p < .001$). The degrees held by planners varied widely from history to biochemistry. All but one of the 17 respondents who self-reported as 'other professionals' had at least a bachelor's degree; those degrees varied as widely as the degrees held by the urban planners.

Table 3.2: Highest level of education achieved and type of employer overall and by profession for all respondents to a survey of perceived professionalism in urban forestry.

	Overall	Civil Engineers	Landscape Architects	Urban Planners	Other Professionals
Respondents (n)	101	29	30	25	17
Highest Level of Education	%	%	%	%	%
Less than Bachelor's Degree	4	0	0	11	7
Bachelor's Degree	43	42	63	32	21
Master's/Professional Degree	45	54	30	42	64
Beyond Master's/Professional Degree	8	4	7	15	8
Employer Type	%	%	%	%	%
Municipal Government	35	35	26	48	36
County Government	16	12	19	21	14
State Government	8	12	4	0	22
Federal Government	1	0	0	5	0
Other Government	6	6	0	5	14
Private	2	7	30	16	0
Non-Profit	11	12	0	0	0
Educational Institution	16	12	11	5	14
Other	5	4	10	0	0

3.4.2 Social Capital Between Allied Professions

There were no significant differences between civil engineers, landscape architects, and urban planners on all 13 latent constructs. These members of the core allied professionals group (the 'Group') work with each other frequently and work with urban foresters least frequently (Table 3.3). Additionally, the Group had a rudimentary understanding of urban forestry (Table

3.4). Group members were significantly less familiar with urban forestry than their own profession; $t(77)=12.60$, $p < .001$. However, their level of familiarity was statistically different than a neutral score ($p < .001$). Respondent familiarity with urban forestry was significantly correlated with several other constructs, but the highest correlation was with familiarity with one's own profession ($\rho=.456$, $p < .001$).

Table 3.3: Frequency that allied professionals (civil engineers, landscape architects, and urban planners) work with other professionals, overall and by profession. Scale 1 to 5 from very infrequently (1) to very frequently (5). Data from a survey of perceived professionalism in urban forestry.

	Allied Group	Civil Engineers	Landscape Architects	Urban Planners
Respondents (n)	84	29	30	25
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Project Managers	4.40 (0.66)	4.48 (0.64)	4.44 (0.64)	4.21 (0.71)
Own profession	4.37 (0.68)	4.52 (0.51)	4.22 (0.80)	4.37 (0.68)
Civil Engineers	4.18 (0.82)	4.56 (0.58)	4.07 (0.78)	3.79 (0.98)
Urban Planners	3.86 (1.02)	3.56 (1.12)	3.81 (1.00)	4.37 (0.68)
Landscape Architects	3.85 (0.95)	3.89 (0.70)	4.11 (0.97)	3.42 (1.12)
Private Developers	3.70 (1.08)	3.67 (1.18)	3.48 (1.09)	4.05 (0.85)
Building Inspectors	3.60 (1.14)	3.48 (1.05)	3.81 (0.96)	3.47 (1.47)
Private Builders	3.52 (1.06)	3.41 (1.01)	3.48 (1.05)	3.74 (1.15)
Urban Foresters	3.01 (1.25)	3.11 (1.16)	3.11 (1.34)	2.74 (1.28)

Table 3.4: Familiarity with and favorability of both own profession and urban forestry as reported by Group members. Scale 1 to 5 from strongly disagree (1) to strongly agree (5). Only Group members are represented here (civil engineers, landscape architects, and urban planners), not all respondents. Data from a survey of perceived professionalism in urban forestry.

	Familiarity with Own Profession	Familiarity with Urban Forestry	Favorability of Own Profession	Favorability of Urban Forestry	Difference between Favorability of Own Profession and Urban Forestry
Mean Construct Score (n=77)	4.60*	3.31*	4.78*	4.55*	
Chronbach's Alpha level of construct	0.736	0.811	0.890	0.916	
Items of Construct (n=77)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	
I have worked with others in the profession	4.82 (0.54)	4.10 (1.16)			
I have a strong understanding of the profession	4.71 (0.70)	3.06 (1.35)			
I have a basic understanding of the profession	4.67 (0.91)	4.10 (1.05)			
I currently work with someone who is in the profession	4.57 (0.92)	2.97 (1.64)			
I have an expert understanding of the profession	4.24 (0.91)	2.31 (1.31)			
The profession has something to contribute to the management of the urban environment			4.85 (0.48)	4.59 (0.78)	0.26**
The profession is important to managing the urban environment			4.82 (0.52)	4.51 (0.86)	0.31**
The profession is important			4.81 (0.53)	4.47 (0.85)	0.34**
The professionals possess specialized knowledge			4.75 (0.60)	4.64 (0.60)	0.11
The professionals possess specialized skills			4.69 (0.58)	4.51 (0.72)	0.18

* indicates significantly different than neutral score (3, scale 1 to 5) at $\alpha < .05$

** indicates significantly different at $\alpha < .05$

The Group viewed urban forestry as important to the management of the urban environment, but also viewed urban forestry as lacking credibility or professionalism compared to respondents' own profession; $t(77)=5.20$, $p <.001$. Respondent favorability of urban forestry was significantly correlated with many other constructs, but the highest correlations were with perceived prevalence of positive attributes of a profession within urban forestry ($\rho=.593$, $p <.001$), perceived prevalence of professional support mechanisms within urban forestry ($\rho=.426$, $p <.001$), and opinion of one's own profession ($\rho=.493$, $p <.001$).

Norms. The Group perceived professional support mechanisms (Table 3.5) as lending a significant amount of credibility to a profession in abstract at 4.31 (scale 1 to 5, $t(83)=22.60$, $p <.001$) and perceived these support mechanisms to be quite prevalent in their own professions at 4.36 with no significant difference between the two ($Z(84)= -1.204$, $p=.228$). However, the Group perceived that support mechanisms were significantly more prevalent in their own professions than in urban forestry ($Z(74)= -7.044$, $p <.001$). With that said, the Group perceived urban forestry as possessing some degree of professional support mechanisms, as evidenced by the construct score of 3.31, which significantly differed from the neutral position. Looking at constituents of the construct, paired samples t-tests revealed a significant difference between the mean score for one's own profession and urban forestry for each of the ten questions. In all cases, prevalence was perceived to be lower in urban forestry than in one's own profession. The greatest difference in mean perception scores was prevalence of licenses or credentials, awards and recognition, and continuing education.

Table 3.5: Norms - Perceived credibility and prevalence of professional support mechanisms as reported by Group members. Scale 1 to 5 from low credibility or low prevalence (1) to high credibility or high prevalence (5). Only Group members are represented here (civil engineers, landscape architects, and urban planners), not all respondents. Data from a survey of perceived professionalism in urban forestry.

	Credibility in Abstract	Perceived Prevalence in Own Profession	Perceived Prevalence in Urban Forestry	Difference between Perceived Prevalence in Own Profession and Urban Forestry
Mean Construct Score (n=77)	4.31*	4.36*	3.31*	
Multiple comparisons of means ($\alpha=.05$)	A	A	B	
Chronbach's Alpha level of construct	0.839	0.834	0.926	
Items of Construct (n=77)	Mean (SD)	Mean (SD)	Mean (SD)	
Professional society offers continuing education	4.67 (0.63)	4.64 (0.65)	3.41 (0.76)	1.23**
Profession has an established body of knowledge that defines what it means to be competent in the profession	4.61 (0.62)	4.56 (0.72)	3.43 (0.77)	1.13**
Profession uses license or credentials for individuals in the profession	4.61 (0.76)	4.77 (0.68)	3.41 (0.89)	1.36**
Active and helpful professional society	4.56 (0.77)	4.44 (0.83)	3.39 (0.77)	1.05**
Professional society offers opportunities for professional mentoring and leadership	4.36 (0.82)	4.23 (0.92)	3.28 (0.69)	0.95**
Profession accredits university degree programs	4.30 (0.93)	4.50 (0.90)	3.12 (0.75)	1.07**
Professional society offers opportunities for awards and recognition	4.25 (0.88)	4.52 (0.70)	3.27 (0.66)	1.25**
Profession requires at least a bachelor's degree to be competent	4.12 (1.13)	4.24 (1.18)	3.39 (0.82)	0.85**
Profession has a respected scientific journal	3.98 (0.96)	4.01 (1.02)	3.31 (0.70)	0.70**
Profession has a clear career ladder	3.69 (0.97)	3.63 (1.11)	3.12 (0.68)	0.51**

* indicates significantly different than neutral score (3, scale 1 to 5) $\alpha<.05$

** indicates significantly different at $\alpha<.05$

Perceived prevalence of support mechanisms in one's own profession was most highly correlated with attributes of one's own profession ($\rho=.585$, $p<.001$), perceived credibility of support mechanisms in abstract ($\rho=.508$, $p<.001$), and opinion of one's own profession ($\rho=.453$, $p<.001$). Perceived prevalence of support mechanisms in urban forestry was most highly correlated with opinion of urban forestry ($\rho=.426$, $p<.001$), familiarity with urban forestry ($\rho=.408$, $p<.001$), and trust of one's colleagues ($\rho=.335$, $p=.002$).

The Group perceived that attributes of a profession (Table 3.6) lend credibility to a profession in abstract at 4.31 (scale 1 to 5, $t(83)=22.63$, $p<.001$). While the group perceived that these attributes were present in both their own professions and urban forestry, they thought the prevalence was greater in their own professions (4.27 vs. 3.87, $Z(78)= -5.857$, $p<.001$). Mean score for one's own profession and urban forestry differed significantly for each of the nine questions comprising these constructs. The greatest differences in mean scores were observed in level of job satisfaction, level of pay, and prestige or respect afforded the professions.

Table 3.6: Perceived credibility and prevalence of attributes of a profession as reported by Group members. Scale 1 to 5 from low credibility or low prevalence (1) to high credibility or high prevalence (5). Only Group members are represented here (civil engineers, landscape architects, and urban planners), not all respondents. Data from a survey of perceived professionalism in urban forestry.

	Credibility in Abstract	Prevalence in Own Profession	Prevalence in Urban Forestry	Difference between Perceived Prevalence in Own Profession and Urban Forestry
Mean Construct Score (n=77)	4.31*	4.27*	3.87*	
Multiple comparisons of means ($\alpha=.05$)	A	A	B	
Chronbach's Alpha level of construct	0.858	0.891	0.888	
Items of Construct (n=77)	Mean (SD)	Mean (SD)	Mean (SD)	
Profession does meaningful work	4.68 (0.60)	4.65 (0.65)	4.40 (0.84)	0.25**
Profession requires specialized knowledge	4.58 (0.68)	4.68 (0.56)	4.38 (0.86)	0.30**
Profession requires a mastery of skills	4.54 (0.70)	4.61 (0.58)	4.22 (0.82)	0.39**
Profession can present practitioners with new challenges	4.50 (0.69)	4.69 (0.56)	4.31 (0.87)	0.38**
Profession has practitioners that are passionate about their work	4.54 (0.74)	4.57 (0.77)	4.32 (0.85)	0.25**
Profession has a high level of job satisfaction	4.18 (0.79)	4.17 (0.82)	3.51 (0.82)	0.66**
Profession has a desirable work environment (e.g., independence, autonomy)	4.17 (0.79)	4.08 (0.85)	3.71 (0.87)	0.37**
Profession is prestigious or highly respected	4.06 (0.80)	3.60 (1.07)	3.13 (0.92)	0.47**
Profession is well-paid	3.58 (0.93)	3.40 (1.00)	2.83 (0.69)	0.57**

* indicates significantly different than neutral score (3, scale 1 to 5) $\alpha<.05$

** indicates significantly different at $\alpha<.05$

Attributes of one's own profession was most highly correlated with support mechanisms in one's own profession ($\rho=.585$, $p<.001$) and perceived credibility of attributes of a profession in abstract ($\rho=.565$, $p<.001$). Perceived prevalence of attributes of urban forestry was most highly correlated with opinion of urban forestry as a profession ($\rho=.593$, $p<.001$).

Reciprocity. Members of the Group indicated the frequency at which they shared general information with colleagues was intermediate (neither frequently nor infrequently); this construct was not significantly correlated with any other construct and was not significantly different from a neutral value of 3 on a scale 1 to 5 ($t(73)=0.397$, $p=.693$). On the other hand, the Group indicated they were asked to share specific information with colleagues in the workplace frequently ($t(72)=15.95$, $p<.001$). These two items are not mutually exclusive as seen in the constituent questions that were combined to create these constructs and their associated internal consistency score (Table 3.7). The sharing of specific information was most highly correlated with the perceived prevalence of attributes of professionalism in one's own profession ($\rho=.368$, $p<.001$).

Trust. Group members felt their colleagues were quite trustworthy (Table 3.8), with an overall construct score of 4.31 ($t(71)=16.47$, $p<.001$) and consistently high scores for all six constituent questions. The trust construct was most highly correlated with one's opinion of urban forestry as a profession ($\rho=.408$, $p<.001$), perceived prevalence of support mechanisms in urban forestry ($\rho=.335$, $p<.001$), and perceived prevalence of attributes of the urban forestry profession ($\rho=.285$, $p<.001$). There was no significant correlation between the trust construct and perceived credibility of support mechanisms or attributes of a profession in abstract.

Table 3.7: Frequency of sharing two types of information as reported by Group members. Scale 1 to 5 from very infrequently (1) to very frequently (5). Only Group members are represented here (civil engineers, landscape architects, and urban planners), not all respondents. Data from a survey of perceived professionalism in urban forestry.

	Sharing General Information	Sharing Specific Information
Mean Construct Score (n=77)	3.05	4.27*
Chronbach's Alpha level of construct	0.818	0.758
Constituent Questions of Construct (n=77)	Mean (SD)	Mean (SD)
I am asked to contribute information or perspective that could be known by someone in another profession	3.52 (0.96)	
I am asked to contribute information or perspective that is common knowledge	3.00 (1.26)	
I am asked to contribute information or perspective that could be contributed by almost anyone	2.62 (1.21)	
I am asked to contribute information or perspective that is specialized to my profession		4.40 (0.64)
I am asked to contribute information or perspective that a person could only have through experience or education in my profession		4.15 (0.88)

* indicates significantly different than neutral score (3, scale 1 to 5) $\alpha < .05$

Table 3.8: Trustworthiness of colleagues as reported by Group members. Scale 1 to 5 from strongly disagree (1) to strongly agree (5). Only Group members are represented here (civil engineers, landscape architects, and urban planners), not all respondents. Data from a survey of perceived professionalism in urban forestry.

