Educating for Sustainable Forestry: Perspectives on the Career Readiness of New Professionals

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EDUCATING FOR SUSTAINABLE FORESTRY: PERSPECTIVES ON THE CAREER READINESS OF NEW PROFESSIONALS

A Dissertation

by

Samantha M. Jones

Submitted to the Graduate College of Winona State University in partial fulfillment of the requirement for the degree of

DOCTOR OF EDUCATION

May 2021
This dissertation, submitted by Samantha Jones in partial fulfillment of the requirements for the degree of Doctor of Education at Winona State University, Winona, Minnesota, is hereby approved by the committee under which the work has been completed.

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ABSTRACT

Educating for Sustainable Forestry: Perspectives on the Career Readiness of New Professionals (May 2021)

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This qualitative phenomenological study explored forestry career readiness from the perspective of forestry employers and early career forestry professionals. A virtual focus group interview, individual online interviews, and a review of forestry education documents produced study data. Participants were selected through snowball sampling. Data were analyzed through open and axial coding. Salient themes emerging from this inquiry centered on the dynamic complexity of forestry, field competence, interpersonal skills, and situated learning. Study findings concluded that sustainable forest management required field skills to conduct remote forestry activities and interpersonal skills to negotiate diverse stakeholder interests. Implications for educational practice and recommendations for future research include re-engineering forestry courses to provide situated interpersonal and field-based learning experiences and exploring forestry educator perspectives on integrating situated learning pedagogies to improve the career readiness of new forestry professionals.
DEDICATION

This work is dedicated to forests and all who dwell within them. May there always be trees for tomorrow.
ACKNOWLEDGEMENTS

We are the product of everything we have experienced; many sources of support made this work possible. I’m grateful for each contribution that led me to this point, including those not explicitly identified here.

Special appreciation to my committee chair, Dr. Holmes, whose immediate confidence in me galvanized the motivation to undertake this program. Thank you as well, Dr. Holmes, for holding the bar high and equipping us with the capacity to clear it. Your inspiring practical wisdom will endure well beyond this academic journey.

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I am eternally grateful to my loving husband and family for giving me the security and encouragement to pursue my ambitions. Thank you for supporting and tolerating me throughout this endeavor; it would not have been possible without you.
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CHAPTER I
INTRODUCTION

Sustaining forested ecosystems and forest resources in the context of rapid environmental and social change depends upon well-educated foresters practicing sound forestry (Sample & Bixler, 2014). National surveys reveal persistent shortcomings in forestry education, with employers reporting that graduates lack the essential interpersonal skills required for the practice of sustainable forestry (Sample et al., 1999, 2015). Sustainable forest management increasingly depends upon not only technical knowledge but also interpersonal skills to collaborate across diverse stakeholder perspectives (Bullard et al., 2014). Land development, climate change, and intensified environmental stressors threaten the integrity of forested ecosystems and increase competition for resources (USDA Forest Service, 2012). Bullard et al. (2014) observed that within this highly competitive and dynamic context, “society-ready” foresters must be able to effectively manage “the complex economic, ecological, and social issues involving forest resources today” (p. 355). Despite long-standing calls within the forestry community to strengthen the interpersonal skills of graduates, producing society-ready foresters remained an unattained priority, leading to claims that academia was no longer providing career-relevant forestry education (Brown, 2003).

Sustainable world ecosystems depend on forests, yet globally, deforestation and forest degradation continue at alarming rates (Food and Agricultural Organization (FAO) & United Nations Environment Program (UNEP), 2020). Forests are vulnerable to the detriments of advancing climate change, and projections estimate that current management trajectories will fail to meet a planned increase in global forest cover needed to mitigate continued warming (FAO & UNEP, 2020; Wang et al., 2019). Achieving sustainability of the world’s forests requires a shift from command-and-control forest management to “governance mechanisms that simultaneously satisfy multiple stakeholder interests” (Sheppard et al., 2020, p. 6). Making that governance shift to achieve sustainability may remain untenable without changes in forestry education to adequately prepare future forestry professionals for the interpersonal aspects of forestry.
Protecting forest resources in the United States is equally dubious without changes in forestry education. The increasing frequency and intensity of wildfires, insect and disease outbreaks, and climatic stressors challenge managers to ensure the vitality and productivity of forested ecosystems (U.S. Global Change Research Program, 2018). Recent assessment of western forests reveals significant decline in the most abundant tree species as a result of increased anthropogenic and natural disturbances (Stanke et al., 2021). Concomitant with the forest management crisis is an inability to deploy a sufficiently trained cadre of forestry graduates (Sample et al., 2015). Existing forest management practices no longer suffice in the current context of accelerating environmental change (Sample & Bixler, 2014). Foresters must navigate not only the technical but also the interpersonal dimensions of forestry to negotiate sustainable management decisions that meet multiple objectives, not just harvest yields (Bullard et al., 2014; Sample et al., 2015). In addition to producing tangible raw materials, forests are vital to sustaining livelihoods, providing clean air and water, conserving biodiversity, and responding to climate change (FAO, 2020). Yet, as Sample et al. (1999, 2015) observed, marked discrepancies exist between the importance and the preparedness of new foresters to resolve management conflicts and communicate effectively.

In the state of Minnesota, hastening environmental change and competing resource management priorities threaten forested ecosystems, highlighting the need for career-relevant forestry education. Handler et al. (2014) cite land conversion, shifting fire regimes, and extreme weather events among the major factors impeding sustainable forest management. Minnesota’s forests are fundamental to clean air and water, biodiversity, raw materials, and a host of occupations directly and indirectly dependent on forested ecosystems. The Sustainable Forest Resources Act (SFRA) established sustainable forestry as a statutory mandate in Minnesota to ensure sound management of this valuable natural asset. SFRA dictates sustainable management and use of forest resources through “cooperation and collaboration between public and private sectors” (Minnesota Forest Resources Council (MFRC), 2019, p. 11). Minnesota’s Forest Action Plan, in addition to being a vehicle for management funds, sets the overarching tone for sustainable forestry in the state. The Forest Action Plan reflects the multifaceted nature of sustainable management in striving to collaborate across
ownerships to maintain the integrity of forested ecosystems and the viability of forest-derived resources and economies for the long-term (MN DNR Division of Forestry, 2020). Further heeding the SFRA statute and providing for evaluation of sustainable forestry practice, Minnesota engages in forest certification. Forest certification is voluntary, with annual audits conducted by third-party agencies that define, evaluate, and recognize sustainable forestry (Minnesota DNR Forestry, 2020a). Minnesota is duel certified through Forest Stewardship Council (FSC) and the Sustainable Forestry Initiative (SFI), both internationally recognized forest certification systems (MN DNR Forestry, 2020).

The SFRA, Forest Action Plan, and dual certification serve to ensure sustainable management of the state’s forest resources, in part by keeping pace with environmental and societal changes. However, a recent increase in state timber harvesting goals further intensified existing sustainable forestry challenges (MN DNR, 2018). Increased timber harvesting goals required foresters to identify more acres of forest to cut in order to reach cord quotas while still meeting broader ecological objectives, such as maintaining ecosystem services and wildlife habitat. Typically, meeting ecological objectives necessitates leaving more trees on the landscape, posing a challenging management conflict. Minnesota Forest Resources Council (MFRC) defined sustainable forestry as proactively managing forests to provide for multiple uses by balancing a diversity of present and future needs (MFRC, 2005). Forest certification violations revealed during the 2019 FSC audit (SCS Global Services, 2019) and internal controversies following the plan for increased timber harvesting point to discrepancies in achieving this balance (Nelson, 2019). Tensions were particularly high between forestry and wildlife management agencies. A coalition of conservationists, including state wildlife managers, charged that harvest planning singly emphasized timber industry needs over wildlife habitat needs (Serna, 2021). Requests from resource managers for workshop scenarios that facilitated opportunities to practice coordinated forest management and more effectively reconcile conflicting management objectives suggests that education has insufficiently prepared its forestry professionals (Eliason et al., 2003).

The north central region of Minnesota is reliant on sustainable management of its forest resources, and thereby, well-trained forestry professionals. This region is uniquely diverse, spanning four ecological provinces
from prairies and parklands to broadleaf and mixed conifer forests. Land ownership and management are equally complex. Most of the north central landscape (59.8%) is privately owned. Public lands allocated among federal (9.6%), state (13.9%), and county (14.8%) agencies and tribal entities make up roughly two percent of land ownership (MFRC, 2017b). The diversity of forest ecology and land ownership sets a complex resource management stage. Moreover, forest-based economic sectors provide vital employment within the region, adding another dimension to management considerations. Logging and wood products manufacturing, along with forest and wildlife management occupations, account for over 2,000 jobs (MFRC, 2017a). Forests are also the foundation of hunting and recreating landscapes and the associated service industries that dependent upon seasonal tourism (MFRC, 2017b). Sustainable management of forest resources is vital for not only ecological but also social reasons, and the complexity of forest diversity, land ownership, and management objectives in the north central region makes this a difficult endeavor. Foresters must possess not only specific technical skills and ecological understandings to manage unique forest systems, but also interpersonal skills to coordinate with a multitude of stakeholders in meeting the multi-use sustainability mandate. This challenging dichotomy mirrors the national context, which is laden with concerns over the career-relevance of forestry education and the society-readiness of forestry professionals (Bullard et al., 2014; Sample et al., 2015).

**Purpose Statement**

The purpose of this qualitative phenomenological study was to explore the career readiness of new forestry professionals in north central Minnesota from the perspective of forestry employers and early career forestry professionals.

**Statement of the Problem**

Minnesota’s forest resources are paramount to the integrity and function of ecological, social, and economic systems, yet remain threatened by environmental change and sustainability challenges (Handler et al., 2014; MFRC, 2017b). Tensions over different management priorities exemplify a broader pattern of discrepancy between the competencies provided by forestry education and those required in practice (Sample et al., 2015; Seitz, 2020; Serna, 2021). A growing crisis of confidence exists in the relevance of forestry education
and the society readiness of new foresters to negotiate the complexities of sustainable forestry (Brown, 2003; Bullard et al., 2014; Meyer, 2019). Alignment between forestry education and practice is well-studied at the national level (Guldin, 2019b; Sample et al., 1999, 2015), yet limited research exists on the career readiness of Minnesota’s new forestry professionals.

**Background of the Problem**

The lack of interpersonal skills among forestry professionals is a long-standing problem (Bullard, 2015; Bullard et al., 2014; Sample et al., 2015). Bullard et al. (2014) opined that “despite national surveys, conferences, and symposia of forestry leaders that have consistently focused on the need to address these skills, they are still the highest priority competencies to strengthen” (p. 359). Early research efforts offer various explanations for the persistent mismatch within the forestry community between the knowledge and skills provided by education and those required in practice. Findings from a 1949-1950 nationwide survey of over 700 practicing foresters ranked speaking and writing competence as highest in terms of overall importance, suggesting a need for more humanities courses in the professional forestry curriculum (Barrett, 1953). Nearly fifty years later, a similar study set out to measure the skills deemed vital by employers and new professionals against perceptions of how well forestry programs imparted those attributes (Sample et al., 1999). Sample et al. (1999) noted discrepancies between required skills and the performance of forestry graduates, attributing large gaps in communication, leadership, collaborative problem-solving, and dispute resolution abilities to forestry curricula primarily focused on technical and scientific training.

A follow-up study yielded similar results. In 2013, Sample et al. (2015) assessed the extent to which forestry degree programs provided students with the knowledge and skills needed for professional forestry practice. Findings from surveys of forestry graduates, faculty members, and deans bared significant discrepancies between importance and preparedness in the interpersonal aspects of forest management, especially communicating effectively and behaving ethically (Sample et al., 2015). Sample et al. (2015) observed a recurrent theme of “tension between the technical/core courses that make up traditional forestry education and those that are needed to respond to emerging issues and incorporate human dimensions” (p. 533).
The authors concluded that forestry programs needed to provide students with expertise in breadth through greater commitment to the social sciences and human dimensions of forest management.

Barrett (1953) and Sample et al. (1999, 2015) attributed the lack of interpersonal skills among forestry graduates to insufficient social sciences education in forestry programs, yet others perceived a more nuanced explanation. Brown (2003) recognized the “gap between what foresters are competent to do and the demands that society is placing on them” (p. 3) but identified a different solution. Rather than advocating increased academic rigor or expanded curriculum, Brown (2003) asserted that learning to think like a forester involved more than the passive receipt of authoritative knowledge. Drawing on the work of Eraut (1985), Brown (2003) declared that professional education existed through not only a detailed understanding of specialized knowledge but also by learning the appropriate context in which to apply this knowledge through accumulated experience. Forestry practice entails specialized technical knowledge readily communicated through coursework, as well as practical knowledge, acquired through direct involvement (i.e., situated learning). Forestry programs traditionally emphasized core academic disciplines and technical training, reflecting an implicit belief in technical rationality (Plack & Greenberg, 2005) when “most problems in real-world practice cannot be solved by the application of factual knowledge” (Brown, 2003, p. 3).

**Sustainable Forestry in Minnesota**

In Minnesota, the dilemma of educating for sustainable forestry manifests in ways that span various facets of the profession. Forests factor significantly in the state’s economy through job creation, tourism, and raw materials provision, and as a result sustaining forested resources undergirds management policy (MN DNR, 2015). The 1995 Sustainable Forest Resources Act (SFRA) established procedures and programs to ensure the sustainable use and management of forests. Minnesota Forest Resources Council (MFRC) emerged from SFRA to provide voluntary guidelines on sustainable management (Minnesota Forest Resources Council, 2005). While voluntary in nature, the guidelines define site-level best management forestry practices.

Further fulfilling the commitment to sustainability, state and county agencies enroll in forest certification programs, namely Forest Stewardship Council (FSC) and Sustainable Forestry Initiative (SFI) (MN
DNR Forestry, 2020b). FSC and SFI set standards for sustainable forestry practices, evaluating and certifying member forest management agencies. Both programs address forest worker preparedness with specific tenets. FSC (2018) management plan standards included a principle to ensure that forest workers “receive adequate training and supervision to ensure proper implementation” (p. 64). SFI (2015) standards and rules outline a training and education objective to “improve the implementation of sustainable forestry practices through appropriate training and education” (p. 24).

Even with standards to promote education and informed coordination among forestry partners, a recent FSC certification audit revealed challenges in communicating and collaborating to achieve multiple sustainable forest management objectives. Audit findings included a corrective action request mandating that stakeholders “subject to direct adverse effects of management operations shall be apprised of relevant activities in advance of the action so that they may express concern” (SCS Global Services, 2019, p. 17). While not mandatory for compliance, a related observation recommended forest managers “seek and consider input in management planning from people who would likely be affected by management activities” before executing management decisions (SCS Global Services, 2019, p. 16). Audit findings validate the claim that society-ready foresters must be equipped with the interpersonal skills to negotiate the human dimensions of forest management (Bullard et al., 2014).

Minnesota forestry education programs follow national SAF accreditation standards, requirements that some have argued limit curriculum options (McGowan 2015). Sample et al. (2015) observed that deans frequently emphasized the difficulty of preparing students in both natural and social sciences within stipulated credit hour limits. Addressing the human dimensions of sustainable forestry insufficiently within the curriculum creates a steep initial learning curve for new professionals and occasion for continuing education. Minnesota’s Sustainable Forestry Education Cooperative (SFEC) offers a range of topics, from field skills to voluntary forest management guidelines (Coffin et al., 2001). In focus group meetings held to assess continuing education needs, participants requested sessions that facilitated partner interaction to practice collaborative decision-making scenarios (Eliason 2003). Cross-training and communication also emerged as key themes,
with several participants noting this “would be an opportunity for improving communication skills, so they can
be more effective in working with loggers and landowners” (p. 75). As observed in the findings of national
research efforts, these interpersonal skills are fundamental to fulfilling the multi-use mandate of sustainable
forest management (Bullard et al., 2014; Sample et al., 2015). Moreover, SFEC focus group findings indicate a
need for problem-based, situated learning to acquire the nuanced interpersonal skills required of a practicing
forester (Brown, 2003).

Significant environmental and economic stressors attend forestry education challenges in Minnesota,
further confounding sustainable management (Handler et al., 2014). Forest managers face increasing challenges
in sustaining forests amid changing climatic and socioeconomic conditions (MN DNR Division of Forestry,
2020). New forestry professionals need to know the latest science surrounding best management practices, and
they must also negotiate the social dimensions of achieving consensus across multiple stakeholders (MFRC,
2019). Recent increases in state timber harvesting goals, set forth in the Sustainable Timber Harvest Analysis
(STHA), further challenge sustainability (MN DNR, 2018). Foresters must now reconcile increasingly
competitive and conflicting management objectives to meet higher timber harvesting targets. Findings from the
most recent certification audit reflect these tensions, and the ongoing controversy surrounding STHA illustrate
the difficulty of contemporary forestry; negotiating sustainable management decisions that also achieve
stakeholder and partner agency outcomes (Nelson, 2019; Serna, 2021). Forestry education’s inattention to the
contentious social aspects of forest management renders graduates ill-prepared for this complex and dynamic
professional practice. Minnesota’s forestry program alumni enter the workforce under these rigorous
environmental and social circumstances, and in the context of limited knowledge on the performance of formal
education. Therefore, a need exists to explore how forestry education is advancing the career readiness of
Minnesota’s future forestry professionals.

Research Questions

The following research questions guided this phenomenological study:

1. What are employers’ career readiness expectations of early career forestry professionals?
2. How do recent graduates describe their first years in the profession?

3. What organizational re-engineering is needed to strengthen forestry education programs?

**Definition of Terms**

This research study explored the career preparedness of forestry professionals in Minnesota. The researcher used the identified definitions for the following terms:

**Eastern Broadleaf Forest Province:** The eastern broadleaf forest province serves as a transition, or ecotone, between semi-arid western prairies and semi-humid northeastern mixed conifer-deciduous forests (MN DNR, 2020).

**Ecological Province:** Ecological provinces are units of land defined by major climate zones, native vegetation, and biome (MN DNR, 2020).

**Forest certification:** Forest certification is a voluntary third-party process that identifies and recognizes well-managed forest land, taking into consideration the ecological, economic, and social components of forests and surrounding communities (MN DNR Forestry, 2020).

**Forest Stewardship Council (FSC):** FSC is an independent, non-profit organization that protects forests for future generations. As a membership-led organization, FSC sets standards under which forests and companies are certified. Membership “consists of three equally weighted chambers -- environmental, economic, and social -- to ensure the balance and the highest level of integrity” (Forest Stewardship Council, 2020).

**Laurentian Mixed Forest Province:** The Laurentian mixed forest province, characterized by broad areas of conifer forest, mixed hardwood and conifer forests, and conifer bogs and swamps, is the most diverse of Minnesota’s ecological provinces (MN DNR, 2020).

**Minnesota Forest Resources Council (MFRC):** MFRC exists to “lead and coordinate efforts related to implementation of the SFRA. The MFRC meets its statutory charge through work associated with its
programs related to site level management, landscape planning and coordination, applied research and monitoring, and policy” (MFRC, 2019, p. 5).

**Prairie Parkland Province:** The prairie parkland province that traverses western Minnesota is characterized by tallgrass vegetation, low winter precipitation and desiccating westerly winds that promote spring fires (MN DNR, 2020).

**Social-ecological Systems:** Social-ecological systems are systems that include societal (human) and ecological (biophysical) subsystems linked through mutual interactions and interdependencies (Levin et al., 2013).

**Society-ready Foresters:** Society-ready foresters are forest managers capable of dealing effectively with the complex economic, ecological, and social issues involving forestry in the 21st century (Bullard et al., 2014).

**Sustainability:** Sustainable forestry is “a proactive form of management that provides for the multiple uses of the forest by balancing a diversity of both present and future needs. It is a process of informed decision-making that takes into account resource needs, landowner objectives, site capabilities, existing regulations, economics and the best information available at any given time” (Minnesota Forest Resources Council, 2005, p. 1).

**Sustainable Forestry:** Sustainable forest management is a “dynamic and evolving concept, which aims to maintain and enhance the economic, social and environmental values of all types of forests, for the benefit of present and future generations” (Food and Agriculture Organization (FAO), 2020).

**Sustainable Forest Resources Act (SFRA):** SFRA is a policy of the state of Minnesota to “(1) pursue the sustainable management, use, and protection of the state's forest resources to achieve the state's economic, environmental, and social goals; (2) encourage cooperation and collaboration between public and private sectors in the management of the state's forest resources; (3) recognize and consider forest resource issues, concerns,
and impacts at the site level and landscape level; and (4) recognize the broad array of perspectives regarding the management, use, and protection of the state's forest resources, and establish and maintain processes and mechanisms that seek and incorporate these perspectives” (Sustainable Forest Resources Act of 1995, Sec. 89A.02, p. 2).

**Sustainable Forestry Initiative (SFI):** SFI is an independent, non-profit organization dedicated to promoting sustainable forest management through representing environmental, social, and economic sectors equally. Forests certified to SFI standards cover a quarter-billion acres, stretching from the Canadian boreal forests to the southern United States. Certification enhances marketing opportunities for SFI program participants (SFI, 2015).

**Sustainable Timber Harvest Analysis (STHA):** The STHA was a third-party analysis conducted that modeled a range of scenarios to demonstrate the tradeoffs between important forest resource values at various levels of timber harvest. Model parameters considered six key forest values: timber productivity, natural resource economies, biodiversity, water quality, wildlife habitat, and forest health. STHA results were considered in determining 10-year sustainable harvest levels (MN DNR, 2018).

**Tallgrass Aspen Parklands Province:** The tallgrass aspen parklands province is dominated by prairie and fire-dependent woodland communities, forming an ecotone between semi-arid western prairie landscapes and semi-humid eastern mixed forests (MN DNR, 2020).

**Voluntary forest management guidelines:** Voluntary forest management guidelines are a set of recommendations developed by MFRC to “provide valuable decision-making tools for landowners, resource managers and loggers throughout Minnesota, who share an ongoing responsibility to make balanced, informed decisions about forest use, forest management and forest sustainability” (MRFC, 2005, p. 9).

**Significance of Study**

This study supplemented the existing body of knowledge on forestry education and the career readiness of foresters. Additionally, it filled a gap in the literature on the educational and early career perceptions and
experiences of Minnesota’s forestry professionals. The research informed the forestry community on the importanc
e of developing society-ready foresters equipped with both field competence and the interpersonal skills needed for sustainable forest management. Research questions were designed to elicit information about forestry curricula and the preparedness of recent forestry program graduates. Responses describing the experiences and performance of recent graduates might assist higher education faculty in developing best practices for imparting career readiness to future forestry professionals.

Summary

Chapter I provided an introduction to the research inquiry with significant information relating to the career readiness of forestry professionals. Additionally, Chapter I outlined the purpose of this study, problem statement, and background of the problem. The research questions guiding this study, definition of terms, and significance of study were also covered in Chapter I. Chapter II will present the review of literature, which explores the evolution of research on forestry education and the career readiness of forestry professionals. Chapter III will present the methodology used in this qualitative phenomenological study. Chapter IV will present the findings of this study, followed by a discussion of those findings in Chapter V.
CHAPTER II

REVIEW OF LITERATURE

Introduction

The purpose of this qualitative phenomenological study was to explore how forestry educators prepare future career professionals for sustainable forest management. This chapter presents the literature review, which identifies and synthesizes relevant publications on forestry education. Chapter II is organized into three sections. The first section provides a background for the competing perspectives on forestry education. Section two discusses evolving interpretations and assessments of forestry career readiness. Finally, the third section explains the theoretical framework undergirding this study.

Evolving Perspectives on Forestry Education

Society of American Foresters (SAF) began accrediting forestry education programs in 1935 (SAF, n.d.). Since that time, ongoing research offered various explanations for a longstanding mismatch within the forestry community between the knowledge and skills that education provided and those required in practice. National surveys revealed persistent shortcomings in forestry education based on the performance of forestry professionals in sustainably managing forests (Barrett, 1953; Sample et al., 1999, 2015). This deficiency reflected a dichotomy in the field that divided priorities between utilitarian and ecological perspectives. The tension surrounding efforts to create a land management ethic that allows humans and natural systems to coexist affects the focus of forest management priorities and in turn, forestry education and practice.

Dichotomous Forest Management Paradigms

Subtle differences in perspectives on forest management trace back to the foundations of the forestry profession. Pinchot (Pinchot, 1947) and Leopold (Meine, 1988), prominent early leaders in forestry, best characterized these divergent and enduring points of view. Pinchot led the United States Forest Service and presided over federal forest management from 1898-1910 (U.S. Forest Service, 2013). Pinchot’s leadership in the creation and protection of forest reserves and his instrumental role in founding the SAF earned him regard as the father of forest conservation (Pinchot, 1947). The “wise use” approach to public land management arose
from Pinchot’s conviction that life itself depended upon natural resources and led to the creation of many new forest reserves (Pinchot, 1947). By 1910, the number of national forests increased from 32 to 149, ensuring a land base for long term sustained yield of forest resources (U.S. Department of the Interior, 2017).

Leopold was likewise deeply concerned with forest conservation but took a different standpoint on its implementation. Leopold (1968) appealed for a moral responsibility to the natural world by extending the boundaries of community to include not only humans, but also the “land” — the soil, water, plants, and animals which enveloped humanity. Where Pinchot focused on forest conservation to secure forest resources, Leopold emphasized conserving the broader ecological values of forests, and called for a holistic community approach to management (Aldo Leopold Foundation, 2020b). Leopold’s land ethic was rooted in recognizing the complex interdependence of human and natural systems. Following from this, sustainable resource management would preserve ecological integrity and function, not just a single resource such as timber. Because of this community-based ethical approach to forest conservation and management, Leopold earned acknowledgement as the father of wildlife ecology (Aldo Leopold Foundation, 2020a).

Pinchot’s wise use philosophy translates today as a utilitarian approach to forest management. From this perspective, trees are viewed as the principal resource of forest reserves and management objectives focus on maintaining timber supply. This contrasts with Leopold’s community ecology, approach in which forest management strives to maintain broader aspects of forest function, such as wildlife habitat. Both paradigms seek to maintain forest resources, but discrepancies in the log-term objectives of each result in different management priorities and tactics. Ultimately, sustainable forest management depends upon striking a balance between the two perspectives to meet multiple land use objectives (Minnesota Forest Resources Council, 2005). These subtle differences remain evident within the forestry community and underlie the pervasive and more conspicuous environmental and social challenges to educating for sustainable forest management.

Evaluations of Forestry Curricula

Forestry education programs reflect the dichotomy of utilitarian and community worldviews on managing forests. The stated mission of SAF to advance sustainable forest resources management through
science, education, and technology and thereby ensure continued use of forests to benefit society in perpetuity

echoes Pinchot’s utilitarian philosophy (Society of American Foresters, n.d.). To serve both perspectives,
forestry curricula must encompass technical, scientific, and social facets of forest management practice
(Bullard, 2015). Technical and scientific coursework in forestry align primarily utilitarian interests, and the
social-ecological aspects of the practice align with Leopold’s community perspective. Effectively integrating
both realms of knowledge to develop an adequately trained cadre of forestry professionals pervaded the subject
of forestry education research for decades.

Accounts of practitioners and scholars stressing the importance of social sciences and humanities
education in forestry program curricula appeared in the literature since the early days of the profession in the
United States (F. Roth, 1910; Toumey, 1921). Krueger (1939) observed that foresters were called upon to
perform many duties beyond silviculture, professional duties for which graduates had received no training.
Among the non-timber producing responsibilities for which foresters were ill-prepared through forestry
education were making relevant judgements and effectively communicating ideas (Liberalizing forestry
education, 1945).