	Trust of Colleagues
Mean Construct Score (n=77)	4.31*
Chronbach's Alpha level of construct	0.947
Constituent Questions of Construct (n=77)	Mean (SD)
My colleagues conduct themselves in an ethical manner	4.39 (0.87)
My colleagues are reliable	4.35 (0.70)
My colleagues can be trusted	4.35 (0.77)
My colleagues meet their responsibilities	4.33 (0.77)
My colleagues follow through on commitments	4.25 (0.75)
My colleagues meet their deadlines	4.17 (0.69)

* indicates significantly different than neutral score (3, scale 1 to 5) $\alpha < .05$

3.5 Discussion

The purpose of this research was to increase our understanding of the group that holds the most influence over planning and management of the urban ecosystem, especially decisions impacting the urban forest. The literature showed that civil engineers, landscape architects, and urban planners took similar steps when establishing themselves as new professions and began working together during the City Beautiful movement over 100 years ago. We hypothesized that, as a result of continuing to work closely together for a century or more, these three well-established professions would share similar attitudes and practices and likely cohere as a Group in the context of SCT. The results strongly supported this hypothesis as there were no significant differences amongst these professions on all 13 constructs representing norms, reciprocity, and trust (Putnam, 2001; Putnam and Feldstein, 2003; Tzanakis, 2013; Harvard Kennedy School, 2015). Additionally, members of the Group expressed trust in each other and indicated that they

share information freely, despite differences in education and background (Hammer, 2000; Billett, 2011). Although a response rate could not be determined, the number of responses was lower than expected. This was a limitation of this study.

We found differences between the three allied professions comprising the Group as highlighted by the level of education attained within each profession. The extent of occupational closure within engineering and landscape architecture is significant, with almost no respondents self-identifying as one of those professionals without a degree in that profession. This is almost certainly a product of the licensure/certification requirements in those two professions, which vary from state to state, but require a degree in that field to practice with very few exceptions (Council of Landscape Architectural Registration Boards, 2016a; National Council of Examiners for Engineering and Surveying, 2016). The planning profession is much more porous, as shown in the variety of degrees present, allowing individuals without formal education in planning to practice as planners or even become certified by the American Planning Association based on experience alone (American Institute of Certified Planners, 2015). This contributes to the encroachment on planning from other professions as reported by Myers and Banerjee (2005).

Urban forestry is currently at least as porous as the planning profession because certification/licensure in urban forestry is not even as rigid as in planning, much less that of civil engineering or landscape architecture. Thus, urban forestry has loosely defined professional boundaries and currently faces competition for control over urban forest management decisions from landscape architecture and civil engineering, and even ownership of the discipline of urban forestry itself (Matlock and Morgan, 2011; O'Herrin et al., 2014, 2015; American Society of Landscape Architects, 2016; O'Herrin et al., 2016). The Group would agree with the assessment of the status of the urban forestry profession as 'open', as we observed the single largest

perceived difference in support mechanisms or attributes of a profession between one's own profession and urban forestry was the certification (credentials or licensure) of individuals.

The results also support our hypothesis that the Group both is heavily invested in and assigns credibility to professional support mechanisms, such as certification. This should come as no surprise as all three professions have consistently operated this way for at least 100 years and their journey to professionalization pivoted on defining boundaries of their new professions through the establishment of a common body of knowledge, and then using that body of knowledge to develop education curricula and certify competency of practitioners (Rose, 1996; Hopper, 2000; Wisely, 2002; McKinney, 2010; Jernigan, 2013; Campbell, 2015). The Council of Landscape Architectural Registrations Boards still encourages landscape architects to become licensed to achieve “equal status to architects and engineers” and promotes licensure as a “professional differentiator” (Council of Landscape Architectural Registration Boards, 2016b).

Support mechanisms are powerful tools of communication that convey professionalism (Brauer, 2011). The Group strongly believed that support mechanisms are very important to lending credibility to any profession and perceived no significant difference between the importance of support mechanisms and the prevalence of these social norms in their own profession. However, they clearly perceived a significant difference between their own professions and urban forestry in all 19 types of norms presented. This, coupled with the fact that Group members reported working with urban foresters less often than any other profession listed, supports our hypothesis that urban forestry is peripheral to the group of allied professionals who plan and manage the urban environment.

The results support our hypothesis that group members trust each other and share information freely. We found scores on both of these constructs to be significantly greater than a neutral value, further supporting the finding that the allied professions operate as a cohesive group when planning and managing the urban environment. We also hypothesized that the Group would be generally aware of urban forestry, but would not view it as critical to the management of the urban environment. As expected, the Group, on average, was aware of urban forestry, with almost no one claiming to be an expert and almost no one claiming to lack basic understanding; however, standard deviations varied here more so than any other group of questions (Table 4). This suggests inconsistent interaction with urban foresters across the Group membership.

The Group perceived that structure and organization was less prevalent in the urban forestry profession relative to their own professions. However, it was surprising to see that the Group did have respect for the practice of urban forestry and viewed it as important. The Group may see urban forestry as a set of skills and knowledge available to anyone who could benefit from the application, similar to project management or sustainability science, rather than a discrete profession requiring dedicated professionals. Another possibility is that the Group may see urban forestry as an important but disorganized profession. In either case, these results would suggest that the Group does view urban forestry as critically important to the management of the urban environment, failing to support the second half of this hypothesis.

Uncertainty about the professionalism of urban foresters harbored by the Group, at least relative to their long-standing relationship with each other, is supported by the results. This could explain why urban foresters continue to report inconsistent results when trying to develop social capital with the Group (O'Herrin et al., 2014, 2015; O'Herrin et al., 2016). This occurs despite viewing urban forestry as important to the urban environment as seen in the results and as

exemplified by members of the Group occasionally co-opting urban forestry into their own professions (Matlock and Morgan, 2011; American Society of Landscape Architects, 2016). Improving the professional support mechanisms in the urban forestry profession, such as establishing professional territory through the combination of a Body of Knowledge and professional certification, would probably greatly improve efforts at collaboration with the Group and improve the public image of urban forestry overall.

3.6 Conclusions

Self-reflection is a common practice among the allied professions, whether the topic is specific, such as accreditation of degree programs, or comprehensive, resembling an existential crisis. The intent of examining ones' own profession may be to realign with the needs of society, or to realign with the needs of practitioners. Regardless of the purpose, the action of intentional and mindful self-improvement is a hallmark of all well-established and highly regarded professions. The urban forestry literature shows a dearth of thought toward this end and urban foresters must learn this practice if the profession is to improve, or even maintain, relevancy.

Self-regulation of professions is as old as the idea of 'professions' itself. Professional support mechanisms are the tangible manifestation of professional self-regulation—both the product and the tool of accountability—and are therefore powerful tools of communication. This study showed that the allied professions were heavily invested in this scheme, where it forms the backbone of significant social capital between these professionals who have been successfully collaborating to manage the urban environment for over a century. Urban forestry, on the other hand, was perceived as having inferior professional support mechanisms including even the basic certification of individual competency, and is therefore failing to self-regulate. If urban foresters wish to increase their influence on the planning and management of the urban environment, they

must increase their social capital with the allied professions through the development of professional support mechanisms.

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4.0 – IDENTIFYING CAREER OPPORTUNITIES IN URBAN FORESTRY

K. O’Herrin, P. Eric Wiseman, Susan D. Day, and Won Hoi Hwang.

4.1 Abstract

We collected 151 urban forestry job postings and analyzed them to outline career opportunities in the profession. We also interviewed 17 successful candidates to those positions to compare reality with written postings. Analysis included salary and minimum requirements of education and certifications. We outlined a career ladder with two tracks: one requiring 4-year education and the other heavily influenced by the profession’s close association with arboriculture. The ISA Certified Arborist credential has fully penetrated the market while the ISA Municipal Specialist holds little significance. We found almost no entry-level positions in urban forestry – students are exiting 4-year degree programs directly into arboriculture jobs. Experience as an arborist was accepted in lieu of education as an urban forester in about half of the positions. However, a degree was required to reach the highest paying positions. 75% of positions were in government including 63% of all positions being in local government. The results of this study can help recruit a greater diversity of students through the creation of new communication tools highlighting the positive aspects of a career in urban forestry. University leaders can use these results to ensure students are trained to meet the needs of society through alignment of curricula with industry. And national urban forestry leaders can promote initiatives that address the major deficiencies found herein.

4.2 Introduction

Cities in North America and around the world are rapidly becoming more interested in managing their urban natural resources (Romolini et al. 2016). A formal urban forestry profession has developed over the last 50 years in close association with the arboriculture

profession. While there has been research into the arboriculture profession (Bardekjian, 2015; Garth, 2015; Hauer and Peterson, 2016a), limited research has focused on urban forestry, particularly career opportunities. Hauer and Peterson (2016b) conducted a national survey of municipal forestry programs and determined usage of common certifications and typical salaries for those employees identifying themselves as arborists or urban foresters, but this is not enough information to chart a typical career path from entry into the workforce until retirement.

An increased understanding of urban forestry's career opportunities could result in a new communication tool that might aid in recruitment into collegiate programs and ultimately into the profession, an approach that other professions have used extensively (American Society of Civil Engineers, 2016; American Society of Landscape Architects, 2016; Landscape Architects Network, 2016). Career path assessment could identify gaps that might deter potential recruits or impede an urban forester's career progress (Baroudi, 1988; Debuse and Lawley, 2009; Kennan et al., 2009; Ahsan et al., 2013; Broome and Gillen, 2014). Additionally, increasing our understanding of urban forestry career opportunities and what is expected by employers could assist in aligning college and university curricula with workforce needs and identifying gaps, also a common practice in other professions (Brauer, 1993; Lang et al., 1999; Lee, 2005; Bullard, 2015).

A Body of Knowledge (BoK) is a living document that defines a profession by establishing the minimum set of knowledge, skills, and abilities required to function as a professional in that discipline (Brauer, 2011; Brauer, 2015). Typical uses include ensuring college curricula are aligned with the needs of the workforce, certifying a minimum level of competency of professionals in the workforce, and assessing a profession's career opportunities.

The Society of American Foresters (SAF) developed its BoK for urban forestry in 2014 through a rigorous, industry-standard process and it will be used here.

A comprehensive assessment of the career opportunities in urban forestry is needed to identify current challenges to increasing recruitment and impediments to early-career professionals, as well as opportunities for improving the profession. What types of positions, at varying levels of responsibility or seniority (e.g., supervisory responsibilities), are present within urban forestry? Are there other types of increased responsibilities beyond supervision that represent career progression?

Outlining a possible/normal career path with benchmarks for progression is referred to as career pathing or outlining a career ladder. Can a career ladder be identified from the postings we collected and are there gaps that might impede career progress? Can individuals enter the profession at upper levels of responsibility, or must they start at entry-level? What are the minimum qualifications for these postings we collected in terms of previous experience, education, credentials, and knowledge, skills, and abilities?

4.3 Methods

We performed a document analysis of job postings for 151 urban forestry positions and then interviewed the candidates who filled 17 of those positions to compare their actual qualifications and job duties with those described in the initial job postings.

4.3.1 Sampling

We collected job postings from January 1, 2014 to July 1, 2015 from the search engine Indeed.com (highest-traffic U.S. job search website (eBiz, 2016)), the job boards of urban forestry-related professional organizations, and email distributions (i.e., postings received by the

authors or forwarded to them by their colleagues). Searches on Indeed.com were performed 2-3 times per week using the search terms ‘arborist,’ ‘city arborist,’ ‘city forester,’ ‘urban forester,’ ‘urban forestry,’ and ‘forester’. Indeed.com searched the content of postings, not just the title, so positions were captured that mentioned any of the six search terms anywhere in the posting. Including ‘arborist’ and ‘city arborist’ as search terms resulted in numerous postings for urban forestry positions mislabeled as arborist positions that would not have been found otherwise for a variety of reasons discussed later, including inconsistency between job titles and heavy usage of the International Society of Arboriculture (ISA) Certified Arborist credential as a job qualification.

All job postings were screened to fit the following definition of urban forestry: an occupation concerned with the management of populations of trees. We intentionally excluded job postings for positions in utility line clearance or arboriculture (focused on the care of individual trees) to limit the scope of this analysis. This resulted in 151 job postings for full-time, permanent professional urban forestry positions.

4.3.2 Data Analysis

We coded job postings per several criteria, including salary, certifications preferred or required, minimum years of experience required, and minimum level of education accepted. Postings were also coded for the presence/absence of the 43 knowledge areas comprising the urban forestry BoK developed by the SAF. We performed the BoK coding by carefully reading each job posting and looking for explicit statements of job duties that used the BoK terminology in similar context. Chi-square with Bonferroni correction was utilized to determine whether each of the 43 knowledge areas comprising the BoK were significantly more prevalent or absent than expected in the coded job postings (Beasley and Schumacker, 1995).

We standardized pay rates across all job postings by converting hourly rates to annual rates. To reduce salary information to a single data point in a consistent manner, we approached pay rates from the perspective of a candidate who met the minimum qualifications and no more, and took an average of the high and low hiring rates when a hiring range was presented. This usually put a candidate in the middle of the first quartile of the full pay range (Duke University, 2016; UT-Dallas, 2016). Therefore, where a full pay range for a position was presented, we calculated a point 10% above the bottom of that range. Finally, these single-point salaries were all adjusted per the cost of living index for their respective locales (BestPlaces.net; 2016). These cost of living indices ranged from 78% (Birmingham, AL) to 243% (San Francisco) of the national average. The resulting standardized salary was used in all analyses.

We performed a two-step cluster analysis to find naturally occurring groups to outline career opportunities (Everitt et al., 2011). The variables considered were the 43 knowledge areas comprising the SAF's BoK along with certifications, type of employer (e.g., commercial, municipal government), hourly or annual pay rate, years of experience required, whether the position was supervisory, whether the position required a degree, and the standardized salary. Our goal for cohesion within groups/separation between groups was a value above 0.5 on a scale of 0 to 1. All analyses were performed using SPSS Statistics 23 (IBM Corp, Armonk, NY).

4.3.3 Interviews

We conducted interviews in June and July 2016 with candidates holding the positions that had been advertised in the analyzed job postings. Three to five interviewees were selected from each of the four clusters identified by the cluster analysis for a total of 17 interviewees whose positions/postings were the most representative of their respective groups. Interviews were conducted by telephone and recorded with participant consent. Interviewees were asked

what job duties they were performing in relation to the 43 knowledge areas comprising the SAF's BoK. They were also asked about their qualifications at the time of hiring (i.e., certifications, education, and previous work experience). Results of the interviews were then compared with the job postings data to identify discrepancies between advertised and actual qualifications and job duties.

4.4 Results

4.4.1 Defining Clusters of Postings

A two-step cluster analysis attempted to identify clusters of positions to represent different rungs on the urban forestry career ladder. The two variables that resulted in a logical clustering scheme were 1) whether or not the position was supervisory, and 2) whether or not the position required a degree. All other variables resulted in too much overlap between different groups of jobs and were dismissed by the cluster analysis procedure.

All positions in the Supervisory/Degree (SD) and Non-supervisory/Degree (NSD) clusters (Figure 4.1) strictly required a 4-year degree with no exceptions for allowing experience in lieu of education. On the other hand, any position in the Supervisory/Experience (SXP) and Non-supervisory/Experience (NSXP) that mentioned a 4-year degree as a desired qualification also stated that experience would be accepted in lieu of that degree. In these SXP and NSXP clusters, there were also positions that required a 2-year degree or a high school degree (with or without this exception mentioned). Overall, 74% of SXP positions and 73% of NSXP positions stated that experience would be allowed in lieu of post-secondary education.