Later efforts examined the congruence between forestry education and practice. Barrett (1953)
conducted a nationwide survey and found that practicing foresters ranked interpersonal skills, not technical
abilities, highest in terms of educational importance. Barrett (1953) alleged that contradictory views and
interpretations surrounded the role of humanities in forestry education programs. The controversy hinged on
definitions of liberal education and which disciplines equipped forestry students with both sufficient technical
training and the fundamentals for meaningful participation in society (Barrett, 1953). Barrett (1953) intended to
discover how well forestry education harmonized this dichotomy from the perspective of practicing foresters.
More than 700 respondents spanning the hierarchy of professional forestry answered the anonymous
questionnaire (Barrett, 1953). Summarizing the responses, Barrett (1953) declared, “our sample believes the
ability to speak and write effectively is the most important attribute a forester may possess” (p. 577). Based on
study findings, Barrett (1953) deemed forestry education deficient, and called for more attention to developing
communication and other interpersonal skills through a shift away from biological and physical sciences to include more social sciences coursework.

The technical-social balancing act that Barrett (1953) described mirrors not only the utilitarian-community dichotomy but also longstanding debates about the role of education in society. The cost of higher education places high expectations for returns on the investment, yet others argue the value of education was not in getting a job but fostering the knowledge and skills to participate in a robust democratic and civilized society (Alvarez & Marsal, 2018; D’Agostino, 2014). Barrett (1953) affirmed that forestry schools owned this obligation to both students and society. Acumen for responsible social engagement and ethical intellect falls within the social sciences curriculum. Barrett (1953) asserted that the reputation and future of forestry as a profession depended upon the ethical integrity of its members and appealed for a curriculum shift toward social sciences. As the accrediting body of forestry education, SAF codifies this moral imperative in a formal ethics guide; yet, the method of fulfilling ethical instruction was left to the discretion of program directors (SAF, 2004, 2016). Barrett (1953) advocated for greater focus on the social sciences and the appeals continued, with some proclaiming that inattention to the interpersonal side of this dichotomy left graduates unprepared to manage forest resources in an ever-changing and complex social context (Vonhof, 2010).

**Interpretations of Forestry Career Readiness**

By the late 1990s, assessments of forestry program adequacy shifted focus from curriculum to interpretations of career readiness. Changing scientific knowledge, technological advances, and evolving public perceptions about what constituted sustainable forestry drove changes in the skills that forest management agencies sought when hiring graduates (Cortner, 1992). Forestry was at a crossroads. Sustainability concerns persistently intensified while education failed to meet late 20th Century environmental challenges (Fisher, 1996). Foresters were generally well-prepared in the utilitarian aspects of forestry, such as forest measurement, technology use, and landscape analysis; however, consistently fell short in the interpersonal dimensions of the profession, such as effective communication, ethical behavior, and collaborative problem solving (Sample et al.,
Fisher (1996) concluded that forestry programs needed to expand the breadth and depth of education to remain relevant.

Sample et al. (1999) viewed forestry education as not keeping pace with the demands of forestry practice and undertook systematic examination of both. The nationwide study addressed three questions: the extent of disparity between education and practice, reasons for the differences between educational outcomes and employer needs, and opportunities for closing this gap (Sample et al., 1999). Like the study conducted nearly 50 years earlier, (Barrett, 1953), this research sought to gauge the performance of forestry education, but using a more comprehensive approach. Sample et al. (1999) collected perceptions of both employers and new professionals in differentiating between the importance and performance of necessary aptitudes and the proficiency of forestry education in imparting those attributes. Employers ranked a list of skills and abilities derived from recent forestry education research and symposia, and indicated the level of education (baccalaureate or graduate) at which each might be attained (Sample et al., 1999). Participating employers then distributed questionnaires to employees that had graduated within the past five years to obtain perspectives on how well forestry education had prepared students for the workplace (Sample et al., 1999). Qualitative surveys of forestry program administrators and review of website information provided additional insights on forestry education (Sample et al., 1999). Results suggested that forestry education was not adapting to the demands of forestry practice wrought by changing scientific knowledge and public perceptions of sustainable forest management.

Across all sectors, forestry employers rated the importance of traditional field competencies (technical skills) relatively high; however, ethics and communication (interpersonal skills) received the highest ratings (Sample et al., 1999). Many employers commented on needing to retrain graduates to practice a broader and more integrative style of forestry than sufficed in the past (Sample et al., 1999). The largest skills gap for long-term success occurred in the ability of employees to effectively work in teams and address public concerns (Sample et al., 1999). While employers did not expect undergraduate education to provide all necessary interpersonal skills, Sample et al. (1999) remarked that many employers sought extension and continuing
education resources to assist practitioners in ongoing professional and career development. Results from the survey of employees and forestry program administrators shed light on this finding. More than 75% of new professionals indicated that courses covering communication (oral and written) could only be found outside the forestry program (Sample et al., 1999). Forestry program leaders identified technical and scientific skills as the primary objective of forestry education, with only 25% mentioning competence in communication and social sciences (Sample et al., 1999). These responses illustrate priority for a utilitarian view of forest management and education in general. Forestry educators are increasingly conflicted between expanding the scope of forestry education to serve the profession, and downsizing to meet administrative and state legislature directives to limit individual student investment and reduce costs (Sample et al., 1999). In an effort to meet these polarized expectations, some forestry schools integrated elements of social studies instruction, such communication, into the existing curriculum rather than instituting additional courses (Daniels & Reed, 1992; Sample et al., 1999). Barrett (1953) also offered this in recommending that technical forestry courses serve as the venue for liberal education to expand social sciences training. Neither transpired in forestry education, and graduates remained ill-prepared to navigate the complex social aspects of sustainable forest management.

**Society-Ready Forester Competencies**

By the early 2000s the term “society-ready” emerged to describe the level of preparedness required of forestry graduates to navigate the multifaceted economic, ecological, and social issues involving forest management (Bullard et al., 2014). Expanding human population, fundamental shifts in forest products markets, advancing climate change and the associated increase in forest pests and pathogens dramatically stressed forested ecosystems and management efforts (USDA Forest Service, 2012). After over 100 years of professional forestry, equilibrium between the dichotomous perspectives was not achieved and concerns remained over the need to enhance interpersonal skills while maintaining robust technical training (Bullard et al., 2014). Utilitarian perspectives on the objective of forestry, and by extension forestry education, resulted in sufficient technical and scientific instruction but at the expense of broader educational experiences. While technically competent, new foresters wielded only marginal aptitude in navigating the sociopolitical
environment of forest management and solving complex, multifaceted problems (Davidson, 2013). Most forestry education research focused on baccalaureate programs; however, Meyer (2019) determined the social curriculum needed to build the interpersonal repertoire of graduates was lacking from graduate study as well.

As notions of forestry career readiness evolved, descriptions of essential acumen diversified. Bullard et al. (2014) identified 48 competency items in three categories of requisite proficiency: technical, general, and personal. Regardless of the change in vernacular, forestry graduates remained ill prepared. Forestry faculty embarking on research-based curriculum revisions found alumni and employers reported the highest demand for improving interpersonal skills (Bullard et al., 2014). New graduates remained technically competent with dendrology, forest measurement, silviculture, and management skills and knowledge. However, this represents only partial preparedness. Survey respondents indicated that “graduates needed greater preparation in general competencies such as oral and written communication and personal competencies such as managing one’s schedule, taking initiative, and being able to work effectively on multiple projects” (Bullard et al., 2014, p. 357).

In 2013, Sample et al. (2015) conducted a follow-up to the 1999 study (Sample et al., 1999) to re-assess the efficacy of forestry programs in providing graduates with appropriate knowledge and skills for contemporary practice. Taking an even more nuanced view of career readiness, Sample et al. (2015) identified 73 competency items under five focus areas in a survey instrument distributed among forestry employers, graduates, faculty, and deans. Though more detailed, the imbalance between technical and interpersonal skills was still discernible in the focus area groups. Current issues, biophysical science, and land management areas embodied 54 technical items, while just two areas, human dimensions and professional skills, encompassed 19 social items. Yet, human dimensions and professional skills areas comprised four of the top five ranked competencies (Sample et al., 2015). Survey results revealed significant discrepancies between importance and preparedness in the interpersonal aspects of forestry, notably communicating effectively and behaving ethically (Sample et al., 2015). Comparing the top five competencies from the previous and follow-up study exposes subtle shifts in the importance and interpretation of specific items (Sample et al., 1999, 2015). Effective
workplace communication replaced the ability to work in teams as highest ranked, and expectations for public relations and sustainable management also gained importance (Sample et al., 2015). Sample et al. (2015) and others (see Barrett, 1953; Bullard, 2014; Fisher, 1996) attributed the shortcomings of graduates to persistent rivalry between traditional core forestry courses and those which imparted the interpersonal skills required for negotiating the human dimensions of forestry. This unresolved tension rippled throughout the forestry community, affecting sustainable management efforts.

**Collaborative Sustainability and Forestry Ethics**

The challenge of producing society-ready foresters able to cope with evolving and complex environmental issues and reconcile conflicting management objectives continues to vex the forestry community (Food and Agriculture Organization (FAO), 2021). Achieving sustainability depends upon on broad interdisciplinary action that considers ecological as well demographic, social, political, and economic implications (Guldin, 2019b). Knowledge coproduction is key to resolving multifarious issues in dynamic context. Pinchot (1947) hailed the value of reciprocity between applied forest science and forest management and the import of this partnership endured (Beier et al., 2017; Young, 2008). Meeting multiple objectives to achieve sustainability increasingly involved cooperating across agency lines and with individuals of differing perspectives. Forest scientists, managers, policymakers, and stakeholders developed collaborations to identify problems, conduct research, and devise solutions with the intent of facilitating informed and coordinated sustainable management of forest resources (Dey & Schuler, 2020; Pile et al., 2019). Despite well-established interagency networks, examples of disharmony remained. Coleman et al. (2018) observed that collaboration between entities with conflicting core beliefs may engender distrust. Approaches to avoid embittered relationships included employing third-party arbiters to help negotiate disparate interests (Coleman et al., 2018). In the absence of moderators, forest management outcomes are too often contentious, and in some cases, raise ethical questions.

Examples from Maine and Minnesota illustrate the nature of such conflicts. Noel (2021) laments the deception of private landowners by foresters securing timber for mills. News of impending disease, insect
outbreak, fire damage, and similar ecological threats were used to coerce sales for reduced stumpage rates (Noel, 2021). In one particularly egregious incident, a forester orchestrated the auction of timber for a private landowner to a select group of loggers affiliated with the mill purchasing the timber, the mill that employed this forester, effectively keeping the winning bid low (Noel, 2021). The situation in Minnesota involves differing stakeholder perspectives on the management of forested public lands. Minnesota state forestry remains under scrutiny from a coalition of wildlife managers and conservation groups charging that the most recent harvest plan jeopardizes sustainability (Serna, 2021). Prioritizing timber industry needs (economics) at the expense of wildlife habitat (ecology) undermines sustainable management: collaborating to meet multiple objectives (Kennedy, 2019). Wildlife advocates and managers argue the plan represents mishandling of federal funds, taxpayer dollars, and forest lands specifically allocated for the maintenance of habitat (Meyers, 2020). Meyers (2020) reported that the U.S. Fish and Wildlife Service was auditing the state’s use of federal funds on designated wildlife management areas to ensure timber harvesting benefited habitat management objectives, consistent with federal regulations. Retired state foresters and conservation leaders regard the harvest plan as one-sided – managing a public good for a single industry – noting that a portion of all small-game license sales are directed to wildlife management areas; hunters expect those lands to be managed for wildlife, not timber production (Seitz, 2020). Recent commentary delineated opposition to the harvest plan on three main points: forest management decisions were biased in favor of meeting timber production quotas, citizen input was limited, and statewide coordination was lacking (Sterle et al., 2021). Sterle et al. (2021) called for returning timber harvesting decisions on fish and wildlife management areas to divisional fish and wildlife managers, and urged citizen support for this initiative.

The ongoing controversy in Minnesota mirrors issues previously documented in forestry literature. Bullard et al. (2014) and Sample et al. (1999, 2015) declared that effective communication and conflict resolution were fundamental to forestry practice. Interpersonal skills remain paramount to working with people and having “tough conversations while not burning bridges” (Wilent, 2021, p. 6). Integrity and honesty are equally important, not just to the reputation of individual foresters, but the overall standing of the profession as
The Society of American Foresters (SAF) endorses a robust code of ethics, and this is often accompanied by agency-specific expectations for ethical science and conduct (Guldin, 2019a). Lewis (2019) asserted that as a professional society, forestry should constantly reevaluate its ethical code to ensure it upheld the standards of professionalism. The events in Maine and Minnesota may imply outdated ethical code; however, closer scrutiny points to the mode of instilling professional ethics as the area of practice that merits reevaluation. Although variously understood and widely accepted that insufficiently addressing the social dimensions of forestry creates a steep learning curve for new professionals, the gap remains between what education delivers and what practice demands.

**Professional Knowledge Analysis**

Over a century of forestry education literature attributed deficient interpersonal competencies among new professionals to a lack of social sciences instruction (see Barrett, 1953; Bullard et al., 2014; Roth, 1910; Sample et al., 1999, 2015; Toumey, 1921); however, this was not the only explanation. Observing a “growing crisis of confidence” in the ability of forestry professionals to “negotiate and then implement a workable consensus,” Brown (2003, p.3) offered an alternative interpretation. Brown (2003) ascribed the disparity between forester competence and the management expectations of society to forestry education’s reliance on technical (utilitarian) solutions. Forestry education failed to embrace the interdependent complexity of forestry practice (i.e., Leopold’s community perspective) and promote in its graduates an ability to solve problems in dynamic situations of uncertainty (Brown, 2003).

Rather than advocating increased rigor or expanded curriculum, Brown (2003) asserted that learning to think as a forester would think involved more than the passive receipt of authoritative knowledge. The practice of forestry shared parallels with medical practice and had much to learn from the problem-based approach of medical education (Brown, 2003; Maudsley & Strivens, 2000). Drawing on the work of Eraut (1985) and Schön (1987), Brown (2003) declared that professional education derived from not only acquiring detailed specialized knowledge, but also understanding the proper context and manner to apply this expertise through accumulated experience. Lave and Wenger (2012) subsequently described such conceptions of experiential
learning as situated, wherein experts guided novice members in progressively participating within the community of practice. Forestry practice entailed coursework-transmissible technical knowledge as well as professional knowledge that required more contextual involvement to attain. Forestry education programs traditionally emphasized core academic disciplines and technical training, reflecting an implicit belief in technical rationality when “most problems in real-world practice cannot be solved by the application of factual knowledge” (Brown, 2003, p. 3).

Eraut (1985) suggested that the professional knowledge base comprised four distinct types of knowledge. Propositional knowledge, or knowing “that,” embodied the ideas received from academics and professionals, while process knowledge, or knowing “how,” consisted of the skills acquired through deliberative problem-solving, decision-making, and planning (Eraut, 1985). Knowing “how” and knowing “that” mirrors portrayals of explicit knowledge, or systematically organized reasoning, and tacit “knowing-in-action,” or spontaneous comprehension (Schön, 1987). Eraut (1985) contended that personal knowledge (experiences, beliefs, memories) conditioned learning in much the same way that Bruner (1979) theorized intuition and existing knowledge played a role in the integration of new information. Forestry students enter the professional with predispositions that follow throughout their careers. A summary of student perspectives revealed that many enrolled in forestry for its professed utilitarian qualities, such as learning practical field skills (McGown, 2015). The fourth body of knowledge, ethical principles, referred to socializing in the vocation and cultivating a sense of professional identity within the community (Eraut, 1985). Professional competence depended upon developing all four knowledge types, yet theoretical instruction (propositional knowledge) enjoyed prominence on account of its academic status within the field (Brown, 2003).

**Contextual Pedagogy**

Brown (2003) offered the clearest articulation of an idea that others gave only cursory attention: a shift in pedagogy, rather than curriculum. Pedagogy broadly refers to the motivation for teaching and the techniques and practices that educators use to teach; the why and how of teaching (Sandri, 2020). Curriculum, while also fundamental to teaching and learning, defines what is taught. The pedagogical perspectives and capabilities of
an educator influence the way that curriculum is delivered. Sankey (2020) observed, however, that pedagogy is often treated as an afterthought, with pedagogical intent retrofitted into the curriculum after committing to a particular teaching tool (especially technological), rather than using pedagogy to guide adoption of appropriate teaching tools. Effectively, this putting the cart before the horse syndrome was part of the criticism that Brown (2003) raised against forestry education: the focus on curriculum had detracted from realizing the real issue of decontextualized teaching.

Academia is critiqued for being an “ivory tower” of idealized notions detached from the complex realities of everyday life and practice (Velez & Power, 2020). Students may apprehend the fundamental theories of a discipline, but putting them into practice in the real world involves dynamic translation of that theoretical ideal into a given less than ideal situation. Velez and Power (2020) maintain that while teachers may not be able to break the physical barriers between classroom and reality, it’s essential to intellectually bridge those worlds. That bridge is built with pedagogies that integrate contextual, or situated, learning (Wright, 2018). Building this bridge is particularly important to the cultivation of sustainability thinking (Lotz-Sisitka et al., 2015). Sustainability is fundamental to forest management. At its core, sustainability education strives to foster an ability to resolve the amorphous, evolving, contentious, “wicked problems” of society (Hull et al., 2018). Brown (2003) observed that forestry students must learn to think like foresters in order to effectively deal with the inherent complexity of sustainably managing forest resources. Furthermore, deep-seated tensions throughout higher education between traditional academic pursuits (rigor) and vocational training (relevance) obscured the real problem of fundamentally misunderstanding the nature of learning (Brown, 2003; Schön, 1987). Expanding the curriculum in an effort to teach interpersonal skills and character only widened the rigor-relevance gap (Brown, 2003). Skilled action, deliberative analysis, and ethical awareness formed the foundation of professional knowledge because in practice, forestry professionals solved problems within a social and institutional context, not idealized theoretical or hypothetical scenarios (Brown, 2003).

From this perspective, Brown (2003) asserted that students must learn “what to notice and what interpretations to make” from those observations, and to communicate “in the appropriate terms to colleagues
and clients” through problem-based learning (p. 7). Under this learner-centered pedagogy, students integrated theory and practice to apply knowledge-in-action and reflect critically on the outcomes to develop viable solutions to real-world problems (Savery, 2006). Forestry is a field-based profession that requires working environmental knowledge of ecological systems, namely forests. While other environmentally-based disciplines such as geography (Day, 2012; Raath & Golightly, 2017) and ecology (Burrow, 2018) adopted problem-based learning, it remained conspicuously absent from forestry education.

One notable exception is that of a case study-based approach to enhance capacity in managing forest genetic resources through collaborative development and distribution of a training guide (Boshier et al., 2015). The training guide covered genetic, ecological, and socioeconomic information for a range of scenarios adaptable to both formal and informal learning situations to facilitate a problem-based approach (Boshier et al., 2015). Using case study data, students practiced examining applications of tree genetics information to design and implement conservation and management actions (Boshier et al., 2015). More importantly, Boshier et al. (2015) asserted that students built upon this propositional knowledge and learned to think about where genetic perspectives were relevant and how to ask pertinent questions in various forest management and policy-making scenarios. This type of contextually situated, applied learning illustrates what Brown (2003) described as learning to ‘think like a forester’ by learning to notice, interpret, and synthesize relevant information and accordingly communicate effectively in familiar and accepted terms.

The wide array of contributors involved in the forest genetics training guide and the pedagogical design of student teamwork (Boshier et al., 2015) substantiated that collaboration was essential to problem-based learning (Savery, 2006). This type of meaningful participation necessarily involves engagement with the broader professional community (Lave & Wenger, 2012). However, some argued that “community” was missing, not only from forestry education, but even from community-based forestry (Flint et al., 2008). While community forestry held promise as a viable approach to conservation and local socioeconomic development, major gaps remained between the idea of community in theory and its integration in practice (Charnley & Poe, 2007). Sustainability education depends upon transformative, collaborative learning across disciplinary...
boundaries (Lotz-Sisitka et al., 2015; Moore, 2005); nevertheless, bridging the gaps that divide perspectives on forestry practices and pedagogies to embrace community and deliver career-relevant education remains a work in progress.

**Theoretical Framework**

A triad theoretical framework constructed of Situated Learning Theory, Graduate Work-Readiness Theory, and Complexity Theory undergirds this study. Each theory provides a unique perspective on the synergistic environment of forestry, comprised of domain (shared knowledge), community (member collective), and practice (vocational expertise and conventions). The domain of forestry knowledge and pedagogy was viewed through the lens of Situated Learning Theory (Lave & Wenger, 2012). Graduate Work-Readiness Theory (Prikshat et al., 2019) explored the career readiness of new forestry professionals within the community, and Complexity Theory (Norberg & Cumming, 2008) depicted the multifaceted interdependencies of human and social systems involved in the practice of sustainable forest management (Figure 1).

Figure 1: *Theoretical framework for conceptualizing forestry career readiness.*

**Situated Learning Theory**

Situated Learning Theory underpins the perspective from which forestry education was explored and forms the theoretical basis for communities of practice. Forest management takes place within a community of practice, a collection of interlinked members participating in a unique profession (Wenger, 1998). The Theory
of Situated Learning encompasses various dimensions of cognitive development relevant to forestry education, including transmission of tacit knowledge and ethical repertoire, and the role of expert practitioner mentorship. Much as Brown (2003) advocated for contextual instruction through problem-based learning, Lave & Wenger (1991) asserted that learning was a situated, social process in which knowledge was co-constructed. Situated Learning Theory evolved from Vygotsky's notion of learning through social development, which posited that cognition resulted from contextualized socialization (Vygotsky, 1978). Following from this, Vygotsky (1978) identified that culture was significant in learning as individuals apprehended and developed their role within the community. Brown (2003) explained that much of what was learned in a professional context may not be consciously known in ways that lend to explicit description. For example, when asked how to identify a particular species of tree, few experts produced a list of botanical characteristics, but instead recognized it by familiarity with its general form or “gestalt” and contextual clues (Brown, 2003). This essential component of skillful professional practice is what Schön (1987) termed knowing-in-action. Through learning in context, novice members of a community became exposed to this type of tacit, process knowledge that was less effectively conveyed through classroom instruction (Eraut, 1985). Moreover, situated learning provided other elusive circumstantial benefits, such as exposure to discipline-specific principles and ethical behaviors expected within a community of practice (Thorne, 2005).

Forestry ascribes to both formal and informal ethical tenets. Society of American Foresters (SAF) formally defined principles “to protect and serve society by inspiring, guiding, and governing members in the conduct of their professional lives” (SAF, 2004). Additionally, SAF accreditation standards delineated metrics for the indoctrination of conservation and professional ethics at the programmatic and curriculum level (SAF, 2016). SAF (2016) standards for accreditation dictate that forestry program mission, goals, and objectives must reflect “the professionalism and ethical behavior necessary to manage and use natural resources for the benefit of society” (p. 24). Inherent beliefs about the value of forest resources range from utilitarian to community-based land ethic, and each holds different perspectives on appropriate management approaches (Leopold, 1968; Pinchot, 1947). These divergent perspectives translate to different definitions of forest sustainability, a
cornerstone doctrine that spans every dimension of the forestry community from education to timber production (Cortese, 1997; Sample & Bixler, 2014; Sheppard et al., 2020). Familiarity with the nuances of interpreting and implementing sustainability perspectives develops through an iterative cycle of unrehearsed action followed by reflection and revision of individual notions (Brown, 2003). Schön (1987) termed this introspective adjustment of the personal ideas that underpinned knowing-in-action the “artistry of professional practice” (p. 158). This type of reflective knowledge is only possible when engaged in context, in effect, situated.

Lave and Wenger (1991) highlighted the role of expert mentorship in situated learning environments. Established practitioners guided novice members through engaging in the vocational and sociocultural practices of a community (Lave & Wenger, 1991). In this way, knowledge was co-constructed as new practitioners move toward full “legitimate” participation within the community of practice (Lave & Wenger, 2012). Many disciplines employ mentorship in situated learning environments. Higher education observed notable benefits, particularly in doctoral student self-efficacy and scholarship and new faculty mentorship programs (Anderson et al., 2013; Holmes et al., 2014; Savage et al., 2004). To facilitate vertical engagement between new and established practitioners within the forestry community, SAF (2016) accreditation standards mandate affiliations with practicing forestry professionals to expand the breadth and relevance of students’ experiences.

For the purposes of this study, forestry employers were considered established practitioners and recently hired foresters were viewed as new practitioners within the forestry community. Following the protocol of Sample et al. (1999), “new” was defined as students completing a baccalaureate or higher degree in forestry within the past five years. Lave and Wenger (2012) stressed that interactive learning was situated in a specific domain of shared knowledge and learning need, embedded within a unique sociocultural and physical environment. Social interaction and collaboration fundamentally defined situated learning environments wherein learners participated in a community of practice which abided common principles and codes of conduct. Established and novice forestry professionals, partner resource management agencies, stakeholders, educators, and students comprise the human dimensions of this community of practice. Embracing the community perspective of Leopold (Meine, 1988), forests and the associated wildlife and ecosystem functions
that forests support constitute the environmental context. Knowledge of sustainable forest management practices forms the domain of shared learning need within professional forestry.

**Graduate Work-Readiness Theory**

Graduate Work-Readiness Theory was the lens this study uses to explore the career readiness of new forestry professionals within the community of forestry practice (Prikshat et al., 2019). Porter and McKibbin (1988) applied this idea in describing the skills that enabled “work-ready” business school graduates. The term “employability skills” summarized the mindset, conduct, knowledge, and competence that facilitated workplace and career success (Bhaerman & Spill, 1988). Employability skills were viewed synonymously with “generic skills” (Hager & Holland, 2006) and “soft skills” (Dharmarajan et al., 2012). Likewise, “transferable skills” described graduate proficiency across a range of qualities and abilities necessary for job success. Higher education, including specific disciplines such as Geography, also applied pedagogical interpretations of transferable skills (Atlay & Harris, 2000; Clark, 2013; Payne, 2017).

Caballero & Walker (2010) described “graduate work-readiness” as the extent to which graduates possessed the attitudes and attributes for successful job performance and career advancement. Moreover, the researchers noted that selection of graduates was unique in that novice members within a community of practice lacked the work experience that typically informed hiring decisions (Caballero and Walker, 2010). Academic achievement as a predictor of intellectual ability traditionally played a key role in graduate selection; however, growing demand for a diverse array of personal traits and career skills demanded more comprehensive metrics (Hager & Holland, 2006; P. Roth & Bobko, 2000). Given the relative novelty of this concept at the time, ambiguity still surrounded delineation of the particular dispositions and skills that constituted work-readiness (Caballero & Walker, 2010). Systematic attempts thus emerged to conceptualize graduate work-readiness and develop more robust scales of measurement (Caballero et al., 2011; Prikshat et al., 2019). Workforce changes amplifying the value of effective selection strategies to secure adaptable and multi-skilled employees drove the trend of increasingly sophisticated graduate evaluation metrics (Caballero et al., 2011; Trank et al., 2002). Discrepancies between employer expectations and the performance of new professionals, like those observed in
forestry (Sample et al., 1999), signaled that graduate assessment practices were not effectively addressing work-readiness (Gardner & Liu, 1997).

Evolving notions of work-readiness paralleled the progressively complex interpretations of forestry career readiness (Bullard et al., 2014; Sample et al., 1999, 2015). Various regional iterations of work-readiness scales emerged in the literature, for example in Australia and South Africa (Hambur et al., 2002; Raftopoulos et al., 2009). Caballero et al. (2011) first developed a broadly applicable “Work Readiness Scale” (WRS) for assessing the job performance potential of graduates. Using qualitative surveys, Caballero et al. (2011) generated a pool of ten categories indicative of work readiness: motivation, maturity, personal growth, organizational awareness, technical focus, interpersonal orientation, work attitude, problem-solving, adaptability, and resilience. Subsequent exploratory factor analysis guided development of a 64-item WRS of four factors labeled personal characteristics, organizational acumen, work competence, and social intelligence (Caballero et al., 2011). The resulting four factors encompassed the original ten and shared similarities with other variously described measures of work-readiness, indicating the multidimensional nature of the work-readiness construct (Atlay & Harris, 2000; Caballero & Walker, 2010). Social intelligence, for example, appeared consistent with adaptability, teamwork/collaboration, interpersonal/social and communication skills (Casner-Lotto, 2006; Gardner & Liu, 1997). Numerous researchers variously characterized these same aptitudes as the essential social acumen that was lacking among graduates in discussions of forestry career readiness (Barrett, 1953; Brown, 2003; Sample et al., 1999).