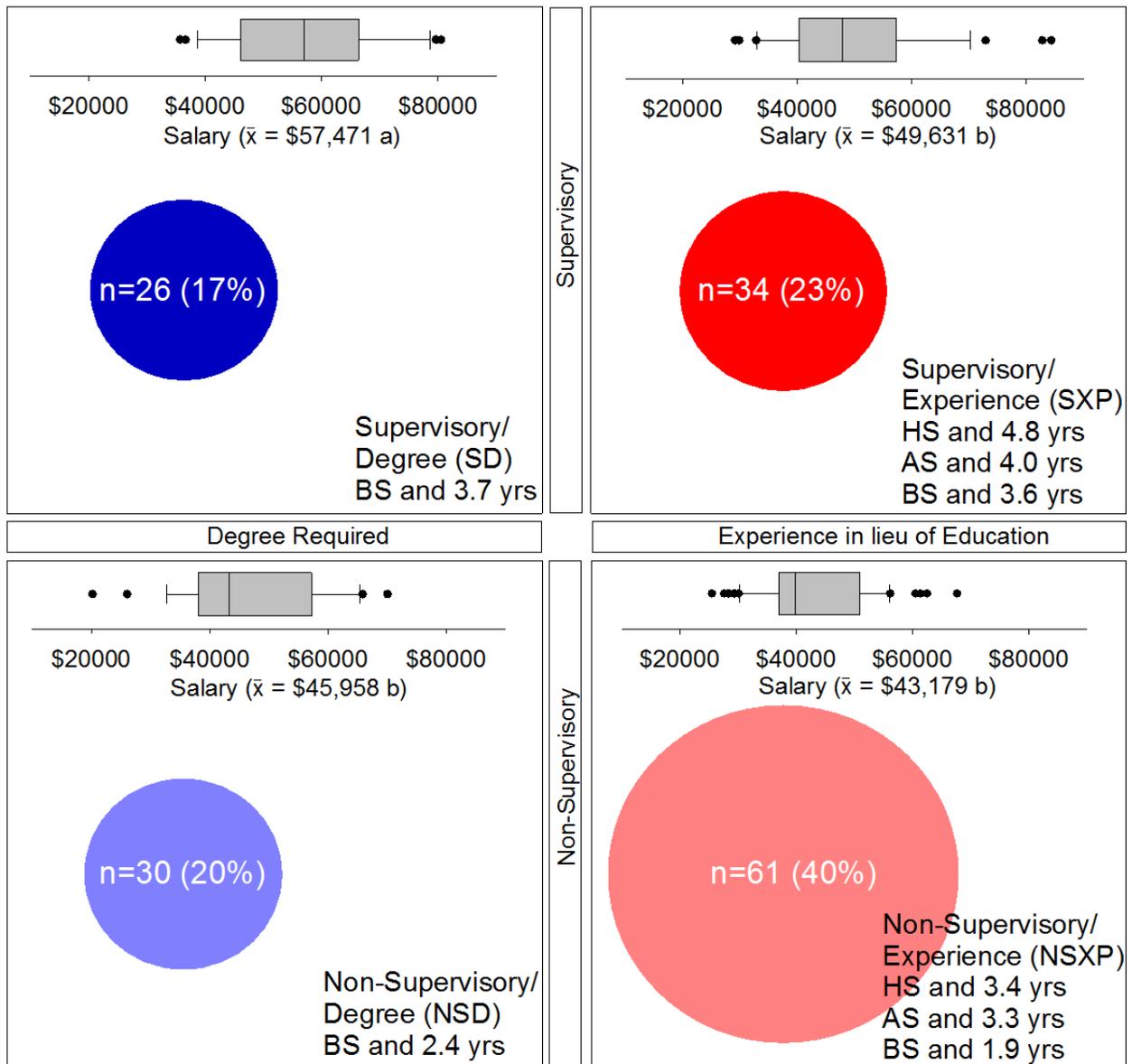
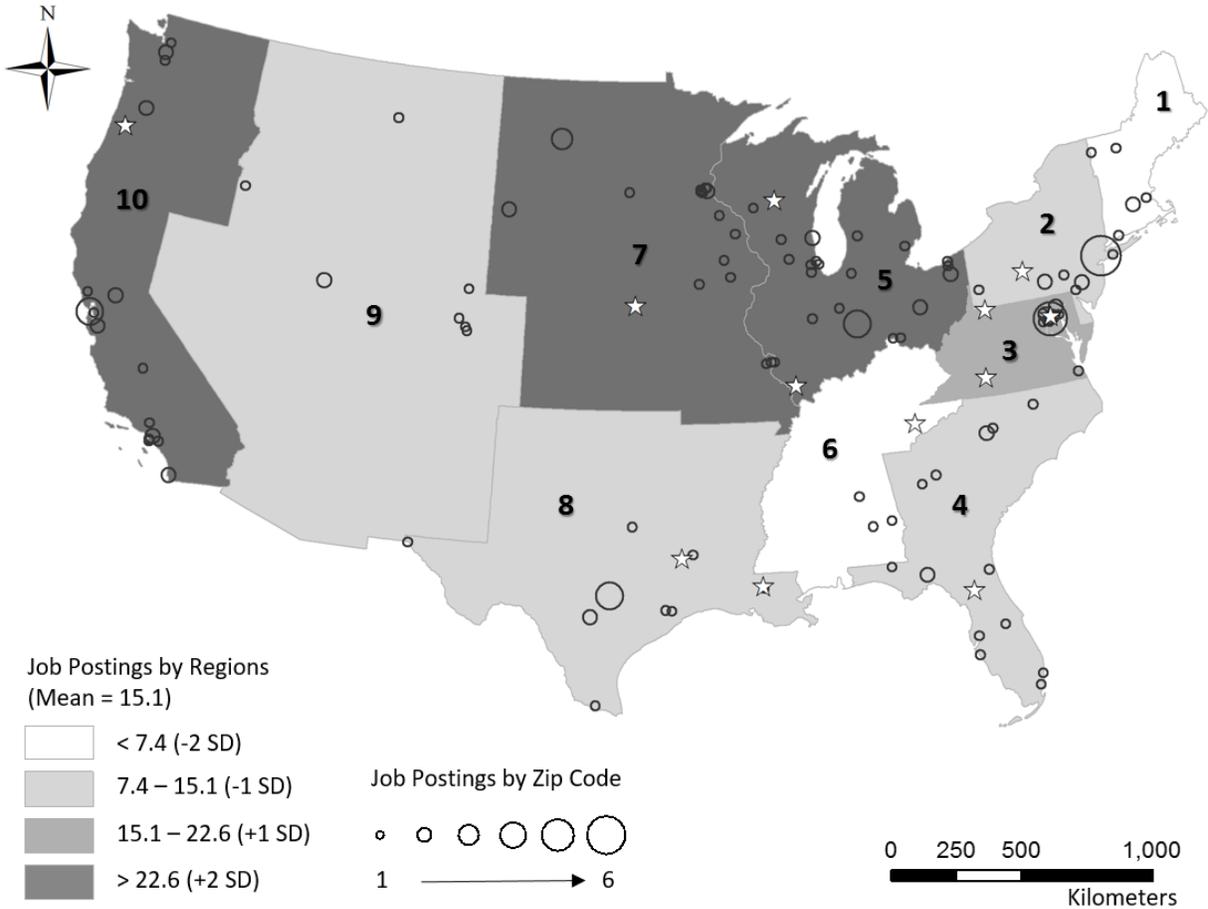


Figure 4.1: Results of cluster analysis on urban forestry job postings (n=151), displaying those variables deciding cluster membership, which were 1) whether the position was supervisory, and 2) whether a degree was required. Also displayed is the standardized annual salary (box plots) including mean and letters denoting statistically significant differences in mean salary ($\alpha=.05$). Also displayed is the average number of years of experience required associated with each level of education (HS: high school diploma, AS: Associate’s degree, and BS: Bachelor’s degree). Bubbles are scaled to represent each group’s membership size relative to total.

Jobs that clustered on the top rung of our career ladder were the employer's lead authority on urban trees about 50% of the time. The other 50% were one or more steps removed from the lead urban tree authority, though still supervisory. Positions on the bottom rung were not supervisory; however, they were still an agency's lead authority on urban trees about 20% of the time, usually as the City Forester for a small town. More often, these positions were managing small programs or projects within larger urban forestry programs.

Geospatial Analysis

The 151 postings were located within 110 zip codes contained within 32 states and the District of Columbia (Figure 4.2). There were 27 of those zip codes that had more than one posting, ranging from two to six postings. We found no significant differences in the number of postings, salary, minimum level of education required, certification usage, or employer type by economic variables (e.g., GDP, income/capita, poverty) at the state or regional level. The number of postings by state was significantly correlated with state population ($r = .846$, $n = 33$, $p < .01$) and by urban population per capita ($r = 0.432$, $n = 33$, $p < .05$).



Region (No. of Postings)	Universities in Region (☆)
1 New England (6)	None
2 Northeast (14)	Pennsylvania State Univ.
3 Mid-Atlantic (19)	Univ. of Maryland–College Park; Virginia Tech; West Virginia Univ.
4 Southeast (15)	Univ. of Florida–Gainesville
5 Western Great Lakes (26)	Southern Illinois Univ.; Univ. of Wisconsin–Stevens Point
6 South Central (3)	Univ. of Tennessee–Knoxville
7 Great Plains (21)	Univ. of Nebraska–Lincoln
8 Southwest / South (13)	Stephen F. Austin State Univ.; Southern Univ. and A&M College
9 Mountain (8)	None
10 West Coast (26)	Oregon State Univ.

Figure 4.2: Map of the conterminous U.S. and District of Columbia showing locations and number (bubble size) of urban forestry job postings (n=151) by region, as well as locations of four-year urban forestry degree programs. Regions are shaded according to standard deviations (e.g., -2 SD) from the mean number of job postings per region (15.1). Postings collected from the internet from January 2014 to July 2015.

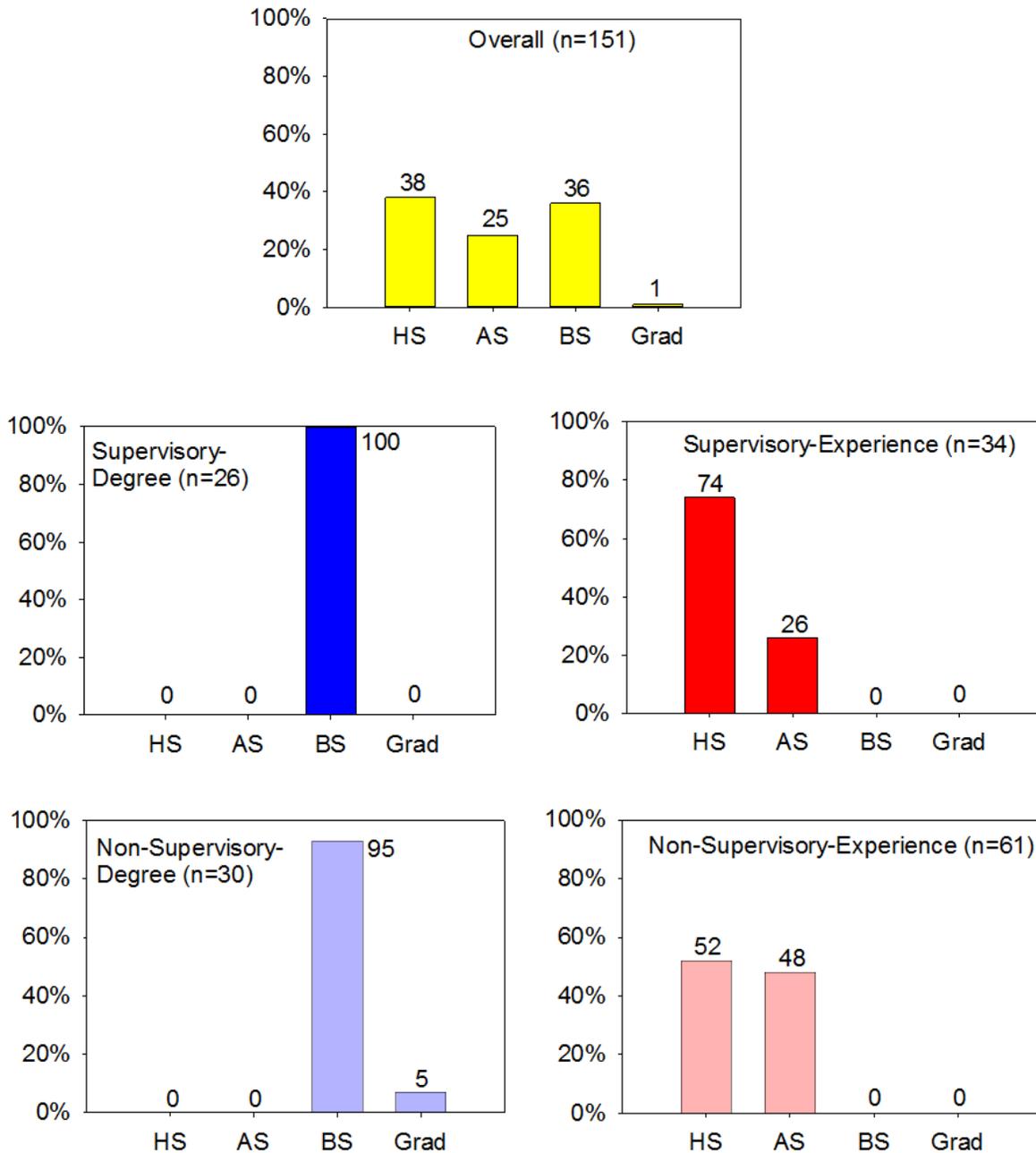


Figure 4.3: Minimum level of education allowed for urban forestry job postings (n=151) collected from the internet from January 2014 to July 2015 overall and by cluster analysis results. Levels of education are HS: High School, AS: Associate's Degree, BS: Bachelor's Degree and Grad: Graduate Degree.

4.4.2 Describing the Clusters

After identifying the most logical clustering scheme, clusters were characterized based on their position on a career ladder. Degree requirement was one of two variables deciding cluster membership; about one-third of all job postings required a Bachelor's degree in a field related to urban forestry (Figure 4.3). There were slightly more jobs that accepted a minimum of a high school degree than those that required a minimum of a Bachelor's degree. The other clustering variable was whether a position was supervisory. Although we found that 40% of the postings were for supervisory positions (responsible for direct reports), only about half of those (22% of total) required previous supervisory experience. There were another 9% of postings that indicated occasional supervision of others (without direct responsibility), yielding a total of 49% of postings requiring personnel supervision to some extent.

For this research, entry-level positions in urban forestry were defined as those requiring a 4-year degree and less than one year of experience (comparable to one or two summer internships). Positions stating that experience would be accepted in lieu of education were not considered entry-level, for example: a position with an eligibility option requiring no secondary education and six years of experience in arboriculture would not be considered an entry-level urban forestry position. Overall, entry-level positions were rare and represented less than 7% of all postings.