Emphasizing the employability of graduates elevated the importance in higher education of cultivating not only disciplinary competence, but also interpersonal abilities to negotiate an ever-changing work environment (Bridgstock, 2009). Increasing demand from employers for graduates equipped with work-readiness skills translated into widely normalized provision of practice-based experiences in higher education programs (Billett, 2012). Yet, comprehensive frameworks to define and quantify “work-ready” across diverse occupational contexts remained under development (Clark, 2013). Graduate work-readiness as a concept was still both pervasive and contested. Despite apparent consensus among stakeholders on the central importance of
graduate employability, Winterton and Turner (2019) charged that considerable diversity pervaded definitions of graduate work-readiness and its inculcation.

Recognizing this lingering ambiguity, Prikshat et al. (2019) conceptualized graduate work-readiness through a comprehensive representation of its theoretical underpinnings in a Work-Related Integrated Competence Model (WRICM). The proposed model intended to provide a foundation for evaluating graduate work-readiness and informing both practice and policy on developing these qualities (Prikshat et al., 2019). Prikshat et al. (2019) extended the work of Finch et al. (2016) to define work-readiness as a “dynamic competence that requires the reconfiguration, synthesis and integration” of intellectual, personality, meta-skill, and job-specific resources (p. 18). Following from these four resource categories, the Prikshat et al. (2019) WRICM delineated increasingly specific definitions of graduate skills (Table 1). The construction of the WRICM (Prikshat et al., 2019) shares similarities with the WRS (Caballero et al., 2011) in having four overarching categories, but with greater specificity of the skills comprised within each. Caballero et al. (2011) noted the importance of internal consistency (non-overlapping themes) in the four WRS factors, and this was evident in the WRICM as well.

Table 1: *Work-readiness integrated competence model (WRICM) resources and skills.*

<table>
<thead>
<tr>
<th>Intellectual resources</th>
<th>Cognitive skills</th>
<th>Problem-solving and analytical skills, planning and strategic thinking, learning skills</th>
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<tbody>
<tr>
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<td>Foundation skills</td>
<td>Numeracy, literacy</td>
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<tr>
<td>Personality resources</td>
<td>Self-management skills</td>
<td>Meta-cognition, lifelong learning, self-regulation</td>
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<td></td>
<td>Innovation and creative skills</td>
<td>Entrepreneurship, change-management, ability to cope with uncertainty</td>
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<tr>
<td></td>
<td>Leadership skills</td>
<td>Leadership skills, logical thinker, visionary, influencer, developing people, managing relationships, taking charge</td>
</tr>
<tr>
<td>Meta-skill resources</td>
<td>Teamwork and political skills</td>
<td>Working with others/collaboration, conflict resolution, diversity management, political skills, interpersonal orientation, people skills</td>
</tr>
<tr>
<td></td>
<td>Communication skills</td>
<td>Written &amp; verbal communication, languages skills, giving and receiving feedback</td>
</tr>
<tr>
<td>Information technology skills</td>
<td>Information and communication technology literacy, ethical issues surrounding technology</td>
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<td>-------------------------------</td>
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</tr>
<tr>
<td>Systems thinking skills</td>
<td>Big picture, fixing recurring problems, solving difficult problems, social/ psychological outcomes</td>
<td></td>
</tr>
<tr>
<td>Job-specific resources</td>
<td>Core business skills</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Performance management, organizational management, professionalism/ethics, and work ethic</td>
<td></td>
</tr>
</tbody>
</table>

The WRICM resources and skills (Prikshat et al., 2019) related to the competencies reported as most salient for new forestry professionals. Foresters responding to Barrett’s (1953) survey ranked areas of knowledge concerned with social relationships and life in the community well above technical, discipline-specific subjects, with the ability to speak and write effectively being the utmost important. These abilities fall within meta-skill resources category of the WRICM, spanning teamwork and political skills and communication skills. Similar connections existed with findings from meta-analyses of new forester performance (Sample et al. 1999, 2015). Sample et al. (1999) remarked that public scrutiny of forest management, along with the rising importance of socioeconomic and ecological considerations, elevated the imperative for interpersonal competencies in workplace ethics, communication, problem solving, and leadership. Fifteen years later, employers ranked effective communication and public relations, ethical behavior, water issues, and sustainable forest management as the skills with the largest gaps between importance and preparedness (Sample et al., 2015). Collectively, these interpersonal aptitudes span the WRICM personality, meta-skill, and job-specific resource areas to encompass leadership, teamwork and political, communication, and core business skills.

The increasing complexity of forester work-readiness interpretations revealed the interconnected nature of forestry as a community of practice. SAF (2016) certification standards reflect this as well, stating that graduates must be able to “knowledgeably develop, apply, and execute management plans that adequately address matters of ownership goals, forest health and sustainability, and the legal and regulatory environments” (p. 27). Bullard et al. (2014) deemed “society ready foresters” as those able to manage complex issues involving the ecological, social, and economic considerations that attended forestry practice. Emergence of necessary competence in managing water resources, and emphasis on the sustainability of forest management.
practices speaks to Leopold’s (1968) concept of a community-based land ethic approach (Meine, 1988). Brown (2003) most succinctly characterized the inherent complexity of forestry practice in observing that foresters needed to learn how to solve problems in the context of dynamic ambiguity, instability, and conflict “when rules and theories no longer provide the answers” (p. 6). The WRICM exemplified such abilities as meta-skill resources for systems thinking, a concept gaining relevance, and application in depicting the interdependence of not only natural but also human systems, and the connections that bind them.

Complexity Theory

As an outcome of systems thinking, Complexity Theory formed the conceptual framework for understanding the context that surrounds the practice of sustainable forest management. Complexity Theory embraces change as a constant in examining the spatial resilience, interactions, and feedbacks in coupled social-ecological systems to address environmental issues (Norberg & Cumming, 2008). Linkages between human and natural systems, described as social-ecological systems, are increasingly identified as complex adaptive systems (Levin et al., 2013). The basis for this concept evolved from theoretical explanations of the essential features of ecosystems (Levin, 1998). Applied to interpretations of social-ecological systems, Levin et al., (2013) asserted that nonlinear feedbacks, deliberate interactions, and spatial, temporal, and individual heterogeneity defined complex adaptive systems, posing substantial modeling and management challenges. Social, political, and ecological context influence the practice of forestry and create an interconnected, interdependent complex adaptive system. Complexity Theory thus serves as an appropriate vantage point from which to explore the interconnections of forestry education and forestry practice.

Complexity Theory, expressed as varying portrayals of complex adaptive social and ecological systems, applies across a range of disciplines. While most commonly relevant to environmentally centered research, evaluation studies also referenced systems thinking and complexity methodologies in journals and conferences (Walton, 2016). Complexity Theory's concept of emergence holds that novel properties not apparent in constituent elements can emerge as systems change. Education applied emergence principles to gain insight on the conditions for promoting sustainable, positive, system-wide change (Mason, 2009). Geography education
embraced problem-based learning as a strategy to expanded student views on the complexity of environmental issues (Raath & Golightly, 2017). Studies of indigenous cultures revealed that Complexity Theory was intrinsic to ecological knowledge systems (Berkes & Berkes, 2009). Berkes and Berkes (2009) observed that through continual reading of the environment, indigenous societies constructed collective mental models of ecological systems and continually adjusted them as new information flowed in. Forest management sought to embrace Complexity Theory in climate change mitigation and adaptation strategies by targeting multiple priorities rather than adhering to singular objectives (D’Amato et al., 2011). Meeting multiple management objectives recalls the enduring dichotomy in forestry: that of Pinchot’s wise use paradigm (U.S. Forest Service, 2013), and Leopold’s community-based land ethic perspective (Aldo Leopold Foundation, 2020a). The ripple effects of how these differing points of view shape forest management priorities and policies, and thus education, mimic the framework of a complex, interconnected social-ecological system. Levin et al. (2013) explained this as macroscale properties emerging from local-scale behaviors and actions that accumulate and feedback to influence higher-level structures and subsequent options.

Brown (2003) stressed that the “crisis of confidence” in forestry was not the result of theoretical illiteracy, but foresters’ “inability to modify practice to meet heightened societal expectations” (p. 6). Learning to think like a forester involved learning in context the specific decision-making skills necessary to achieve deliberative analysis and successfully apply professional knowledge (Brown, 2003). Such a model of situated, problem-based learning emulates the adaptive knowledge base and management approach characteristic of indigenous social-ecological systems (Berkes et al., 2000). SAF accreditation standards signify recognition of the value in this type of contextual hands-on learning to acquire the process knowledge (Eraut, 1985) and meta-skill resources (Prikshat et al., 2019) that Brown (2003) deemed essential to problem solving and planning within the complex social and institutional context of forestry practice.

Among the overarching parent institution standards for SAF accreditation was a requirement for access to outdoor laboratory sites to provide a physical environment conducive to learning (SAF, 2016). Standards for the Forest Technology degree mandated that students complete a “forestry-related work experience of at least
80 hours” to “simulate working conditions of typical employers” (SAF, 2016, p. 38). Additionally, each of the professional degrees required lab and field experiences to ensure that program graduates “knowledgeably develop, apply, and execute management plans that adequately address matters of ownership goals, forest health and sustainability, and the legal and regulatory environment” (SAF, 2016, p. 27). The matters cited in this standard exemplify components of the individual systems nested within the larger complex adaptive social-ecological system of forestry practice (Levin et al., 2013). Varied land ownership creates a mosaic of different management approaches and possibilities across the landscape (MFRC, 2017b). Forest health and the attending management practices to ensure sustainability change in response to shifting environmental conditions (Handler et al., 2014). Economic and political forces impinge upon forest management policies (MN DNR, 2018), and individual views on the value of forests and definition of sustainability influence these larger actions. As Levin et al. (2013) explained, individual actions driven by individual beliefs accumulate to collective behaviors that influence system dynamics and future outcomes.

Influencing perspectives on natural resources is the foundation of change toward sustainability (Speth, 2008). Complexity Theory offers a way to conceive of the coupled interdependence between natural and human systems and thereby identify salient opportunities to promote sustainable practices (Norberg & Cumming, 2008). One pivotal venue for transformative change is education (Lotz-Sisitka et al., 2015). Situated Learning Theory underscores the value of contextual, applied learning guided by experts within the community of practice (Lave & Wenger, 2012). The long-term sustainability of indigenous social-ecological systems, reliant on constantly monitoring and adapting to the environment, substantiates the benefits of this pedagogy (Berkes et al., 2000). Integrating this pedagogy in educating forestry students to “think like a forester” through situated, problem-based learning (Brown, 2003) may render “society-ready” graduates (Bullard et al., 2014). The practice of forestry takes place within a nested set of interdependent social and ecological systems interacting to construct a complex adaptive system (Levin et al., 2013). Sustainable forest management within this dynamic social-ecological community depends upon equipping new forestry
professionals with the resource competencies for effective communication, teamwork, conflict resolution, and systems thinking skills (Brown, 2003; Prikshat et al., 2019; Sample et al., 2015).

Summary

Chapter II presented the review of literature, which explored the evolution of forestry education perspectives and the career readiness of new forestry professionals. Additionally, this chapter described the theoretical framework undergirding this qualitative phenomenological study. Chapter III will outline the methodology used to explore the career readiness of new forestry professionals. Chapter IV will present study findings, followed by a discussion of those findings in Chapter V.
CHAPTER III

METHODOLOGY

The purpose of this chapter is to introduce the research methodology for a proposed qualitative phenomenological study exploring the career readiness of new forestry professionals. Chapter III presents the research questions and details study design and rationale for the chosen methodology. This chapter presents the research questions, study design, and rationale for methodology, including the role of the researcher. Further, Chapter III describes the research setting and demographics, study sample, and the protocol for participant selection and instrumentation. Procedures for data collection, and analysis are also explained, followed by a discussion of trustworthiness, study limitations, and delimitations. Chapter III also explains the measures taken to ensure ethical practices and concludes with a chapter summary.

Research Questions

The following research questions guided this phenomenological study:

4. What are employers’ career readiness expectations of early career forestry professionals?

5. How do recent graduates describe their first years in the profession?

6. What organizational re-engineering is needed to strengthen forestry education programs?

Study Design

This study used a qualitative approach with a phenomenological design to explore the career readiness of Minnesota’s future forestry professionals. Qualitative study is appropriate when the goal of the research is to explain a phenomenon by relying on the perceptions and meaning of lived experiences (Patton, 2015). Creswell and Poth (2018), posit that qualitative approaches seek to explore an issue for the purpose of identifying variables and understanding the relationships among them. Phenomenology emphasizes subjectivity and discovery of the essence of human experience through intentional suspension of preconceived ideas (Moustakas, 1994). Participant voices, rich descriptions, and complex interpretations of the problem are captured in qualitative analysis findings (Creswell, 2014). A qualitative phenomenological research design
facilitated deeper understanding of how forestry education is preparing future professionals for careers in sustainable forest management.

Through a constructivist worldview, this study seeks understanding by developing subjective meanings of lived experiences (Creswell & Creswell, 2018). Inquiry into the perceptions held by different groups about a shared reality were used to apprehend multiple viewpoints (Patton, 2015). Constructivism follows three core assumptions: humans construct meaning through engagement with the phenomenon of study, interpretations are conditioned by historical perspectives, and the generation of meaning is inherently social (Crotty, 1998). These assumptions influence the interpretation of qualitative study findings. Guba & Lincoln (1989) explained that from a constructivist view, truth is a matter of consensus among constructors, phenomena can only be understood within the context of study, and the results of inquiry have “neither special status nor legitimation,” but rather represent one construction of many to be considered in working toward consensus (p. 45).