Employer Type

Local government (municipal and county) dominated the results compared to other types of employers, representing nearly two-thirds of all urban forestry job postings (Figure 4.4). Commercial employers all clustered in the NSXP cluster ($p < .001$) and represented 31% of employment in that cluster. Local government was overwhelmingly the employer for both SD

(85%) and SXP clusters (88%), though it was only statistically significant in the SXP cluster ($p < .001$).

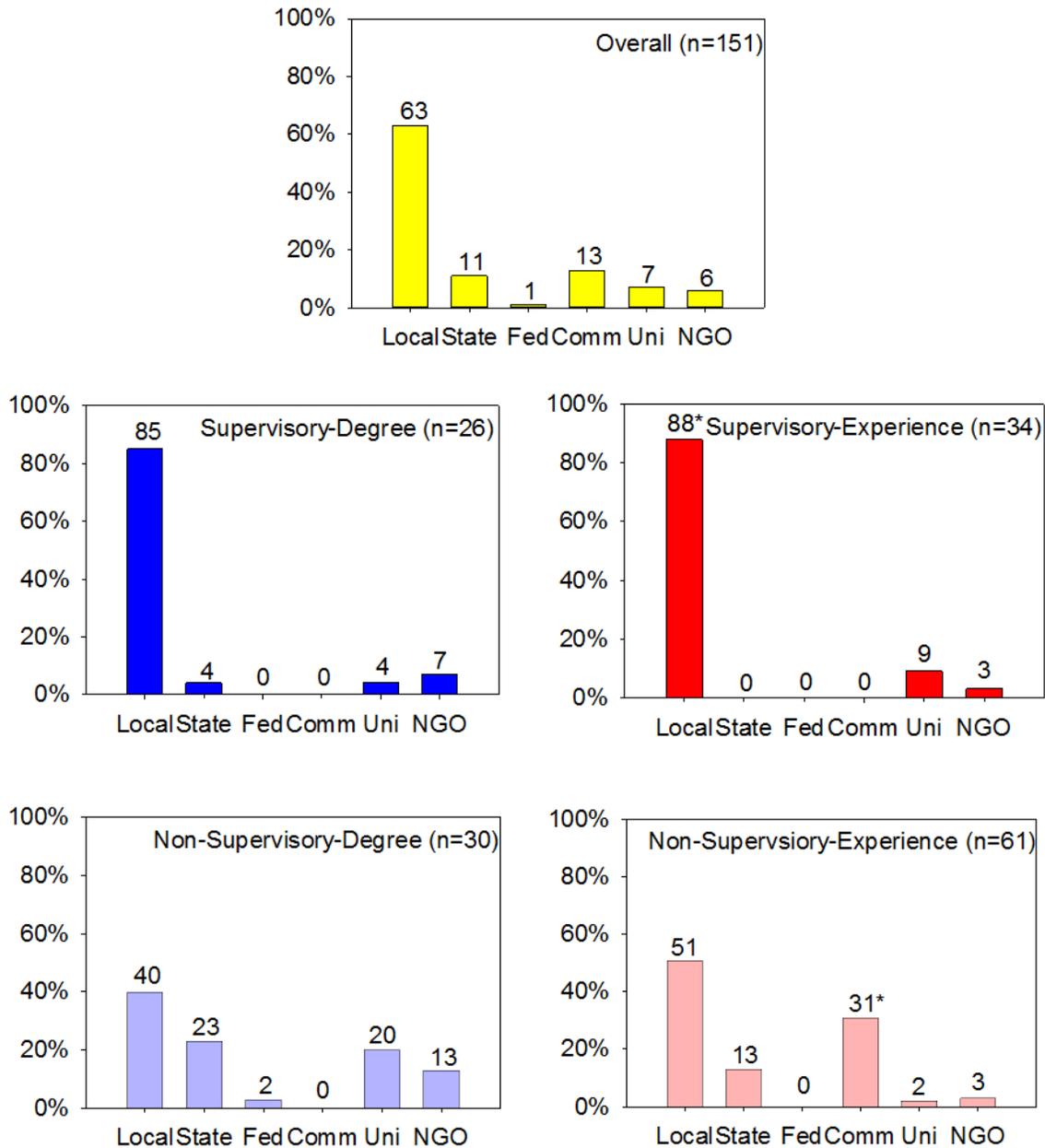


Figure 4.4: Type of employer for urban forestry job postings (n=151) collected from the internet from January 2014 to July 2015 overall and by cluster analysis results. Employers are Local: municipal or county government, State: state government, Fed: federal government, Comm: commercial company, Uni: university or college (instructional positions were excluded), and NGO: non-governmental non-profit organization. An asterisk (*) indicates statistical significance at $\alpha < .05$.

Credentials

The ISA Certified Arborist credential was the most-frequently listed credential in postings, both as a preferred (14%) or as a required (45%) credential (Figure 4.5). The ISA Municipal Specialist credential was never required and was only mentioned as preferred in 9% of postings, while the ISA Tree Risk Assessment Qualification (TRAQ) was required in 6% of postings. The SAF Certified Forester credential was never mentioned in any posting. Postings in the SXP cluster required the ISA Certified Arborist credential at 62% ($p < .001$) and a Pesticide Applicator's License at 44% ($p < .001$), which was significantly more than other postings. Postings on the right side of Figure 1 mentioned credentials more frequently overall ($\bar{x} = 1.27$) than postings on the left side ($\bar{x} = 0.80$); $t(1) = -2.58$, $p = .011$.

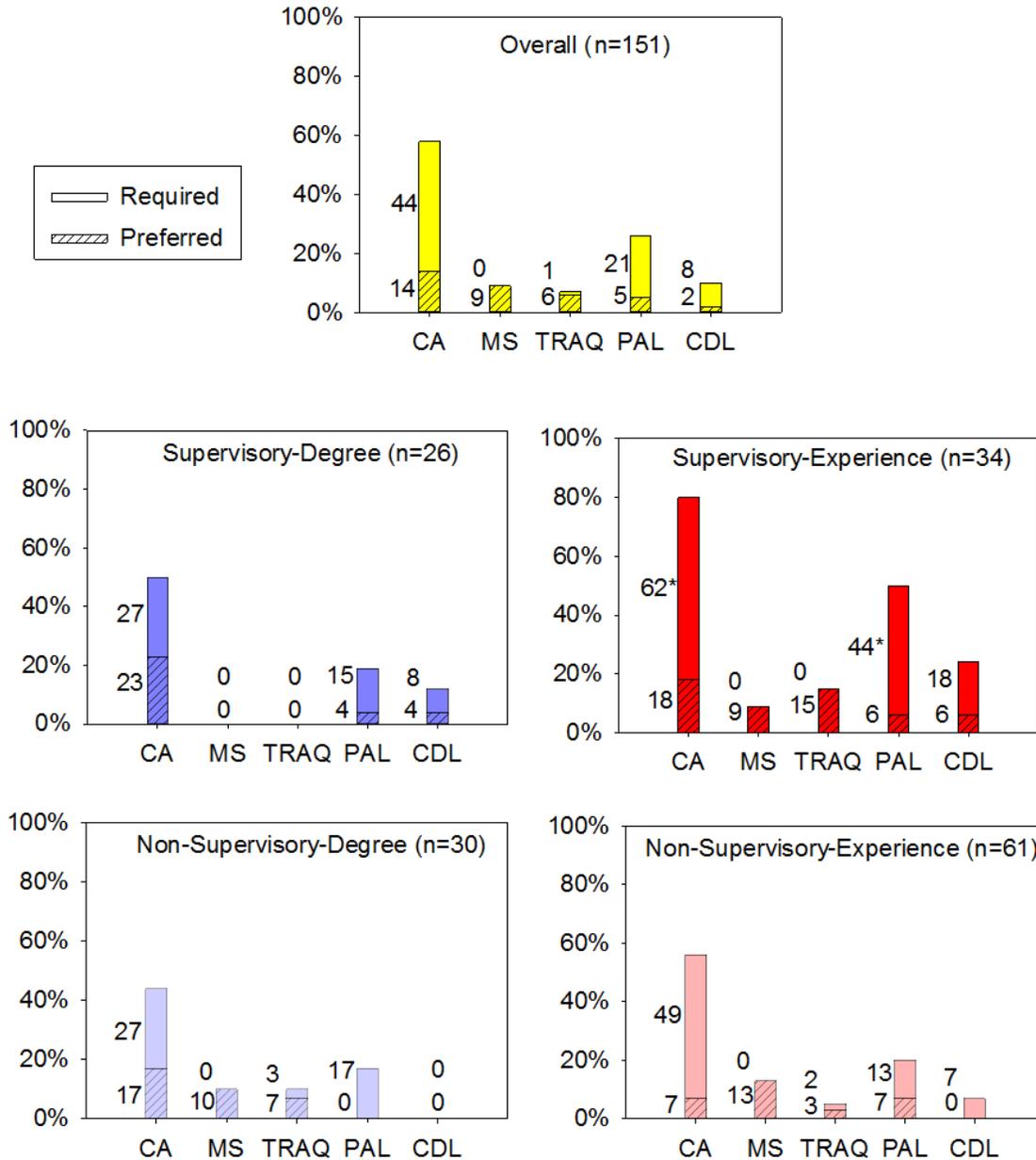


Figure 4.5: Certifications listed as required or preferred in urban forestry job postings (n=151) collected from the internet from January 2014 to July 2015 overall and by cluster analysis results. Certifications are CA: Certified Arborist, MS: Municipal Specialist, TRAQ: Tree Risk Assessment Qualification, PAL: Pesticide Applicators License, and CDL: Commercial Driver's License. An asterisk (*) indicates significance at $\alpha < .05$.

Salary

Local government jobs had the highest average standardized annual salary at about \$50,000 (Figure 4.6). Each of the four clusters had some postings that were presented in hourly

rates and some as annual salaries, with hourly-rate jobs less common overall at only about 25% of postings. No cluster had more than its expected share of hourly-rate jobs. The average standardized salary was about \$49,000 for positions advertising annual pay rates (n=110) and about \$44,000 for positions advertising hourly pay rates (n=28), a marginally significant difference of about \$5,000 (p=.075). Additionally, the average salary for the SD cluster was significantly higher than the other three clusters, which were statistically similar. Salaries were as follows: Commercial (\bar{x} =\$37,568, stdv=\$3,872), Institution (\bar{x} =\$43,278, stdv=\$8,565), Local (\bar{x} =\$51,046, stdv=\$13,202) NGO (\bar{x} =\$32,804, stdv=\$11,085), and State (\bar{x} =\$46,733, stdv=\$10,752). There was only one Federal position with salary information (\$60,092).

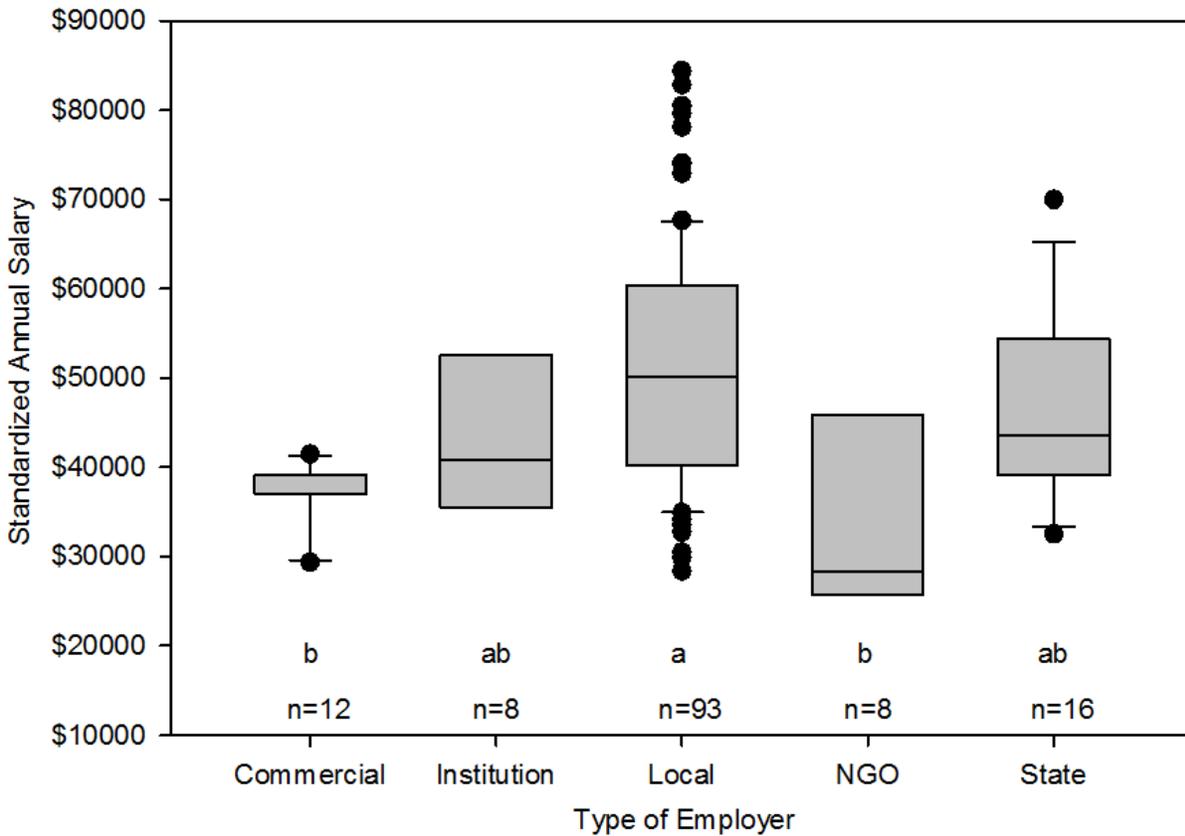


Figure 4.6: Standardized annual salary of urban forestry job postings (n=137) collected from the internet from January 2014 to July 2015 by type of employer. Federal government is omitted here as an employer type because there was only one position with that type of employer (\$60,092). Letters below boxplots denote statistically significant differences in mean salary ($\alpha=.05$).

Job Titles

Postings were analyzed to determine the common job titles used in each cluster (Figure 4.7). Overall, only 40 of 151 postings (26%) included urban forest/forestry/forester in the title while 23% included forest/forestry/forester in the title without qualifying it as urban and/or community forestry (e.g., Regional Forester). The words arborist/arboriculture/arboricultural were in the job title of 17% of postings, and 14% of postings had job titles that omitted any reference at all to forestry, urban forestry, arboriculture, or trees (e.g., Natural Resources

Specialist, Park Land Manager). Also, 6% included city forester without urban and/or community, and 5% included community forestry/forester without also using the word ‘urban.’

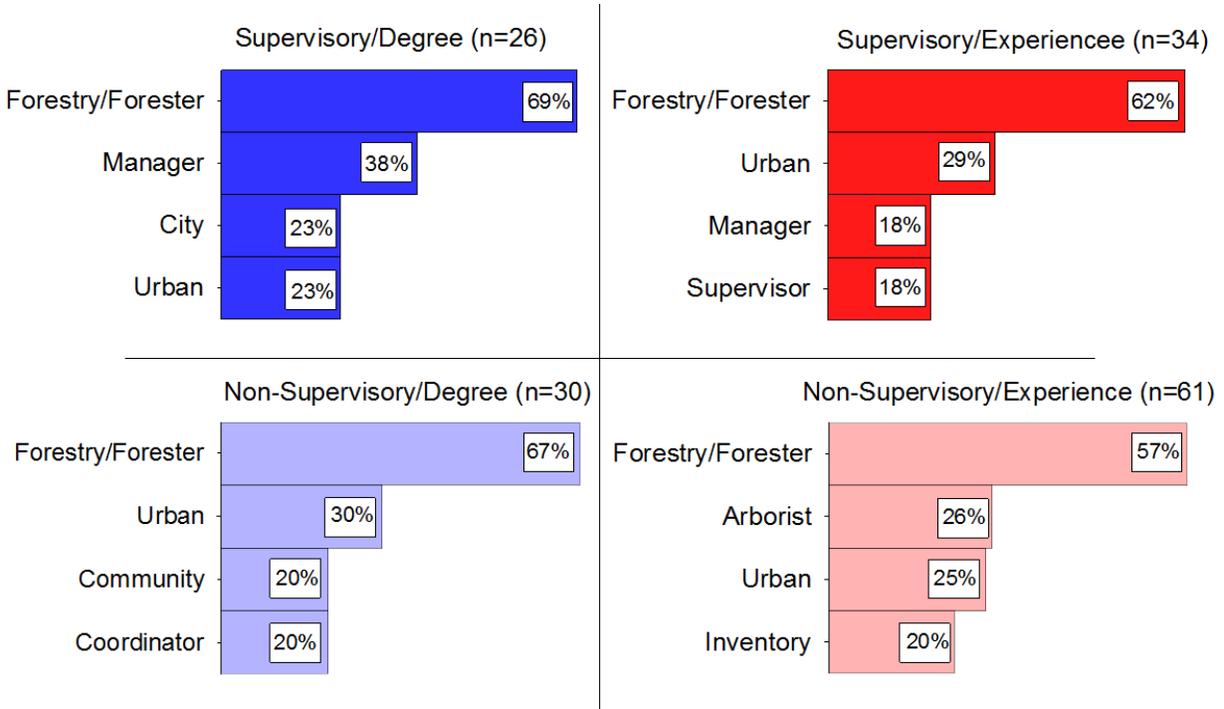


Figure 4.7: Four most common words contained within the job titles of urban forestry job postings (n=151) collected from the internet from January 2014 to July 2015. Presented by cluster.

Degree Majors

About 75% of job postings listed the degree majors acceptable for the positions (Figure 4.8). In those cases, Forestry was the most common major listed, followed by Horticulture, and then by Urban Forestry. Only Forestry and Horticulture were specified in over half of job postings in each of the four clusters.

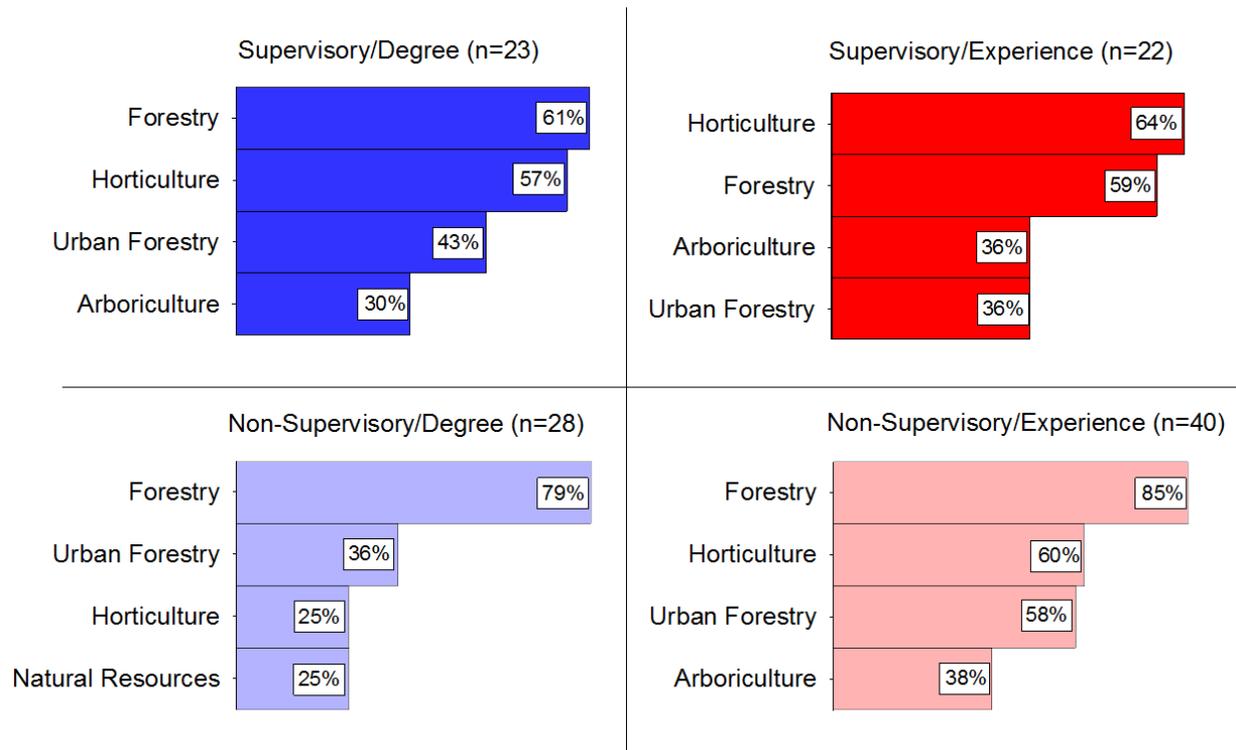


Figure 4.8: Four most common degree majors listed as examples of acceptable degrees in urban forestry job postings, where available (n=113) collected from the internet from January 2014 to July 2015. Presented by cluster.

Job Duties

Postings were analyzed for the presence of the 43 knowledge areas comprising the SAF’s BoK for urban forestry (Table 4.1). Overall, the most frequently included knowledge areas in statements of job duties were (3I) managing a proactive tree maintenance or planting program (54%), (1A) identifying and diagnosing problems related to pests (52%), and (1B) applying solutions (integrated pest management) to those pest problems (53%). Nearly half of postings listed (3A) utilize data management tools such as geographic information systems (49%) or (6C) manage personnel (49%). Four knowledge areas were present in less than 5% of postings including (4F) addressing Wildland/Urban Interface challenges (1%), (2F) managing interaction

of trees with overhead and underground utilities (4%), (4A) optimizing the urban forest for ecosystem services (2%), and (4D) optimizing the urban forest for wildlife habitat (2%). The ISA Certified Arborist credential was listed as required (rather than listed as preferred or not mentioned at all) significantly more than expected in those postings that also mentioned the arboriculture-specific duties of 1A, 1B, 1C, 1D, and 3B (all $p < .05$).

Table 4.1: Frequency in urban forestry job postings (n=151) collected from the internet from January 2014 to July 2015 of the 43 knowledge areas comprising the Society of American Foresters' Body of Knowledge. Frequencies shown overall and by cluster (SD: supervisory, requiring degree; SXP: supervisory, experience in lieu of degree; NSD: non-supervisory, requiring degree; NSXP: non-supervisory, experience in lieu of degree). One asterisk (*) indicates lower than expected frequency at $\alpha=.05$. Two asterisks (**) indicates higher than expected frequency at $\alpha=.05$.

Criteria	Overall (n=151)	SD (n=26)	SXP (n=34)	NSD (n=30)	NSXP (n=61)
	%	%	%	%	%
Domain 1: Forest Science					
1A - Identify and diagnose problems related to pests	52	46	68	40	53
1B - Apply integrated pest management	53	46	68	40	54
1C - Identify and diagnose problems related to tree structure, function, and regeneration.	25	23	24	10	33
1D - Apply solutions to problems related to tree structure, function, and regeneration.	23	19	21	7	33
1E - Identify and diagnose problems related to soil/water relations and other abiotic factors.	9	8	12	3	10
1F - Apply solutions to problems related to soil/water relations and other abiotic factors.	5	4	9	3	3
Domain 2: Infrastructure					
2A - Analyze/assess the potential impact of public and private development projects on the urban forest	5	0	12	7	3
2B - Prescribe, implement and inspect sites for proper protection of trees at construction sites and from other disturbances	31	43	29	37	25
2C - Interpret design and construction documents and plans	6	0	6	17**	3
2D - Develop and implement plans, strategies, and programs to address the interaction of green and grey infrastructure assets	5	12	0	3	5
2E - Work with public and private entities to mitigate the impacts of development projects on the urban forest	6	4	12	7	3
2F - Manage the interaction of the urban forest with overhead and underground utilities	4	12	0	7	2
2G - Monetize (i.e. appraise and value) green infrastructure	5	12	6	3	2
Domain 3: Forest Management					
3A - Utilize data management tools, including GIS	49	50	27*	50	61
3B - Assess, manage and mitigate tree risks	31	23	29	30	34
3C - Design, conduct, analyze, utilize and maintain urban forest inventory	39	31	47	30	43
3D - Develop sustainable urban and community forest management plans	17	27	18	27	8
3E - Develop and manage long range goals, objectives and policies for the urban forest	9	4	18	13	5
3F - Manage the urban forest to optimize tree diversity (e.g., species, size, age)	11	15	6	10	12
3G - Use of appropriate equipment and tools in urban forest management	11	12	21	7	7
3H - Plan and implement individual forestry projects	16	23	15	7	18
3I - Manage proactive tree maintenance and planting program	54	58	77**	57	39*
3J - Formulate, analyze, and interpret policies, guidelines and regulations	21	19	27	27	15

Table 4.1 (continued): Frequency in urban forestry job postings (n=151) collected from the internet from January 2014 to July 2015 of the 43 knowledge areas comprising the Society of American Foresters' Body of Knowledge. Frequencies shown overall and by cluster (SD: supervisory, requiring degree; SXP: supervisory, experience in lieu of degree; NSD: non-supervisory, requiring degree; NSXP: non-supervisory, experience in lieu of degree). One asterisk (*) indicates lower than expected frequency at $\alpha=.05$. Two asterisks (**) indicates higher than expected frequency at $\alpha=.05$.

Criteria	Overall (n=151)	SD (n=26)	SXP (n=34)	NSD (n=30)	NSXP (n=61)
	%	%	%	%	%
Domain 4: Ecosystems					
4A - Optimize the function and benefits of the forest to sustain urban ecosystem services	2	0	0	7	2
4B - Strategize the use of urban forest biomass	5	4	3	7	5
4C - Optimize the volume of the urban forest canopy	5	12	0	7	3
4D - Optimize wildlife habitat within the urban forest	2	0	3	7	0
4E - Address the role of urban forestry in natural disasters	22	23	50**	13	10*
4F - Address the role of urban forestry in Wildland/Urban Interface challenges	1	0	0	0	2
Domain 5: Communication					
5A - Respond to citizen inquiries and concerns	37	39	59**	30	28
5B - Establish public relations and marketing programs	13	15	12	17	12
5C - Provide public outreach and education programs	36	23	35	67**	28
5D - Attend meetings and speak as the credible professional	23	31	18	20	23
5E - Coordinate, train, engage and manage volunteers and job programs	15	12	27	23	7
5F - Develop and enhance public and private partnerships	13	15	9	33**	3
5G - Work with an interdisciplinary team to achieve a shared goal	7	8	3	10	8
Domain 6: Project Management					
6A - Prepare and manage budgets	31	50	44	40	10*
6B - Pursue grants and outside funding sources	26	23	15	43	25
6C - Manage personnel	49	100**	94**	17*	18*
6D - Formulate strategies and advocate for an effective and sustainable urban forest program	7	15	9	3	3
6E - Ensure compliance with proper methods, guidelines, and procedures	31	35	47	27	23
6F - Write specifications and manage and enforce contracts	12	23	18	10	5
6G - Evaluate and measure success of programs	13	23	24	0	8

4.4.3 Interview Results

Job Duties

Twenty candidates were chosen at random to be interviewed. Seventeen participated and three declined or did not respond. Our interviews revealed that the analyzed job postings omitted

nearly half of the duties (knowledge areas comprising the SAF's BoK) performed by candidates during their early tenure in these positions (error of omission). There was a clear pattern in the errors of omission representing five distinct areas of knowledge, skills or abilities (Table 4.2). In more than 50% of interviews, candidates were performing those duties even though they were not listed in their postings.

On the other hand, it was rare to find candidates failing to perform a duty that was listed in a posting (error of commission). There was only one knowledge area listed in job postings that candidates were failing to perform in more than 50% of interviews. We found that 53% of candidates had 1B – application of integrated pest management listed in their job posting, but never actually performed this task.

Table 4.2: The five distinct job duties being performed by the candidates of analyzed urban forestry job postings (n=17), but were not included in the job postings (error of omission) collected from the internet from January 2014 to July 2015. Candidates were interviewed within 18 months of their hire dates.

Area of knowledge, skills, or ability and associated job duty	Error of Omission
Any arboricultural competency aside from those related to insects and diseases	
1C - Identify and diagnose problems related to tree structure, function, and regeneration.	59%
1D - Apply solutions to problems related to tree structure, function, and regeneration.	59%
1E - Identify and diagnose problems related to soil/water relations and other abiotic factors.	65%
1F - Apply solutions to problems related to soil/water relations and other abiotic factors.	53%
3B - Assess, manage and mitigate tree risks	53%
Protecting the existing canopy resource	
2A - Analyze/assess the potential impact of public and private development projects on the urban forest	65%
2C - Interpret design and construction documents and plans	59%
2D - Develop and implement plans, strategies, and programs to address the interaction of green and grey infrastructure assets	71%
2E - Work with public and private entities to mitigate the impacts of development projects on the urban forest	71%
2F - Manage the interaction of the urban forest with overhead and underground utilities	71%
Planning and managing the urban forest population using modern inventory technology	
3C - Design, conduct, analyze, utilize and maintain urban forest inventory	59%
3F - Manage the urban forest to optimize tree diversity (e.g., species, size, age)	76%
Monitoring and addressing the effectiveness of the urban forestry program	
3E - Develop and manage long range goals, objectives and policies for the urban forest	53%
6D - Formulate strategies and advocate for an effective and sustainable urban forest program	71%
6G - Evaluate and measure success of programs	71%
Communication and collaboration	
5D - Attend meetings and speak as the credible professional	65%
5G - Work with an interdisciplinary team to achieve a shared goal	76%

Qualifications

All but two of the interviewed candidates had previous experience in arboriculture or urban forestry (ranging from two to 20 years): one had significant experience managing

conservation-based outreach and education programs and the other was filling one of the very few entry-level positions. The individual with significant program management experience was the only interviewee introduced to arboriculture or urban forestry after 30 years of age.