Phenomenology

The approach to this study was phenomenological in nature. Hermeneutic phenomenology aligns with the research problem by offering an inductive method to interpret and describe lived human experiences (van Manen, 2016). Phenomenological research has strong philosophical underpinnings. Moustakas (1994) credits Husserl (1931) with phenomenology’s focus on the discovery of meaning and essence. Husserl’s (1970) descriptive approach is recommended for understanding ordinary human experiences as perceived by each individual (Hamill & Sinclair, 2010; Sousa, 2014).

Rationale for Methodology

Qualitative phenomenological research centers on developing experiential understanding by constructing knowledge about the essence of the phenomenon of study through firsthand participant accounts (Moustakas, 1994; Stake, 2010). The intent of this study was to understand the experiences of career preparation and readiness as perceived by several individuals within the forestry community (Creswell, 2014). Exploring perspectives of forestry employers and new forestry professionals facilitated understanding of how forestry education prepares students for careers in sustainable forest management.
Role of the Researcher

Qualitative inquiry relies upon the interpretative perceptions of the researcher throughout all stages of the study (Stake, 2010). In this study, the researcher acquired data through document review, focus group, and individual interviews. Given the researcher’s centrality in qualitative studies, the credibility of inquiry is closely linked to the credibility of the inquirer (Patton, 2015). The role of the researcher as the primary instrument of data collection and analysis compels disclosure of personal values, background, and experience to understand how these may influence the study (Creswell & Creswell, 2018). Bloomberg and Volpe (2019) emphasize that “maintaining a reflexive approach throughout ensures a critical review of the involvement of the researcher in the research” (p. 46). Reflexivity implies taking an intentionally reflective stance on researcher positionality to raise awareness of inherent subjectivity and biases (Bloomberg & Volpe, 2019).

It is important to note the researcher has been a faculty member at a four-year degree granting university within the study area since 2014. At the time of this study, the researcher was engaged in a collaborative effort investigating the possibilities for creating an accredited forestry program at the university. Prior work experience and ongoing partnership in various capacities with forest research and management agencies afforded the researcher contextual knowledge of the field of forestry. While the researcher maintains professional affiliations within the forestry community, no supervisory relationships existed between the researcher and study participants. An understanding of forestry terminology and practices enhanced the researcher’s ability to enrich this study. Strict adherence to study protocol, triangulation across multiple data sources, and reflexivity were employed to offset the influence of this positionality and mitigate researcher bias (Creswell & Creswell, 2018). Journaling throughout the research process facilitated deliberate self-reflection and critical analysis of key issues, improving reflexivity and the trustworthiness of study findings (Bloomberg & Volpe, 2019).

Study Setting

The setting of this study was north central Minnesota, as characterized by the Minnesota Forest Resources Council (MFRC) North Central Landscape Plan. MFRC describes the nine million-acre north central
landscape as encompassing Aitkin, Becker, Cass, Clearwater, Crow Wing, Hubbard, Itasca, and Mahnomen counties, and the southern half of Beltrami and eastern half of Polk Counties (MFRC, 2017b). The north central region is unique in its ecological diversity. North central Minnesota spans four different ecological provinces, from prairie and tallgrass aspen parklands to broadleaf and mixed forests. Land ownership and management are equally complex. Most of the north central landscape (59.8%) is privately owned. Public lands are divided among federal (9.6%), state (13.9%), and county (14.8%) agencies. Tribal entities constitute roughly two percent of land ownership (MFRC, 2017b). The region’s natural landscape diversity is not mirrored in its social profile.

Vast areas of the north central landscape are rural and sparsely populated (0-1,271 persons per square mile), with a handful of urban centers dotting the region. Bemidji, Brainerd, Detroit Lakes, Grand Rapids, and Park Rapids are among the largest cities. Demographically, the north central landscape is less diverse than greater Minnesota; however, the region contains a higher percentage of Native Americans (5.9%) than the state-wide one percent average (MFRC, 2017a). The remaining majority of residents report as white (89.5%), with small numbers declaring two or more races (2.5%), Hispanic (1.9%), and other races and ethnicities. Despite lower incomes, homeownership rates across the region are slightly higher (77%) when compared to state-wide average of 72% (MFRC, 2017a). North central residents find employment in retail, health care, service, agriculture and forest industries (MFRC, 2017a). Forest-based economic sectors provide important employment within the region. Wood products manufacturing, along with land, forest, and wildlife management account for over 2,000 jobs, highlighting the value of forest resources to residents of the north central landscape (MFRC, 2017a).

**Study Sample**

The sample for this study was drawn from the larger pool of practitioners within the north central Minnesota forestry community. Forest practitioners included both employers and early career foresters. The Society of American Foresters (SAF) considers recent graduates (up to five years post-graduation) as transitional, or early career professionals (SAF, 2020). This study followed that characterization in defining
early career foresters as those securing employment in a forestry position no more than five years after graduating from an accredited forestry program. Forestry positions will include both foresters and forestry technicians. Recent graduation and employment ensured the time relevance of educational programs, as well as detailed recollection of school and early career experiences. Phenomenological sampling aims to collect instances of experientially rich descriptions (van Manen, 2016). Employers responsible for hiring and overseeing the performance of forestry positions provided perspectives on the career preparedness of new professionals. Perspectives on forestry education and early career experiences were obtained from early career foresters.

**Selection of Participants**

Individuals selected to participate in this study were identified using snowball sampling. Yin (2011) asserts that snowball sampling is an appropriate selection method when initial participants have knowledge of additional candidates. To identify informative sources and mitigate bias, it’s important to consider the reason for choosing each participant and let study purpose, rather than convenience, guide participant selection (Yin, 2011). When using purposive sampling, the researcher selects individuals with the necessary lived experience to contribute understanding of the central phenomenon of study and research problem (Plano Clark & Creswell, 2015). Creswell and Poth (2018) affirm that in qualitative research, data collection activities depend upon the approach to inquiry. Given the phenomenological approach of this study, a relatively small sample of 14 participants were selected for interviews (Creswell & Creswell, 2018). Following snowball sampling, forestry employers in the north central region were interviewed first to provide guidance on selecting early career foresters.

**Data Collection**

The data collection methods used in this study conformed to typical phenomenological research protocol. Collection of study data began after obtaining approval from the Winona State University Institutional Review Board (IRB). IRB approval reaffirmed the code of ethics that builds trust and upholds confidentiality, as established by law (Creswell, 2014).
In qualitative phenomenological research, the study describes the common meaning of lived experiences relating to the phenomenon of inquiry for several individuals (Bhattacharya, 2017). Characteristic of phenomenology, this study assembled data from multiple sources, including review of publicly available documents, focus group interviews, and semi-structured individual interviews (Creswell & Creswell, 2018). Each data source contributed uniquely to interpreting the experiences and meaning of the preparedness of early career professionals to sustainably manage forest resources. Using more than one source of data enabled the researcher to corroborate study findings. Triangulating across a methodological combination “increases validity as the strengths of one approach can compensate for the weaknesses of another approach” (Patton, 2015, p. 389). A semi-structured focus group interview, individual online interviews, and document review provided the data for this phenomenological study exploring the career readiness of new forestry professionals (Figure 2).

Figure 2: Data sources and collection sequence.

Focus Group Interview

The researcher used a semi-structured virtual focus group interview as the first method of data collection. Phenomenological interviews gather the experiential narratives used in qualitative research to develop a deep and rich understanding of a human phenomenon (van Manen, 2016). Semi-structured interviews follow a set of prepared questions to maintain consistency, with flexibility to pursue unexpected yet relevant directions that emerge during interview conversations (Bhattacharya, 2017). Zoom videoconference software was used to conduct the virtual face-to-face focus group interview with study participants (Zoom Video Communications Inc., 2020). Zoom was selected as the virtual interview platform for its ease of use, accessibility, data management options, and security features (Archibald et al., 2019; Gray et al., 2020). The
researcher conducted a virtual semi-structured focus group interview with forestry employers to obtain perspectives on the performance of early career foresters. Additionally, following snowball sampling protocol, the researcher solicited names and contact information of early career forestry professionals for individual semi-structured interviews.

**Individual Interviews**

The second method of data collection was asynchronously conducting individual online interviews with early career forestry professionals. In phenomenological studies, the researcher plans and carries out a series of procedures to develop an organized and systematic study, including a set of interview questions (Moustakas, 1994). Online interviews reduce the boundaries of space and time, and nonetheless yield data comparable in richness and depth to in-person interviews (Ratislavová & Ratislav, 2014). Interviews conducted online prioritize participant comfort, as respondents choose the setting most convenient for them to answer questions (Bowden & Galindo-Gonzalez, 2015; James, 2016). Bowden and Galindo-Gonzalez (2015) further observe that online interview questions facilitate iterative reflection, leading to more thoughtful and succinct responses. Conducting interviews online is not without limitations, including the absence of non-verbal cues and delays in receiving responses (Bowden & Galindo-Gonzalez, 2015). The researcher informed participants of study timelines and sent email reminders to encourage punctual completion.

**Document Review**

The last method of data collection involved reviewing publicly available documents, such as forestry program accreditation standards and curricula. The term “document” covers a variety of written materials, visual images, and archival data. Document review is commonly used in qualitative research to acquire deep and contextual understanding of the phenomenon of inquiry (Bhattacharya, 2017). Bloomberg and Volpe (2019) observe that documents situate and connect the narrative to the broader political, cultural, and social infrastructure of the study. Documents reviewed prior to interviewing study participants equipped the researcher with information to guide the conversations and limit disruptive clarifying questions (Yin, 2011).
Triangulation

Triangulating across multiple data sources to obtain in-depth understanding of the phenomenon of inquiry strengthens the credibility of qualitative studies (Plano Clark & Creswell, 2015). This study triangulated data from three sources: a focus group interview with forestry employers, and online individual interviews with early career forestry professionals, and a review of forestry education documents (Figure 3).

Figure 3: Data triangulation method.

Qualitative data is often triangulated across data sources to develop a more complex understanding of the studied phenomenon (Bloomberg & Volpe, 2019). Triangulation across multiple data sources enables the researcher to corroborate information from different perspectives (Creswell & Poth, 2018). Patton (2015) recommended various techniques for triangulating qualitative data, including comparing the responses of participants with different points of view and checking interviews against reviewed documents. Data from the focus group interview with forestry employers and the individual semi-structured interviews with early career forestry professionals lent insights on career readiness from two different perspectives. Forestry education documents provided context for subsequent interviews, and were also cross-referenced with participant narratives about forestry programs and early career experiences.
Instrumentation and Data Analysis

Qualitative research is interpretive, with the researcher being the primary instrument of interpretation (Stake, 2010). Unlike quantitative designs that rely on statistical instruments to create validity and reliability, in qualitative research, the researcher as the central instrument of inquiry is responsible for creating trustworthiness (Yin, 2011). Qualitative data collection and analysis proceed simultaneously; as data accumulate, the researcher begins the process of interpretation and write-up (Creswell & Creswell, 2018). A challenging aspect of qualitative analysis is synthesizing large amounts of data by reducing volume through identifying significant themes to communicate “the essence of what the data reveal” (Patton, 2015, p. 521). Creswell and Poth (2018) describe this process as a data analysis spiral, because steps are interrelated and ongoing rather than linear. The spiral illustrates five stages: organizing the data, coding emergent concepts, classifying codes into themes, developing interpretations, and representing the data to describe the phenomenon of inquiry (Creswell & Poth, 2018).

Descriptive phenomenology involves four main steps: bracketing, intuiting, analyzing, and describing (Hamill & Sinclair, 2010). Bracketing is a process whereby the researcher reflects upon preconceived views and prior experiences related to the central phenomenon of study, describes and documents these perspectives, and intentionally suspends them from analysis (Plano Clark & Creswell, 2015). The process of bracketing adds scientific rigor and validity to qualitative study (Sorsa et al., 2015). Phenomenological descriptions reveal essences through intuition rather than deduction from empirical examples (Osborne, 1994). Qualitative researchers intuit meaning through innately understanding the experiences shared by study participants to interpret the meaning of phenomenon (Sousa, 2014). Qualitative analyses involve successive processes of organizing, coding, validating, and interrelating emergent themes and theories to make meaningful interpretations of the data (Creswell, 2014). Describing is the final step in qualitative research. Thick, rich descriptions that elucidate context and experience and facilitate understanding the meaning and significance of the central phenomenon are the foundation of qualitative reporting (Patton, 2015).
Trustworthiness

Demonstrating trustworthiness in qualitative studies depends upon establishing credibility, transferability, dependability, and confirmability (Erlandson et al., 1993; Lincoln & Guba, 1985). The researcher employed strategies to produce a trustworthy phenomenological study. Patton (2015) described key elements of inquiry that affect the credibility of qualitative studies, including systematic and conscientious fieldwork and analysis. Yin (2011) referred to this as working methodically by “following some orderly set of research procedures” to maintain research rigor, avoid bias, and validate both study methods and results (p. 20). To achieve credibility, the researcher adopted a purposeful qualitative design and adhered to an orderly set of protocol for collecting and analyzing data. Triangulation across multiple views on the phenomenon of inquiry further enhanced the credibility of this study (Erlandson et al., 1993).

The transferability of a qualitative study demonstrates that findings have relevance to similar settings and circumstances (Lincoln & Guba, 1985). Patton (2015) regarded the transferability of qualitative research as analogous to the external validity of quantitative research. As such, the inquirer holds responsibility for providing sufficient contextual information to establish meaningful similarities between the phenomenon of study and comparable situations. Thick, rich descriptions of the study setting and participants enable identification of shared characteristics and thereby decisions regarding transferability (Creswell & Poth, 2018). Description is the foundation of transferability. Effective descriptions have the ability to transport the reader “vicariously into the context being described” (Erlandson et al., 1993, p. 31). Rich descriptions provide abundant and interrelated details, while thick descriptions illustrate connections to theory and scientific knowledge (Stake, 2010).