Only one interviewed candidate had a Bachelor's degree in Urban Forestry. Two candidates had no secondary education but significant arboriculture experience, three had unrelated secondary education with arboriculture experience ranging from 2 to 20 years, and the remaining 11 candidates had related secondary education with a wide range of experience in primarily arboriculture and urban forestry. Of those 15 candidates who had pursued secondary education, one had earned an Associate's degree, 12 had earned Bachelor's degrees, and the remaining two had earned both Bachelor's and Master's degrees.

All 17 interviewed candidates were ISA Certified Arborists except the two who were filling entry-level positions: one had only been out of college for about a year and the other had 30 years of experience in horticulture/lawn care. Both were preparing for the certification exam. Regarding other credentials, 29% were certified as ISA Municipal Specialists, 47% had achieved ISA TRAQ qualification, 24% held a Pesticide Applicator's License, and 35% held a Commercial Driver's License.

4.5 Discussion

There are many potential ways to organize job postings or create structure leading to a logical career ladder. In our analysis, the two rungs of the career ladder were separated by supervisory responsibilities. Supervisory positions (the top rung) were found almost exclusively in local government (Figure 4.3). Non-supervisory positions (the bottom rung) were found

working for more diverse agencies, though local government still dominated. Commercial positions were only found in the NSXP cluster.

Benjamin (2016) conducted two surveys of urban forestry employers: an online survey in which respondents were primarily small local governments and private companies. Although the preamble drew a sharp distinction between arboriculture and urban forestry, there were still 122 respondents indicating they were private employers of urban foresters, suggesting that this study did not adequately capture commercial urban forestry positions. Clearly, commercial companies do not regularly advertise supervisory urban forestry positions externally; our inability to analyze this sector of job postings was a limitation of this study.

4.5.1 Experience in lieu of Secondary Education

In addition to separating rungs on the career ladder vertically based on supervisory responsibilities, Figure 1 also splits urban forestry positions into left and right side rails based on degree requirements. Those positions on the left side strictly required a 4-year degree in a related discipline. Hauer and Peterson (2016b) conducted a national survey of municipal forestry programs and, without discerning between arborist and urban forestry positions, found that at least one person on staff tasked with responsibilities for trees had a 4-year degree 47% of the time and our interview results found that 71% of candidates had a directly-related 4-year degree, both of which exceed our finding that 36% of postings require a 4-year degree.

On the other hand, right-side positions allowed experience in lieu of post-secondary education about three-quarters of the time, or almost half of all 151 postings. Interviews confirmed that individuals are hired into SXP and NSXP positions with experience in lieu of post-secondary education in a related discipline about 40%, and even one instance occurred in

the NSD cluster. Reviewing postings from SXP and NSXP in context reveals that these positions represent an excellent pathway for individuals to move from arboriculture into urban forestry, often into a role supervising arborists (contracted or in-house) and/or as an agency's lead authority on urban trees.

Accepting experience in lieu of post-secondary education occurred in all clusters except the SD cluster. The interviews revealed that experience was also accepted in the NSD cluster, even though such an allowance was not indicated in the job posting and may be atypical. Additionally, the average salary for the SD cluster was significantly higher than the other three clusters, which were statistically similar (Figure 4.1). Viewing the postings as either in the SD category (strict education requirements and highest salary) or 'all others' represents another scheme to categorize these job postings, but one in which post-secondary education again forms the schism. Hauer and Peterson (2016b) found those individuals identifying as the Forestry Manager or City Forester started around \$59,000 annual salary, which is slightly higher but comparable to our SD cluster. That same study found that individuals classifying themselves as Urban Forestry Specialists or Working Foremen started around \$47,000 annually, which is slightly higher but comparable to our findings for clusters NSD and SXP. They also found that production arborists started around \$40,000, which is comparable to our NSXP cluster's salary, although we intentionally excluded production arboriculture positions. Note that Hauer and Peterson surveyed local governments exclusively which represents only about two-thirds of the postings in this study.

Regardless of how postings are clustered, it is important to note that almost half of urban forestry positions accept experience in lieu of education. This is not seen in the allied professions of civil engineering or landscape architecture where licensure requires a Bachelor's degree (and

significant experience) with virtually no exceptions at all. Certification in urban planning can be achieved with significant work experience and no post-secondary education; however, that work experience must occur specifically in the planning discipline, not a related field as arboriculture is related to (but different than) urban forestry. The current hiring practices in urban forestry are obviously quite different from these well-established allied professions.

4.5.2 Use of Credentials

The ISA Certified Arborist credential was mentioned as required or preferred in 58% of all job postings. Hauer and Peterson (2016b) found that about 60% of U.S. residents live in a community that has an ISA Certified Arborist on staff. We found that the SXP cluster was especially heavy on certifications. The Certified Arborist was listed as required more than expected ($p < .05$) in those postings that also listed arboriculture-specific duties, which suggests that it was being used to reinforce that a position was arboriculture-heavy, rather than being used as shorthand for listing out arboriculture-specific duties.

Although our interviews revealed that the ISA Certified Arborist is a widely-held credential, the ISA Municipal Specialist credential was held by only 29% of interviewed candidates. Hauer and Peterson (2016b) similarly found that only 15% of U.S. residents live in a community that has a Municipal Specialist on staff. Although the TRAQ qualification has only been offered nationally since 2013, the credential was already twice as common as the Municipal Specialist credential among interviewed candidates. Benjamin (2016) found the Certified Arborist, Pesticide Applicator's License, and Commercial Driver's License to be the top three most desirable certifications amongst small governments and private companies. Large governments desired the Certified Arborist, Pesticide Applicator's License, and Municipal Specialist. Only one interviewee, who had over 20 years of experience in commercial

arboriculture, mentioned that he had the ISA Board Certified Master Arborist (BCMA), and none of the job postings mentioned it or the Certified Forester (Society of American Foresters). Hauer and Peterson (2016b) also found that advanced ISA credentials, such as the BCMA, were uncommon among urban forestry professionals.

These results show that although the Certified Arborist is ubiquitous in the urban forestry job market, professionals are still interested in additional certifications such as TRAQ, which has become relatively popular very quickly. On the other hand, the Municipal Specialist appears to be deficient in some respect because not a single posting required the Municipal Specialist and only 9% mentioned it as a preferred qualification, indicating that it currently holds very little value to employers. Still, 29% of interviewees held the credential, so practitioners are clearly interested in an ‘urban forestry’ certification to differentiate themselves from the ubiquitous Certified Arborist. Some type of new ‘Urban Forester’ certification, aligned with university curricula and typical areas of professional practice, might appeal to employers trying to evaluate candidates for urban forester positions. Employers are obviously responsive to changes in the industry, as 7% were already preferring or requiring TRAQ. The lack of a successful urban forestry certification is a major deficiency of the profession that needs to be addressed.

4.5.3 SAF Body of Knowledge

The clusters SXP and NSXP, which accepted work experience in lieu of education, tended to place greater emphasis on the arboriculture-focused duties (Table 4.1) than those positions requiring degrees in the SD and NSD clusters. It is interesting that no job duty was present in more than about 50% of job postings, not even arboriculture skills. One would assume that arboriculture duties are more prevalent in the jobs than stated and were omitted from postings simply because requiring the ISA Certified Arborist credential would imply that a

comprehensive range of arboriculture duties would be required of the candidate. However, that credential was listed as required (rather than preferred or not mentioned at all) significantly more than expected in those postings that also mentioned arboriculture-specific duties, showing that the credential was being used to reinforce arboricultural job duties rather than simply denote them. Arboriculture skills were the only consistent statistical difference in job duties between positions that strictly require 4-year degrees and those that allow for experience in lieu of education.

Benjamin (2016) conducted a survey of urban forestry employers and found that tree risk assessment and customer service were the two skills that were consistently lacking in recent graduates. Our study found tree risk assessment listed in only 31% of postings and responding to customer concerns listed in only 37% of postings. Employers should place more emphasis on these skills in postings if they really feel they are lacking amongst recent graduates.

There is no established BoKe being used within the profession to guide and align university curricula, job postings, and certification of practitioners. Thus, there is no strong consensus on ‘what is urban forestry’ or ‘who practices urban forestry’ as evidenced by the lack of consistency in duties between job postings and echoed in focus groups (O'Herrin et al., 2014, 2015; O'Herrin et al., 2016). Even arboriculture, which is frequently argued to encompass or be synonymous with urban forestry, only appeared in job postings half of the time. Confusion about professional identity is consistently mentioned by urban foresters in focus groups; this undoubtedly conveys a sense of disorganization or lack of consistent standards to colleagues in allied fields, contributing to encroachment by other professions onto urban forestry (American Society of Landscape Architects 2016, Matlock and Morgan 2011). Consistent application of its

Body of Knowledge represents a potential opportunity to advance the urban forestry profession, a practice that is fundamental to other professions.

4.5.4 Entry-Level Positions

Positions in the NSD cluster required a Bachelor's degree and an average of 2.4 years of experience, while the NSXP cluster required a Bachelor's degree and an average of 1.9 years of experience (or more experience in lieu of post-secondary education). Across these two clusters (bottom rung of the career ladder), there were only 10 entry-level positions or about 7% of all postings, where entry-level is defined as requiring a four-year degree and less than one year of experience. A third, bottom rung is missing from the urban forestry career ladder where entry-level positions ought to be. Instead, urban forestry clearly relies almost entirely on arboriculture to provide employment to graduates immediately after college. Our interviews confirmed that candidates in urban forestry positions in any cluster often had significant arboriculture experience, regardless of post-secondary education. Hauer and Peterson (2016b) similarly found that individuals who were the city's lead authority on trees had an average of 20 years of experience and had been in their current position for over 10 years. Therefore, competition for entry-level positions is fierce, which is forcing recent graduates to spend time as an arborist before qualifying for an urban forestry position.

There is no exact prescription for how many jobs in any career field should be entry-level because the factors influencing the need for entry-level positions are fluid, including retirements, demands of a rapidly changing society, and changes in funding/support. For example, an article examining positions for academic librarians found 20% to be entry-level amidst a flurry of published opinion pieces lamenting the tough job market for recent graduates, indicating 20% was still insufficient (Tewell, 2012).

In urban forestry, only about 7% are entry-level which appears to be forcing recruits to spend time in an adjacent profession first. This close relationship between employment in arboriculture and employment in urban forestry should come as no surprise considering the shared history and professional society of the two. This expectation of spending time in arboriculture before entering urban forestry occasionally surfaces in anecdotal reports from urban foresters as a means of earning credibility by working in the field before moving into a supervisory position. Although this arrangement may have been previously sufficient, it will need to be reexamined if urban forestry is to attract more diverse recruits.

Put another way, a student who wants to pursue a career in urban forestry should expect to first spend a significant amount of time in arboriculture because that is typical and because entry-level positions only represent about 7% of all positions available in urban forestry. This may discourage many potential recruits into the profession. This likely represents a significant impediment to diversifying urban forestry because working in arboriculture may not be attractive to all potential recruits into urban forestry. Urban forestry's inability to provide for its own recruits also likely conveys unprofessionalism.

4.6 Conclusions

In this study, we organized job postings into a career ladder, determined typical qualifications and job duties that constitute the rails and the rungs of that ladder, and identified several structural deficiencies. This was achieved, in part, through the application of a current and valid BoK developed by the SAF. Establishing and using a BoK is a hallmark of a well-established profession and additional applications for the future should include aligning university curricula/accreditation standards and certification of professionals with this BoK.

Major deficiencies we identified included 1) an insufficient number of entry-level urban forestry positions, 2) no urban forestry-specific credential being used consistently, and 3) incomplete descriptions of job duties in job postings. A fourth major problem is that about half of all postings allowed for experience as an arborist (or even experience in other professions) in lieu of an urban forestry degree, which greatly devalues degree programs as perceived by students. The only incentive to pursue a four-year degree in urban forestry may be that salaries in the small SD cluster (strict education requirements) were statistically higher than all other clusters. These deficiencies will contribute to confusion of identity amongst current practitioners and are probably a significant detriment to recruitment.

We are trying to recruit students into four-year degree programs while also telegraphing to arborists and other professionals that urban forestry welcomes them without that same specialized education. This is occurring while trying to convince our colleagues in allied professions that we are as professional as they are when no two urban foresters can even agree on a definition of their own profession. Urban forestry leaders must begin to consider the health of the urban forestry profession as one national system, apart from arboriculture, and enact significant changes to our processes and functions if we are to maintain relevancy, much less improve our station.

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5.0 – STUDENT PERCEPTIONS OF URBAN FORESTRY AS A CAREER PATH

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5.1 Abstract

Urban forestry, an emerging profession, lacks racial, ethnic, and gender diversity among practitioners and U.S. undergraduate urban forestry degree programs suffer from low enrollment. We surveyed life and natural science-oriented students to determine how the structure and organization of a profession factors into their career decision-making processes, their level of previous knowledge of urban forestry, and their new impression of urban forestry as a career after exposure to an informational video. The sample population consisted of students at 18 U.S. universities enrolled in classes in a natural or life sciences department or college. Responses indicated that personal interest and job satisfaction are the most important factors to students when considering career paths, and are more important than pay and prestige. Previous knowledge of urban forestry was unfavorable, especially in suburban students. After viewing a video about urban forestry, students' new impression was slightly favorable and no other significant barriers to career interest were identified. The very wealthiest students displayed lower interest in urban forestry than other students. Otherwise, we found student perception was not influenced by gender, race, residential setting growing up, or socio-economic status. This suggests urban forestry may be appealing to a greater diversity of students. Lack of awareness seems to be a significant obstacle to recruiting more diverse students into urban forestry. Thus, the profession may need to promote its public image independent of traditional forestry and natural resources programs to better capture the attention of new students.

5.2 Introduction

Urban forestry emerged as a discrete profession in the late 1960's and has been offered as a bachelor's of science degree in the United States since at least 1975 (Jorgensen, 1967, 1993; Miller, 2016). Since then, urban forestry has received increased recognition and financial support from the U.S. Federal government (U.S. Congress, 1978, 1990) and local governments (Hauer and Peterson, 2016) as cities became increasingly interested in managing urban natural resources to improve the urban environment (Romolini et al., 2016). However, as urban forestry is still a relatively new and small profession, it lacks much of the structure and organization seen in other professions such as an active, national recruitment strategy (Banken, 2013; American Society of Civil Engineers 2016), professional certification (Bayles, 2003; Adams et al., 2004; Kelly, 2007; Brauer, 2011; Brauer et al., 2013; Brauer, 2015), and active management of the public image (McClendon et al., 2003; American Society of Landscape Architects, 2007; Banken, 2013). Encroachment by professions such as civil engineering (Matlock and Morgan, 2011) and landscape architecture (American Society of Landscape Architects, 2016) shows that urban forestry has not yet achieved widespread recognition or established itself as well as it could. Urban foresters consistently report that the public especially does not yet understand urban forestry (O'Herrin et al., 2014, 2015; O'Herrin et al., 2016).

It is unknown how college students perceive urban forestry as a viable career, or if they are aware of it at all. Understanding student perceptions and knowledge could be valuable to guide management of the public image and to inform student recruitment efforts of colleges and universities that offer curricula in urban forestry (Sharik and Frisk, 2011; Banken, 2013; Bennett et al., 2015). In reviewing existing urban forestry degree programs, the University of Nebraska –

Lincoln and the Nebraska Forest Service found six ‘leading’ programs and seven programs with lower enrollment (UN-Lincoln, 2015). Our own review recently found 10 degree programs advertising online a bachelor’s of science in urban forestry (Appendix B). Most of these degree programs are housed within traditional forestry and/or natural resources colleges, which historically suffer from poor diversity (Outley 2008; Sharik et al., 2015). Urban forestry degree programs, suffering from poor public recognition of the profession, may rely excessively on recruiting students from the same sources as these traditional programs, continuing this pattern. This may contribute to low enrollment in urban forestry because of low interest in this pool of potential recruits. Furthermore, this is thought to contribute to the poor racial, ethnic, and gender diversity among urban forestry practitioners (Kuhns et al., 2002, 2004). As more cities look toward tree-based solutions for urban environmental problems, it could be valuable to the urban forestry profession to increase the number of degree program graduates. It could also be valuable to increase the diversity of practitioners to more closely resemble the urban areas served, thereby increasing cultural competency and equity in service delivery (Cohen et al., 2002; Saha et al., 2008; Herring, 2009).

Social Cognitive Career Theory (SCCT) provides a framework to examine how students perceive urban forestry as a career path. SCCT is one of the most comprehensive theories attempting to explain or predict career choice and its utility in such analyses is well documented (Lent et al., 1994; Lent et al., 2000; Lent and Brown, 2006; Lent et al., 2008). SCCT is a complex model that operationalizes how an individual chooses a career; but before any conscious choice ever enters the model, Learning Experiences play a critical role in how an individual subconsciously perceives a career path. Learning Experiences, as defined by SCCT, are the positive or negative emotional reactions an individual develops about a profession in the

context of career choice. In this study, we assume that most students have never been exposed to urban forestry as a career and thus have no impression of it. Instead, students were shown a short video discussing urban forestry careers and asked to answer questions to assess their impression of urban forestry as a career.

SCCT suggests that Learning Experiences are directly influenced by an individual's demographic characteristics, and values and beliefs which here will include disposition toward career characteristics in general, relationship with nature and the environment generally, and disposition toward natural resource careers specifically. Additionally, we are interested in which professional support mechanisms (e.g., certification, accreditation) students use to judge a career path and how that influences their impression of urban forestry as a career.

The purpose of this research was to:

- Determine what professional support mechanisms, values, and beliefs are most important to students when considering career paths (generally, not specific to careers in natural resources).
- Determine if students are being exposed to urban forestry as a career path and what demographics and values contribute to varying levels of exposure.
- After intervention by video, assess student impressions of urban forestry as a career and the demographics that contribute to varying impressions.

5.3 Methods

We conducted a web-based survey of students at 18 universities (Appendix C), primarily located east of the Rocky Mountains. Students were contacted through faculty at their university

who either agreed to conduct the survey in-class or to email the survey link to a class list of students. We were interested in students who already had an interest in natural or life sciences rather than all university students. Therefore, the faculty and classes targeted were all in a natural or life sciences department or college (e.g., agriculture, natural resources, environmental studies, geography, biology, ecology).

5.3.1 Data Collection

The survey instrument consisted of 70 questions, almost all of which were 5-point Likert scale questions ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) intended to be combined into a total of 10 constructs. Social Cognitive Career Theory (SCCT) provided a framework for understanding what influences a student's career decision-making process (Lent et al., 1994; Lent et al., 2000; Lent and Brown, 2006; Lent et al., 2008). We adopted a framework aimed at understanding how students perceive urban forestry as a career and what factors may explain that perception. In SCCT, Person Inputs (demographics) and Background Contextual Affordances (beliefs and values) combine to influence Learning Experiences (the positive or negative emotional reactions toward a career).

Person Inputs. Person Inputs are unchanging demographic characteristics. Students self-reported their race and gender, as well as their residential setting growing up (i.e., urban, suburban, or rural) and socio-economic status (SES) during their last year of high school.

Background Contextual Affordances. Background Contextual Affordances are beliefs and values students learn from their environment growing up. We asked students about seven main topics to determine their beliefs and values: 1) their family's attitude toward the environment and nature in general, as well as careers in this area; 2 and 3) their family's motivators when

considering career paths; 4 and 5) their own motivators when considering a career path; and 6 and 7) their interest in consumptive and non-consumptive types of outdoor recreation.

Learning Experiences. Learning Experiences are the positive or negative emotional reactions students have toward a career, largely based on their initial exposure. We assumed most students would not have been previously exposed to urban forestry at all, or they may believe we were referring to commercial or utility arboriculture. Thus, instead of assessing their impression of urban forestry as a career at this point, we measured their previous knowledge of urban forestry. Then we administered a three-minute video about urban forestry as a career before assessing their new/first impression of urban forestry as a career.

In addition to the SCCT framework, we asked students how important 18 professional support mechanisms are when considering a potential career path. Professional support mechanisms are the processes or functions typical to a well-organized profession and are used to further or advance a profession by supporting individuals and regulating who may identify as a professional. These range from tangible products and services such as certification and accreditation to intangible concepts such as meaningfulness of the work.

5.3.2 Pilot Testing

The survey was pilot tested in November 2015 with 36 students. The results were analyzed for internal consistency of 10 latent constructs representing Person Inputs, Background Contextual Affordances, and Learning Experiences with the use of Chronbach's alpha. One construct concerning opinion on environmental policy was changed significantly to improve internal consistency. In the nine other constructs, only minor changes were deemed necessary to improve Chronbach's alpha scores.

5.3.3 Data Analysis

We first used descriptive statistics to characterize respondents by examining their Person Inputs. We also used descriptive statistics to assess the importance students placed on 18 professional support mechanisms when considering potential career paths. We then examined the internal consistency of 10 latent constructs using Chronbach's alpha and adjusted constituent questions where necessary to develop constructs exceeding an alpha score of 0.700. One construct concerning opinion on environmental policy still had insufficient internal consistency, even after major changes during pilot testing, and was abandoned. We then created a new variable representing change in score from Previous Knowledge to New Impression (before and after watching the video). Chi-square test of independence with Bonferroni correction as a post-hoc test was performed on demographic characteristics to determine which groups were under or over-represented in the sample population. We used ANOVA and regression to determine how constructs representing Person Inputs and Background Contextual Affordances may influence Learning Experience constructs.

5.4 Results

We received 1,056 usable responses from undergraduate students at 18 universities. There were 22 faculty who distributed the survey; 7 forwarded the survey link to their students by email and 15 provided time in class for students to complete the survey.

5.4.1 Demographics

The racial composition of respondents was similar to the figures published by the U.S. Department of Education for 2014 (Table 5.1). Respondent mean age was 20.9 and median age was 20.

Table 5.1: Race, gender, residential setting last year of high school, and family income last year of high school of respondents to a survey of life and natural science-oriented students on their perceptions of urban forestry as a career. Student average age was 21 and were from 18 universities east of the Rocky Mountains in the U.S.

Race (n=1019)	Number of Respondents	Percent of Respondents	USDE*
American Indian or Alaskan Native	5	0.5%	0.9%
Asian/Pacific Islander	131	12.9%	6.0%
Black or African American	137	13.4%	15.0%
Hispanic or Latino	61	6.0%	15.0%
White	646	63.4%	60.0%
Another Race	39	3.8%	3.1%
Gender (n=1052)			
Male	530	50.2%	
Female	522	49.8%	
Residential Setting (n=1056)			
Urban	159	15.1%	
Suburban	688	65.2%	
Rural	209	19.7%	
Family Income (n=1056)			
Less than \$20k	56	5.3%	
\$20-40k	121	11.5%	
\$40-60k	130	12.3%	
\$60-80k	156	14.8%	
\$80-100k	195	18.5%	
\$100-150k	192	18.2%	
More than \$150k	206	19.4%	

*United States Department of Education report on racial/ethnic composition of all U.S. college students for 2013
<http://nces.ed.gov/fastfacts/display.asp?id=98>

Chi-square revealed the following trends in demographics of respondents to be statistically significant ($p < .001$): Black or African American students were represented more than expected in the lowest socio-economic status (SES) category and less than expected in the two highest SES categories. White students were represented less than expected in the three lowest SES categories and more than expected in the two highest SES categories.

Asian students were represented less than expected in rural areas. Black or African American students were represented more than expected in urban areas. White students were represented less than expected in urban areas and more than expected in rural areas.

Asian females were represented more than expected and Asian males were represented less than expected. White males were represented more than expected and White females less than expected. Females of any race from suburbs were represented more than expected and females of any race from rural areas were represented less than expected. Males from suburbs were represented lower than expected and males from rural areas were represented more highly than expected.

Urban students were represented more than expected in the two lowest SES categories. Suburban students were represented less than expected in the lowest SES category and more than expected in the highest SES category. Rural students were represented less than expected in the highest SES category.

5.4.2 Professional Support Mechanisms

The most important professional support mechanisms to students (Table 5.2) were the passion or enthusiasm they would have for their work, the meaningfulness of the work they would be doing, and the opportunity to take on new challenges. The least important were opportunities for recognition and awards, the presence of a scientific journal, and that the profession does not require a master's.

Table 5.2: Importance of 18 professional support mechanisms to college students when they are considering a career path from themselves. Scale 1 to 5 from very unimportant (1) to very important (5). Student average age was 21 and were from 18 universities east of the Rocky Mountains in the U.S.

Professional Support Mechanism	Mean (SD)
The passion or enthusiasm you would have for your work	4.57 (0.43)
The meaningfulness of the work you would be doing	4.42 (0.54)
There would be opportunities to take on new challenges	4.35 (0.56)
The level of job satisfaction commonly associated with the profession	4.30 (0.54)
The type of work environment commonly associated with the profession (always indoors, always outdoors, mix of both)	4.18 (0.71)
The profession has an active and helpful professional society	3.97 (0.67)
There is an established body of knowledge for the profession (professionals agree on what you need to know to be considered a professional in this field)	3.94 (0.70)
There is a clear career ladder (you can visualize the promotions you might accomplish in 10 or 20 years)	3.88 (0.93)
The pay level commonly associated with the profession	3.87 (0.75)
The work you would be doing would require you to be an expert	3.87 (0.77)
The profession has a professional society that will offer opportunities for professional mentoring	3.86 (0.75)
The profession has a professional society that offers continuing education and credentials such as certification to document professional knowledge	3.84 (0.77)
Degree programs for this profession are accredited (the quality of the college program and degree is regularly checked by a profession-specific third party)	3.78 (0.82)
Licenses or credentials are commonly used in the profession to document individuals' knowledge	3.73 (0.87)
The level of prestige or respect commonly associated with the profession	3.67 (0.90)
The profession has a professional society that offers opportunities for professional recognition and awards	3.53 (0.94)
There is a respected scientific journal in the profession	3.48 (1.23)
The profession doesn't require formal education beyond a bachelors' degree (doesn't require a masters' degree)	3.10 (1.26)

5.4.3 Personal Motivations

Student motivations concerning pay and prestige (Personal Motivations 1) and personal interest and job satisfaction (Personal Motivations 2) were influenced by their family's motivations including the importance their family places on pay and prestige in career choice (Family Motivations 1) and the importance their family places on personal interest and job

satisfaction in career choice (Family Motivations 2). The constructs Family Motivations 1 ($b=0.330, p<.001$) and Family Motivations 2 ($b=0.290, p<.001$) showed a statistically significant effect on the construct Personal Motivations 1 ($F(2, 1053)=181.96, p<.001$) with an R^2 of 0.26. Additionally, the constructs Family Motivations 1 ($b=0.062, p<.001$) and Family Motivations 2 ($b=0.349, p<.001$) showed a statistically significant effect on the construct Personal Motivations 2 ($F(2, 1053)=149.45, p<.001$) with an R^2 of 0.22.

5.4.4 Previous Exposure

As anticipated, students showed low rates of previous exposure to urban forestry overall at a score of 2.53 on the Previous Exposure construct (Table 5.3) which was significantly below a neutral score of 3; $t(1049)=-13.24, p<.01$. White students ($\bar{x}=2.61 \pm 1.14$) were significantly more aware of urban forestry than Asian students ($\bar{x}=2.25 \pm 0.98, p<.05$) ($F(6, 1013)=2.89, p=.008$). Urban students ($\bar{x}=2.89 \pm 1.21, p<.001$) and rural students ($\bar{x}=2.75 \pm 1.16, p<.001$) were significantly more aware of urban forestry as a career than suburban students ($\bar{x}=2.38 \pm 1.11$) ($F(2, 1047)=17.99, p<.001$). There was no statistically significant difference between urban and rural students ($p=.710$). Students from the SES category of \$60-80k ($\bar{x}=2.81 \pm 1.21$) were the most aware of urban forestry, and significantly more so than students from the SES categories of \$40-60K ($\bar{x}=2.44 \pm 1.13$), \$100-150K ($\bar{x}=2.39 \pm 1.09$), and Greater than \$150K ($\bar{x}=2.34 \pm 1.01$) ($F(6, 1043)=3.68, p=.001$). Female students ($\bar{x}=2.31 \pm 1.07$) were significantly less aware of urban forestry than male students ($\bar{x}=2.75 \pm 1.19$) ($t(1)=37.81, p<.001$). The constructs Family Nature ($b=0.320, p<.001$), Personal Motivations 2 ($b=-0.312, p<.001$), Nature Activity 1 ($b=0.217, p<.001$), and Nature Activity 2 ($b=0.110, p=.002$) all showed a statistically significant effect on Previous Knowledge ($F(4,1045)=57.17, p<.001$) with an R^2 of 0.18.

Table 5.3: Chronbach’s alpha, mean score, and variance of nine constructs created from survey questions and used in analysis. Also included is a description of the construct. Scale 1 to 5 from least (1) to most (5). Student average age was 21 and were from 18 universities east of the Rocky Mountains in the U.S.

Construct name	Construct Description	Chronbach’s alpha	Construct Mean	Construct Variance
Family Nature	Family’s disposition toward nature and the environment	0.838	3.44	0.91
Family Motivations 1	Importance family places on pay/prestige in career choice	0.859	3.42	0.93
Family Motivations 2	Importance family places on personal interest and satisfaction in career choice	0.812	4.01	0.76
Personal Motivations 1	Importance respondent places on pay/prestige in career choice	0.779	3.77	0.74
Personal Motivations 2	Importance respondent places on personal interest and satisfaction in career choice	0.803	4.48	0.58
Nature Activity 1	Interest in consumptive outdoor recreation (hunting and fishing)	0.862	3.25	1.28
Nature Activity 2	Interest in non-consumptive outdoor recreation (hiking and camping)	0.883	3.91	1.00
Previous Knowledge	Previous knowledge of urban forestry	0.940	2.53	1.15
New Impression	Impression of urban forestry as a career path	0.861	3.26	0.85

5.4.5 New Impression

Student impressions of urban forestry as a career path were slightly favorable overall with a score of 3.26 (Scale 1 to 5) after viewing the video (Table 5.3). This was significantly more favorable than a neutral score of 3; $t(1025)=9.63$, $p<.01$. There was no statistical difference in the construct of New Impression between females and males, between students of different ethnic origin or race, or between students who grew up in different residential settings.