Dependability focuses on the processes of inquiry to demonstrate that findings are consistent and repeatable (Lincoln & Guba, 1985). Rather than reliability, qualitative researchers seek to establish dependability through clear and thorough documentation of a logical study design (Patton, 2015). To provide for a check on the dependability of this study, the researcher kept a running account of the research process
through journaling to record significant incidents and insights, recording and transcribing interviews, and maintaining organized and secure storage of study data (Erlandson et al., 1993).

Last, confirmability (parallel to objectivity) is concerned with showing that interpretations and findings emerged from the data, not the researchers own preconceived beliefs or motivations (Patton, 2015). Because qualitative analyses are interpretive, researchers must account for the influence of personal bias on data interpretations. To ensure study findings are shaped by the respondents, the researcher used bracketing to set aside personal views and experiences related to the central phenomenon (Plano Clark & Creswell, 2015). Erlandson et al. (1993) recommended providing ample evidence that study data substantiate interpretations and conclusions to allow for assessment of confirmability. Language is valued as the representation of reality in qualitative research (Yin, 2011). The researcher included explicit statements of participants in reporting the findings of this study to demonstrate confirmability.

**Limitations of the Study**

Qualitative interpretations of meaning include not only summarizing and discussing findings, but also disclosing study limitations (Creswell & Creswell, 2018). Limitations are potential weaknesses in a study, often related to methodology, that may influence the interpretation of findings (Bloomberg & Volpe, 2019). Bloomberg and Volpe (2019) noted that every study has inherent limitations; acknowledging them provides an important opportunity to demonstrate critical thinking about the selected methods. The researcher recognizes the limitations of document review include the possibility that information may be incomplete, inaccurate, or not representative of all perspectives, and that interview responses are limited by participant recall, articulacy, and openness (Plano Clark & Creswell, 2015). Focus group limitations center on managing group dynamics. Participants will not be equally confident in expressing their viewpoints, especially when it is perceived as being in the minority (Patton, 2015). Furthermore, the time constraints of hosting multiple participants in one interview session heighten the importance of the researcher acting as a moderator to encourage reticent individuals. Carefully selecting participants with forestry experience and triangulating information across three data sources decreased the influence of this study’s limitations.
Delimitations of the Study

This study was framed by a number of delimitations. Qualitative phenomenological inquiry generally focuses in-depth attention on a small number of participants (Creswell & Creswell, 2018). The sample for this study was delimited by snowball sampling to select a minimum of 10 individuals with appropriate lived experience (Yin, 2011). Participant eligibility was determined based upon location, employment position, and tenure. The geographic extent of this study was delimited by the 10 counties comprising the north central region of Minnesota (MFRC, 2017b). Focus group participants were selected from forestry employers in the region overseeing forestry and forest technician positions to gain insight on the career preparedness of new professionals and recruit interview participants. Interview participants were delimited by tenure, to include only those with no more than five years employment in forester or forestry technician positions. Accredited forestry programs exist at the two-year, four-year, and master’s level. This study was delimited by a primary interest in accredited four-year forestry programs, though accredited two-year degrees were examined for reference.

Ethical Considerations, Informed Consent, and Confidentiality

A strong sense of ethics is essential in research, and especially in qualitative studies because of the numerous discretionary choices made by researchers (Yin, 2011). Institutional review board (IRB) evaluation of research involving human subjects ensures compliance with federal laws and prevents violations of confidentiality (Bloomberg & Volpe, 2019). Human subjects training was completed and IRB approval for this study was granted upon successful defense of the research proposal. The researcher took measures to uphold a strong code of ethics throughout the duration of inquiry (Creswell & Poth, 2018). Adhering to the methodology outlined in this chapter was central to the validity, reliability, and overall trustworthiness of this study. Creswell and Creswell (2018) define considerations to promote integrity in each stage of research, including: gaining local permission from site and participants, clearly disclosing the purpose of the study, explaining and obtaining informed consent, respecting participant time schedules and potential power imbalances, and preserving the privacy and anonymity of participants. Additionally, the researcher stored all study data securely and provided participants with access to the finished dissertation (Creswell & Creswell, 2018).
Chapter Summary

Chapter III outlined the methodology of this phenomenological study on the career readiness of forestry professionals. The chapter presented research questions, research design, rationale for the methodology, and the role of the researcher in conducting this qualitative inquiry. The study setting and sample were described to contextualize this research within Minnesota’s forestry community. Chapter III detailed the processes for selecting study participants, ensuring trustworthiness, and collecting data from publicly available documents as well as focus group and individual interviews with practicing foresters. Additionally, this chapter discussed triangulation and data analysis procedures, limitations and delimitations that frame this study, and the measures taken to address ethical considerations. Chapter IV will present study findings. Chapter V will discuss the theoretical connections and conclusions of this study as well as implications for practice and recommendations for future research.
CHAPTER IV

RESULTS AND FINDINGS

Introduction

The purpose of this study was to explore the career readiness of new forestry professionals in north central Minnesota from the perspective of forestry employers and early career forestry professionals. Chapter IV revisits the problem statement, study design, research questions, and participant recruitment. Additionally, this chapter presents the results of data collected from a focus group interview, individual interviews, and a review of relevant documents. Findings from these data supported characterization of study participants and coding analysis of responses to illustrate the study’s emergent themes. The chapter concludes with a closing summary and a bridge to the final chapter in this dissertation.

Restatement of the Problem

Minnesota’s forest resources are paramount to the integrity and function of ecological, social, and economic systems, yet remain threatened by environmental change and sustainability challenges (Handler et al., 2014; MFRC, 2017b). Tension over forest management priorities exemplify a broader pattern of discord between the competencies provided by forestry education and those required in forestry practice (Sample et al., 2015; Seitz, 2020; Serna, 2021). A growing crisis of confidence exists in the relevance of forestry education and the society readiness of new foresters to negotiate the complexities of sustainable forest management (Brown, 2003; Bullard et al., 2014; Meyer, 2019). Alignment between forestry education and practice is well-studied at the national level (Guldin, 2019b; Sample et al., 1999, 2015), yet limited research exists on the career readiness of Minnesota’s new forestry professionals.

Review of Study Design

This study used a qualitative phenomenological approach to explore perspectives on the career readiness of Minnesota’s future forestry professionals. Characteristic of phenomenology, a relatively small number of participants (N = 14) was selected to develop rich descriptions and complex explanations of the phenomenon of study (Creswell, 2014). Through a constructivist worldview, the researcher sought understanding by
developing subjective meanings of lived experiences from multiple viewpoints (Creswell & Creswell, 2018). Snowball sampling was employed to identify study participants with the relevant life experiences to inform interpretations of a shared reality (Yin, 2011; Patton, 2015). Data were assembled from multiple sources, including a virtual semi-structured focus group interview, individual online interviews, and publicly available documents (Creswell & Creswell, 2018). Triangulating across this methodological combination increased the validity of study findings as the strengths of one approach counterbalanced the limitations of another (Patton, 2015).

**Research Questions**

Information gathered though the focus group meeting, individual interview responses, and review of documents were analyzed to answer the following research questions:

1. What are employers’ career readiness expectations of early career forestry professionals?
2. How do recent graduates describe their first years in the profession?
3. What organizational re-engineering is needed to strengthen forestry education programs?

**Participant Recruitment**

Participant recruitment was operationalized using the names and email contact information of forestry supervisors across the region from agency websites. Emails were sent to potential focus group participants explaining the study and inviting participation (Appendix A). Further email communication with those responding in the affirmative directed participants to complete an online Doodle poll to schedule a meeting date for the virtual focus group interview (Appendix B). Following snowball sampling protocol, focus group participants provided names and contact information of early career foresters, those within five years of graduating. Early career foresters were contacted via email to invite participation in the study by responding to an online interview questionnaire delivered through Qualtrics (Appendix C).

**Data Collection**

Data collection commenced following Institutional Review Board (IRB) approval (Appendix D). Interpretation and analysis proceeded simultaneously with data collection (Creswell & Creswell, 2018). Data
collection entailed three phases. Phase one consisted of a semi-structured virtual focus group interview with forestry supervisors (N = 5). Focus group members responded to prompts yielding reflections and insights on the skills and competencies of early career forestry employees (Appendix E). Phase two involved collecting responses from early career foresters through the online interview questionnaire (Appendix F). New forestry employees responding to the questionnaire (N = 9) offered firsthand perspectives on forestry education and early career experiences. Phase three, review of relevant documents, took place concurrently with the focus group and individual interviews. Reviewing publicly available forestry documents afforded contextualization of interview responses.

**Interview Context**

The semi-structured focus group interview took place using Zoom videoconference software (Zoom Video Communications Inc., 2020). Given the virtual meeting venue, participants were able to self-select a comfortable setting and saved time and travel costs (Gray et al., 2020). The virtual meeting lasted one hour and ten minutes. No technical difficulties were encountered, and participants remarked that the software was easy to use. Focus group participants appeared at ease and conversations were amicable and fluid. A transcript and recording of the meeting were automatically generated by Zoom software.

Qualtrics was used to conduct individual online interviews. Interviews were structured asynchronously to accommodate participant schedules. Participants were contacted via email and invited to complete the questionnaire at their convenience within the allotted eight-day time span. The online interview questionnaire allowed participants to choose the most convenient time and setting, and the option to revisit the questionnaire (within 72 hours) provided opportunity for reflection and revision (Bowden & Galindo-Gonzalez, 2015). Emails were sent to remind participants of incomplete questionnaires. Response times ranged from eight to 54 minutes for those completing the questionnaire in one visit. All participant responses were automatically recorded and stored within the Qualtrics project.
Participant Descriptions

The researcher selected five supervisors and nine early career professionals from the Minnesota forestry community for this study. Study participants were required to be employed in forest management. Focus group and interview participants provided background information to characterize group demographics and compose participant descriptions while remaining individually anonymous. Focus group and individual interview participants are referred to as supervisor or forester, respectively, and an assigned number to maintain anonymity. Focus group participants included supervisors from county, state, and federal forest management agencies (Table 2). Five supervisors responded to the invitation and four attended the virtual focus group meeting. The participant unable to attend the meeting shared thoughts and insights on early career forester expectations and competence via email. Respondents had a combined total of over 75 years of experience in the field of forestry.

Supervisor 1 (S1) is a female working within the U.S. Forest Service. No other background information was provided by this participant.

Supervisor 2 (S2) is a male employed in state forest management. S2 has a bachelor’s degree in forest management and was hired in forestry immediately after graduation. He is native to the area and has worked in various forestry positions for the past 16 ½ years. S2 has held his current supervisory role for the past three-and one-half years.

Supervisor 3 (S3) is a male employed in state forest management with a bachelor’s degree in forestry. S3 has held his current supervisory position for a little over four years. Prior to that, he had experience working in the state’s wildfire management program, county land management, and federal prescribed fire and invasive species control.

Supervisor 4 (S4) is a male employed in county-level forest and land resources management. He has been in this role for 10 years but acquired a variety of experience prior to this position. S4 has a master’s degree in wetland ecosystems. He transitioned through coastal and wetlands work, zoning department
employment, and private land surveying before securing his current position managing the county’s natural resources.

Supervisor 5 (S5) is a male employed in county-level forest and land resources management with a bachelor’s degree in forestry. He has worked in forestry for 34 years in various capacities, including administration of county and state forest resources in neighboring and western states. S5 has held his current position for the past 10 years.

Table 2: *Focus group interview participant characteristics.*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Gender/Sex</th>
<th>Agency</th>
<th>Years of Experience in Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>Female</td>
<td>Federal</td>
<td>NA</td>
</tr>
<tr>
<td>S2</td>
<td>Male</td>
<td>State</td>
<td>16.5</td>
</tr>
<tr>
<td>S3</td>
<td>Male</td>
<td>State</td>
<td>15</td>
</tr>
<tr>
<td>S4</td>
<td>Male</td>
<td>County</td>
<td>10</td>
</tr>
<tr>
<td>S5</td>
<td>Male</td>
<td>County</td>
<td>34</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>&gt; 75</strong></td>
</tr>
</tbody>
</table>

Snowball sampling ensured that participants responding to the online individual interview questionnaire had graduated from a forestry program within the last five years. Participating members (N = 9) represented a range of demographics, employment agencies, forestry positions, and tenure (Table 3). Seven of the nine participants were males (78%), one reported female (11%), and one (11%) chose not to disclose this information. Most were between 20 and 29 years of age (78%) and two were 30-39 years old (22%). The race and ethnic designations reported by participants included White (78%), White and American Indian (11%), and undisclosed (11%). Participants were employed with county (22%) state (44%), and federal (33%), forest management agencies as Forest Technicians (56%) and Foresters (44%). Position tenure in forestry ranged from less than two years (44%) to four years (22%).
Table 3: *Individual interview participant characteristics.*

<table>
<thead>
<tr>
<th>Gender/Sex</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>78%</td>
<td>7</td>
</tr>
<tr>
<td>Female</td>
<td>11%</td>
<td>1</td>
</tr>
<tr>
<td>Prefer not to say</td>
<td>11%</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>9</strong></td>
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<table>
<thead>
<tr>
<th>Age Category</th>
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<tr>
<td>30-39</td>
<td>22%</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>78%</td>
<td>7</td>
</tr>
<tr>
<td>White, American Indian</td>
<td>11%</td>
<td>1</td>
</tr>
<tr>
<td>Prefer not to say</td>
<td>11%</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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</table>

<table>
<thead>
<tr>
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<tr>
<td>Four-year</td>
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</tr>
<tr>
<td>Master's</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Employer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>County</td>
<td>22%</td>
<td>2</td>
</tr>
<tr>
<td>State</td>
<td>44%</td>
<td>4</td>
</tr>
<tr>
<td>Federal</td>
<td>33%</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Position title</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forestry Technician</td>
<td>56%</td>
<td>5</td>
</tr>
<tr>
<td>Forester</td>
<td>44%</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Position Tenure</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 1.9 years</td>
<td>44%</td>
<td>4</td>
</tr>
<tr>
<td>2 - 2.9 years</td>
<td>22%</td>
<td>2</td>
</tr>
<tr>
<td>3 - 3.9 years</td>
<td>11%</td>
<td>1</td>
</tr>
<tr>
<td>4 - 4.9 years</td>
<td>22%</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>

**Data Analysis and Findings**

Thematic analysis of the interview transcripts (five focus group interviews, 9 individual interviews) resulted in emergent themes relating to this study’s central phenomenon of forestry career readiness. Following a qualitative approach, the researcher took sequential steps to prepare and interpret the data and group specific
details into general themes (Creswell & Creswell, 2018). The focus group interview transcript and questionnaire responses were downloaded and organized, and then read and edited to correct software misinterpretations and spelling errors. Corrected transcripts and responses were reread to build familiarity with content and reflect on its overall meaning. After establishing a general sense of the data, the researcher began thematic analysis. Recurrent words and phrases were highlighted in different colors (coded) to demarcate common themes (Creswell & Creswell, 2018). Coded text was subsequently aggregated into a smaller subset of general themes describing relevant study phenomena (Plano Clark & Creswell, 2015). Systematically coding the data into emergent themes enabled the researcher to identify commonalities across participant perspectives and interpret the meaning of their collective experiences, transitioning understanding to a higher conceptual level (Yin, 2011). The researcher journaled this process and used bracketing (setting aside what is known) to avoid bias and intuiting (innately interpreting experiences) throughout coding analysis stages (Patton, 2015). Phenomenological research explicitly maintains linkages between the data and findings (van Manen, 2016). As such, salient participant statements that clearly illustrate emergent themes are included as direct quotes in the sections that follow.