Students from the SES category of $> \$150K$ had the least favorable impression of urban forestry as a career overall ($\bar{x}=3.05 \pm 0.84$), which was statistically significantly lower than

students from the categories < \$20K ($\bar{x}=3.45 \pm 0.79$, $p=.043$), \$20-40K ($\bar{x}=3.36 \pm 0.84$, $p=.039$), \$60-80K ($\bar{x}=3.36 \pm 0.80$, $p=.016$), and \$80-100K (3.30 ± 0.86 , $p=.075$) ($F(6, 1019)=3.22$, $p=.004$).

There was no statistically significant difference between the other SES categories.

The constructs Family Nature ($b= 0.202$, $p<.001$), Family Motivations 1 ($b= 0.115$, $p<.001$), Personal Motivations 1 ($b= -0.111$, $p=.002$), and Nature Activity 2 ($b= 0.227$, $p<.001$) all showed a statistically significant effect on the New Impression construct ($F(4, 1021)=45.82$, $p<.001$) with an R^2 of 0.15.

5.5 Discussion

This study aimed to determine how life and natural science-oriented students are influenced by professional support mechanisms and their Background Contextual Affordances (values and beliefs students learn from their environment growing up) when considering career possibilities. Additionally, we determined students' level of previous knowledge of urban forestry and, after learning about it, their new impression of it as a career.

We intentionally contrasted concepts of job satisfaction and personal interest against concepts of high pay and job prestige, a dichotomy of competing interests often faced by job-seekers (Judge et al., 2010). We found that job satisfaction and personal interest were the most important considerations to students (and to their parents) when considering career choice. The construct representing these items had the highest score of all seven Background Contextual Affordance constructs. This was supported by our finding that the two most important professional support mechanisms (Table 5.2) were the passion or enthusiasm a student would have for their work and the meaningfulness of the work.

Similarly, Sharik and Frisk (2011) surveyed students enrolled in traditional forestry degree programs and found that students had pursued forestry careers largely due to personal interest and perceived job satisfaction (love of nature and the outdoors), despite hesitations concerning low wages, job availability, and poor public image of the profession. Like traditional forestry, urban forestry can be a rewarding career path for someone with a love of nature and working outdoors while still presenting opportunities for new challenges which are the very traits of a profession that these students are receptive to. There were no obstacles identified, regarding either professional support mechanisms or Background Contextual Affordances, that would prevent urban forestry from appealing to life and natural science-oriented students.

After finding little or no evidence that the professional support mechanisms most valued by students and their Background Contextual Affordances would be detrimental to perceptions of urban forestry, we turned to an examination of how Person Inputs may influence perceptions. Sharik (2015) found females and non-white students to both be underrepresented in traditional forestry relative to other natural resource disciplines. And it is known that there is poor racial, ethnic, and gender diversity among urban forestry practitioners (Kuhns et al., 2002, 2004). Thus, we provided students with a Learning Experience in the form of a three-minute video about urban forestry as a career and then assessed how their new/first impression varied by demographic. There were differences in impression where the wealthiest students were less interested and students within the midrange socio-economic status were more interested. However, we found no statistically significant difference in impression of urban forestry as a career between students of different genders, races, ethnic backgrounds, or residential setting.

This is promising as it shows that the dominance of white males in the profession is not due to urban forestry lacking traits that appeal to other groups or possessing traits that repel

them. Instead, it is likely due to lack of exposure. Thus, there is potential to attract more diverse populations of students into urban forestry degree programs if awareness of urban forestry as a career can be increased via positive Learning Experiences.

This study found that students are not consistently being made aware of urban forestry as a career choice. Assessing this awareness of urban forestry, and any demographics that may explain differences in level of awareness, was another objective. We had assumed awareness of urban forestry was low and our results support that assumption. When considered in isolation, the score of 2.53 on the construct Previous Knowledge would fall halfway between ‘neither disagree nor agree’ and ‘disagree’ that they knew about urban forestry. However, this was the lowest score of all nine constructs and we feel that it is critically important to note that there was no other construct on the survey with which they disagreed with more than having previous knowledge of urban forestry. This is not surprising as we are not aware of any nationally or regionally coordinated effort to promote urban forestry as a career or to manage the public image of urban foresters in general.

Males were more likely than females to know about urban forestry. Rural students were more likely to know about urban forestry than suburban students. And white students were the most likely racial or ethnic group to know about urban forestry. While this may seem counterintuitive, this is consistent with the historical demographics of traditional forestry and natural resources programs in which most urban forestry degree programs are imbedded (Kuhns et al., 2002, 2004; Sharik and Frisk, 2011). We suggest that rural, white males are most likely to be exposed to urban forestry as a career because they are most likely to be in adjacent natural resources programs.

We did not measure how students from any background specifically were exposed to urban forestry (Learning Experiences), so reasons for these differences are open to interpretation. Urban forestry lacks the structure and organization seen in many other professions such as active recruitment efforts. There is no outreach and education initiative at the national or regional level that we are aware of that would result in this outcome, though there are state-level programs. Examining strategies for exposing K-12 students to urban forestry is a logical step for further research, and could include evaluating and assessing the impact of existing programs such as Urban Forests: A Supplement to Florida's Project Learning Tree (de Vera et al, 2006) and the expansive Urban Forest Lesson Guide supplement to LEAF: Wisconsin's K-12 Forestry Education Program (LEAF, 2016).

We did not differentiate between arboriculture and urban forestry when asking students about previous knowledge, and possible confusion between the two while responding to questions about knowledge of urban forestry (before watching the video about urban forestry as a career) is a limitation. Thus, low rates of previous knowledge of urban forestry would probably have been even lower if we had made the distinction clear. As is, with rates of exposure to urban forestry being so low and inconsistent, it seems students only learn of urban forestry when they have already elected to pursue a career in traditional forestry or natural resources, effectively filtering students out that may otherwise be interested in a natural resources career but are turned off by some component of the public image of these programs (e.g., natural resources careers are only found in rural areas).

Aside from the wealthiest students displaying lower interest in urban forestry than other students, we found no Person Inputs that would preclude urban forestry from recruiting a greater diversity of students. Examination of professional support mechanisms and Background

Contextual Affordances likewise revealed no significant barriers. Lack of awareness seems to be the greatest obstacle to recruiting more students and a greater diversity of students into urban forestry. The profession may need to promote its public image independent of traditional forestry and natural resources programs to better capture the attention of new students.

5.6 Conclusions

Urban forestry is a new and relatively small profession and thus still suffers from lack of awareness. Exposure to urban forestry amongst these natural and life science-oriented students is low and inconsistent. This study suggests that several possible factors can probably be eliminated as potential barriers to recruitment and that this lack of awareness is probably the greatest impediment to expansion. Currently, students who choose to study urban forestry are pre-filtered by their attraction to adjacent traditional forestry and natural resources programs, excluding students who might be interested in urban natural resources management. Enrollment could probably be increased and diversified through an active, national strategy to provide Learning Experiences to students. The current makeup of students pursuing urban forestry degrees is unlikely to change unless the profession and degree programs develop a public image and recruitment strategy that reaches beyond the populations historically reached by traditional forestry and natural resources programs.

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6.0 – CONCLUSIONS

6.1 Professionalism of Urban Forestry

We found that the allied professions were heavily invested in professional support mechanisms and professional self-regulation. This scheme formed the backbone of significant social capital between these professionals who have been successfully collaborating to manage the urban environment for over a century. Urban forestry, on the other hand, was perceived by allied professionals as having inferior professional support mechanisms including even basic certification of individual competency, and is therefore failing to self-regulate. This communicates disorganization and unprofessionalism. If urban foresters wish to increase their influence on the planning and management of the urban environment, they must increase their social capital with the allied professions who dominate that realm through the development of professional support mechanisms. These results highlight some issues at the core of urban forestry, including lack of consensus on professional identity which is usually established by a BoK and associated professional certification. Urban forestry should invest in these professional support mechanisms.

6.2 Urban Forestry Career Opportunities

We identified several potentially significant deficiencies in the urban forestry career ladder, the most noteworthy being the dearth of entry-level positions available to recent graduates of four-year degree programs. Instead, there is an expectation that most urban forestry graduates will spend their first 2-5 years after college working as an arborist, as supported by our interviews and focus groups. This is a potentially significant deterrent to recruitment because not every student who wants to be an urban forester also wants to or is capable of working as an

arborist. This lack of entry-level urban forestry positions represents a bottleneck into the profession from four-year degree programs and may be contributing to low enrollment in those degree programs. This situation is also likely contributing to issues of professional identity and public image such as urban forestry being mistaken as synonymous with arboriculture. This and several other deficiencies we observed in the career ladder need to be addressed nationally if urban forestry is to serve as a reliable and consistent career path. Urban forestry should invest in addressing these deficiencies, especially the lack of entry-level positions. Those organizations that employ more than one or two urban foresters (e.g., large municipalities, state forestry agencies) are most likely to be able to accommodate entry-level employees.

6.3 Student Perceptions of Urban Forestry

We found the public image of urban forestry is not actively managed or promoted. This was reflected by very low rates of previous knowledge of urban forestry as a career among life and natural science-oriented students. However, after providing a brief introduction to urban forestry as a career, we eliminated several potential barriers to diversifying recruitment into the profession including race, gender, residential setting growing up, and socio-economic status (except for the wealthiest students). Urban forestry presents an opportunity to both pursue a love of nature as a career and live in a non-rural area, and should thus be more attractive to females and non-whites than the current composition of practitioners would suggest. Exposure to urban forestry amongst these life and natural science-oriented students was low and inconsistent, and awareness seems to be the greatest limiting factor to increased diversity. This is a significant impediment, though it is promising that race and gender were not significant barriers. Future research should examine increasing awareness and providing positive Learning Experiences

through K-12 programming such as occurs at nature centers and the Wisconsin LEAF/School Forest program.

6.4 Implications of this Research

This study revealed that, as a relatively young profession, urban forestry lacks much of the structure and organization seen in other, more well-established professions. However, it also revealed that growing pains are typical and that the single most important process or function we can adapt from successful professions ranging from medical doctors to ergonomic engineers is professional self-reflection. The intent of examining ones' own profession may be to realign with the needs of society, or to better serve practitioners. Regardless of the purpose, the action of intentional and mindful self-improvement is a hallmark of all well-established and highly regarded professions. The urban forestry literature shows a dearth of thought toward this end. The most important contribution of this study is probably not concerning any current ailment, but rather introducing the concept of viewing the profession holistically and initiating a conversation about improving urban forestry where there previously was none.

This study started by examining poor recruitment into the profession and quickly branched into studying career opportunities and our relationship with allied professionals as well. Some possible solutions to those problems were identified. However, those problems are just symptoms of a larger, more significant illness. There are problems at the core of the profession including confusion and disagreement on our professional identity, a lack of national leadership, a lack of a dedicated professional society, poor name recognition, and persistent lack of awareness. These are the fundamentals of a profession and are here in disarray. Efforts to improve the profession must begin by addressing these critical problems. Modeling new structure and organization on the successes of other professions would be the best way to begin.

APPENDIX A

List of organizations that distributed the link to the survey of allied professionals concerning their perceptions of professionalism in urban forestry.

- 1) American Rivers
- 2) American Society of Landscape Architects
- 3) American Planning Association
- 4) National Association of Clean Water Agencies
- 5) National Recreation and Parks Association
- 6) The Nature Conservancy
- 7) Sustainable Urban Forests Coalition
- 8) US Water Alliance

APPENDIX B

Universities in the United States that offer undergraduate degree programs allowing specialization (majors, minors, etc.) in urban forestry. This list represents programs that appear to be active as of October 2016.

School	City	State
Pennsylvania State University	State College	PA
Southern University and A&M College	Baton Rouge	LA
Southern Illinois University	Carbondale	IL
Stephen F. Austin State University	Nacogdoches	TX
University of Florida	Gainesville	FL
University of Maryland	College Park	MD
University Nebraska - Lincoln*	Lincoln	NE
University Tennessee - Knoxville	Knoxville	TN
University Wisconsin - Stevens Point	Stevens Point	WI
Virginia Tech	Blacksburg	VA
West Virginia University	Morgantown	WV
*Proposed		

APPENDIX C

Universities that participated in the study of student perceptions of urban forestry as a career. Faculty at each school participated by either administering the survey to their students in-class, or by forwarding a link to their students via email.

University	City	State
Colorado State University	Fort Collins	CO
DePaul University	Chicago	IL
Cornell University	Ithaca	NY
Lincoln University	Lincoln University	PA
University of Maryland	College Park	MA
Oregon State University	Corvallis	OR
Purdue University	West Lafayette	IN
Southern Illinois University	Carbondale	IL
Stephen F. Austin State University	Nacogdoches	TX
University of Massachusetts	Amherst	MA
Tennessee State University	Nashville	TN
University of Missouri	Columbia	MO
University of Tennessee-Knoxville	Knoxville	TN
University of Wisconsin-Stevens Point	Stevens Point	WI
Virginia Tech	Blacksburg	VA
Virginia State University	Petersburg	VA
Virginia Commonwealth University	Richmond	VA
West Virginia University	Morgantown	WV

APPENDIX D

IRB approval for survey of allied professionals (Chapter 3) and for survey of college students (Chapter 5)



Office of Research Compliance
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MEMORANDUM

DATE: December 8, 2015
TO: Susan D Day, Keith Taylor O'Herrin, Eric Wiseman
FROM: Virginia Tech Institutional Review Board (FWA00000572, expires July 29, 2020)
PROTOCOL TITLE: A Regional Approach to Understanding the Urban Forestry Workforce and Building its Capacity through Collegiate Programs
IRB NUMBER: 12-1020

Effective December 8, 2015, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the Amendment request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

<http://www.irb.vt.edu/pages/responsibilities.htm>

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As: **Exempt, under 45 CFR 46.110 category(ies) 2**
Protocol Approval Date: **November 5, 2015**
Protocol Expiration Date: **N/A**
Continuing Review Due Date*: **N/A**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

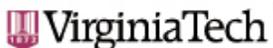
The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

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APPENDIX E

IRB approval for interviews of successful job candidates (Chapter 4)



Office of Research Compliance
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MEMORANDUM

DATE: May 20, 2016
TO: Susan D Day, Keith Taylor O'Herrin, Eric Wiseman
FROM: Virginia Tech Institutional Review Board (FWA00000572, expires January 29, 2021)
PROTOCOL TITLE: A Regional Approach to Understanding the Urban Forestry Workforce and Building its Capacity through Collegiate Programs pt.2
IRB NUMBER: 16-376

Effective May 20, 2016, the Virginia Tech Institutional Review Board (IRB) Chair, David M Moore, approved the Amendment request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

<http://www.irb.vt.edu/pages/responsibilities.htm>

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As: Expedited, under 45 CFR 46.110 category(ies) 5,6,7
Protocol Approval Date: April 7, 2016
Protocol Expiration Date: May 19, 2017
Continuing Review Due Date*: May 5, 2017

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

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