**Virtual Focus Group Interview**

The virtual semi-structured focus group interview with forestry supervisors comprised two sections. Brief introductions provided background information for each participant. The ensuing discussion yielded insights into the career readiness expectations and performance of early career forestry professionals, addressing the first research question. Four themes emerged from coding analysis of the interview transcript: Dynamic complexity of forest management, Enhanced interpersonal skills, Essential field familiarity and competence, and Value of applied learning and mentorship. There was general agreement among the group regarding the nature of forestry, the requisite skills and competencies of foresters, and experiences with early career professionals. All participants shared similar perspectives on the emergent themes (Table 4). The following descriptions and representative statements from the interview further illustrate each theme.
Table 4: Themes formulated from focus group interview data.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Brief Description</th>
<th>Percentage of Participants Discussing Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dynamic Complexity of Forest Management</td>
<td>80%</td>
</tr>
<tr>
<td>2</td>
<td>Enhanced Interpersonal Skills</td>
<td>80%</td>
</tr>
<tr>
<td>3</td>
<td>Essential Field Familiarity and Competence</td>
<td>100%</td>
</tr>
<tr>
<td>4</td>
<td>Value of Applied Learning and Mentorship</td>
<td>100%</td>
</tr>
</tbody>
</table>

Emergent theme 1: Dynamic Complexity of Forest Management

Forest management is a dynamic and complex endeavor (Sample & Bixler, 2014). The milieu of that complexity emerged almost immediately as participants described early experiences in the field and the nature of forestry positions, the first interview question. Even before the interview began, small talk and greetings exchanged between participants included mention of planning for “random” land-related non-forestry activities and inquiries about quickly transitioning to fire season, depending on the forecast. One supervisor commented that foresters must also “learn how to be real estate lawyers” as many land management responsibilities beyond sustaining forested ecosystems fall within the wheelhouse of forestry. Responses to interview question 2a (What are the most important knowledge, skills, and abilities that foresters need?) explicate the multifaceted work of forestry.

S3: I value being able to work independently right off the bat, because there's a definite seasonal flow in forestry, and even more so with the DNR [MN Department of Natural Resources] since we have fire.

S4: Well, counties are a little special because our foresters are more like land managers. They're carrying a lot of different hats, doing wildlife projects, tax forfeited land demolition, and building roads [in addition to] forestry, setting up timber sales. They're doing a lot of negotiation with private landowners and with boundaries and doing their own surveying. I definitely am trying to fit a team, and because we work closely together. Sometimes I’m looking for someone with more computers and technical skills, other times I’m looking for the production Forester, somebody coming from industry has always been great to have for that private work ethic. We also do fire preparation, work in tandem with DNR, so I’m really looking for that diversity on my staff … because we make decisions that can make a lot of changes.
S5: It's hard to pick out one. They always need to know the forestry technical skills out in the woods, but boy communication skills is huge in this day and age.

Change is a fundamental component of complexity (Levin et al., 2013), and this was reflected in participant accounts of the evolving sociopolitical and environmental context that surrounds sustainable management of forested ecosystems and forest resources. Stories of change emerged in response to interview questions 3a (In what areas are new foresters generally most competent?) and 3c (What suggestions would you offer forestry educators to improve the career readiness of new foresters?).

S5: We're running into a time in forestry where there's just a lot more outside influence on what's going on up here because of the changing demographics. I'm getting a lot of people who've lived here their whole lives [saying] "You can't harvest there, that's where we deer hunt". So, it's not even always people coming in, it's even the locals at times, but I know the retirees that are moving up and wanting to see the north woods looking exactly like they think it should is really coming into play more and more.

S4: The foresters used to be all talking about trees, but I just have seen an incredible shift to this whole concept of ECS [ecological classification systems] and native plant communities; they are fantastic at seeing it. That was a big shift in 20 years and I'm really impressed that they're grasping that concept.

S4: These loggers have got a new level of education themselves through MLEP [Minnesota Logger Education Program]. They understand basal area, they understand the silviculture behind it [forest management].

Participant narratives characterizing forestry as multifarious and ever-evolving emerged throughout the discussion. S4’s description of the many “hats” carried by county employees encapsulated the breadth of responsibilities any forester may encounter. Bullard (2014) coined the term “society ready” to describe foresters proficient in handling this array of ecological, economic, and social dimensions involved with contemporary forestry. S5 succinctly depicted the changing sociocultural context of forestry practice, echoing observations noted in forestry literature (Fisher, 1996; Sample et al., 1999, 2015; Sample & Bixler, 2014).

Emergent theme 2: Enhanced Interpersonal Skills

Effective communication emerged as vital to forester proficiency. Forest sustainability is multidimensional (Minnesota Forest Resources Council, 2019) and forestry is a collaboration that occurs within a network of interconnected actors, a community of practice (Lave & Wenger, 2012). Achieving sustainable
management thus depends upon the ability of foresters to negotiate the social dimensions of forestry (Bullard et al., 2014). Responses to question 1a (What degree is required for the forestry positions you supervise?), 2a (What are the most important knowledge, skills, and abilities that foresters need?), and 3d (What techniques do you use to fill competency gaps?) demonstrate the importance of interpersonal communication skills.

S5: I think the four-year degree gives a lot more in the communication arena. Being able to talk to people professionally and being able to write professional documents and letters. The technical skills that you get out in the woods seem to be the same whether it’s a two- or four-year degree, but I find communication skills to be much more improved with a four-year degree.

S4: I agree with the communication skills … Foresters are coming in as introverts but end up finding that they really need to be diplomats and sell their projects, whether it be marketing their own wood or justifying a clear cut and regeneration harvest.

S5: At the county level at any time, I or the forester and can be called in front of the county board, and we're on TV now, and you have to be able to communicate what we're doing out in the woods and be able to handle some discussions at a level with five county board members talking to you. And also, I think communication comes in huge with timber sale administration, it’s a big part of the sale. You have to keep in contact and keep talking with people, and that resolves a lot of problems ahead of time.

S5: Also, it keeps things off my plate a little bit if foresters can handle some of the issues with private landowners. It just helps to have people who can have good conversations with them and try to clear things up and not inflame a situation.

S3: There’s a lot of relationship building and trust that needs to go on, and that doesn't happen overnight. If you can get the logger to trust you that you're going to treat them right on a sale, they'll go the extra mile for you to and they'll let you know before something happens and be talking with you to make sure everything goes smoothly.

S2: There's a lot of tricks to the trade to know. Every logger is different, unique, and you have to know how to communicate with some of them. They're all different, some of them you can kid with, some of them you can't.

Interpersonal skills dominated conversations about necessary forester abilities, particularly proficiency with negotiation. S4 described foresters as “diplomats” for needing to “sell” forestry projects, market timber sales, and justify harvest methods. S5 explained that foresters can be called before the county board to defend management actions. Composure and clear articulation become especially important in these situations, as county board meetings are televised. S5 pointed out that communication skill were better among four-year
forestry program graduates. S3 commented on the importance of “relationship building” and establishing trust with loggers, and S2 offered that every logger was different, so learning how to communicate effectively required time and practice. These observations are not unique. Forestry employers across the nation also consistently ranked effective communication and interpersonal aptitudes highest in terms of important competencies (Sample et al., 1999, 2015).

Emergent theme 3: Essential Field Familiarity and Competence

Many students are drawn to forestry by an inherent affinity for the outdoors and the opportunity for hands-on, practical learning (McGown, 2015). However, focus group participants reported a lack of essential field familiarity and competence among early career foresters. While technologically savvy, many were inexperienced with basic forestry equipment and remote independent fieldwork. Interview questions 2a (What are the most important knowledge, skills, and abilities that foresters need?), 3a (In what areas are new foresters generally most competent?), and 3b (What knowledge, skills, and abilities do new foresters generally seem to lack?) elicited the following representative responses.

S1: I expect new forestry professionals to know how to use basic forestry tools such as a compass, GPS, diameter tape, clinometer, etc.; however, this is not always the case. I would like to hire someone who knows how to go to the woods and come back at the end of the day.

S3: I value being able to work independently. We have people in multiple offices and you're not with them every day, so they have to be able to go out and get their work done. A lot of that depends on their life experiences. You can see it big time in somebody who grew up on a farm, they just go. Somebody who really didn't have any tie to the land, it takes a little more.

S1: I see students, seasonal employees, and new hires without dendrology or tree/plant identification classes. I believe dendrology is a basic requirement for natural resource professionals. If people don’t know our local species of trees, how could they possibly collect accurate data, much less manage our forests?

S5: It seems like a lot more are coming in with GIS [geographic information systems] skills, we're seeing a lot more of this technology, and you know you gotta teach them to look up because this whole generation is looking down at their phones their whole life, and now they need to look up at the trees, to see the forest through the woods.
S3: I’ve been surprised at the number of interns and sometimes even new hires that really haven't spent either a lot of time on the woods on their own, or any hands on with small engines, never ridden a snowmobile and never ridden a four-wheeler, those types of things.

S4: I want to echo you, that's kind of where I was heading is that “woods-sense”. In the past a forester would grab an aerial photograph and be able to navigate their way through the woods. My new foresters are demanding GPS tracks and smartphones and technology in their hands, and they're still looking down at their hands instead of being able to really make sense of from some of those traditional tools. That's why I kind of like those that came through the technical two-year degree and then moved on to the four year-degree.

S2: It’s just the self-awareness that you're going to be out in the woods by yourself, every day, and that you need to pack for it and prepare for it. You have to tell them hey, make sure you bring your lunch. You don't know if you're going to be caught back in the middle of nowhere and it's going to be lunchtime and you’re two hours from your truck.

S2: Even dressing appropriately, when its 30 below, make sure you have layers. We still have people get frostbite. Simple things like that people don't know, from what I’ve seen.

S5: This the new crop coming in, they think everything is just a phone call away, and they aren't quite prepared if things go a little sideways out in the woods or their cell phone dies.

Supervisors unanimously agreed that new foresters often lacked basic field skills and familiarity with remote work settings and common forestry equipment. S1 expressed concern over new hires without dendrology or tree identification knowledge, and the implications of this deficit on collecting accurate data to manage forests. Self-reliance and the ability to work independently were explicitly noted as important by S1 and S3, with S4 labelling this “woods-sense” and S2 adding self-awareness to further qualify this attribute. S3 reflected that personal background and life experiences influenced the field savviness of new foresters. S5 and S4 observed that geospatial skills were adequate, perhaps at the expense of an analog ability to read the landscape and plan appropriately for daily work circumstances.

**Emergent theme 4: Value of Applied Learning and Mentorship**

Applied learning under the guidance of senior foresters emerged as the preferred and most effective way to acquire forestry-specific interpersonal and field competencies. Brown (2003) advocated for developing process knowledge (“knowing how”) through problem-based instruction. Responses to interview questions 3c (What suggestions would you offer forestry educators to improve the career readiness of new foresters?) and 3d
(What techniques do you use to fill competency gaps?) substantiate the value of senior forester mentorship as early career foresters begin participating in the practice of forestry (Lave & Wenger, 2012).

S5: I remember going through college, they teach you the x's and y's and everything as to what to do, but boy they sure didn't even tell you about the politics, and how politics will trump science every time... You [professors] taught us how to do all this stuff out in the woods, but you made it sound like we're working in vacuum. But you just can't put into play everything you learned because there's so many outside forces out there that affect what you do day to day. You don't realize that until you get into a little bit.

S3: Until you write your own timber sale with your own prescription and have it harvested and then see how the regeneration goes, it's very hard to truly put it all together. At least at the state, we offer some of that through internships. Whenever we could we'd set them [interns] up with a forester. They hop in the same truck and go check timber sales, they worked with loggers, they cruised timber, they did regen checks. They could talk to the different foresters and get a broad range of experiences.

S2: I’ve had many conversations with coworkers about “Well, this is what we were taught in school, but in the real world, this is how we have to do it”. I wish there would have been more interactive classes in the forestry program itself, bringing in folks from agencies like the counties or the state or the federal government, and having some interaction with them or even the logging community. Incorporate that somehow into a class.

S4: Having real-life situations that aren't all academic. Scenarios for how you’re going to deal with the nuances of a landowner worried about visual quality, confusing survey lines, or a county board member who doesn't like what they're hearing.

S2: We really rely on our more senior staff to help get those new foresters the skills they need to do the job on their own. Sale administration is a big one. If they don't have any experience, that's one area where they're not going to be doing any sale administration on their own for a while. That would be literally throwing somebody to the wolves. They need some time to figure out the communication part, sale regulations, is the logger trying to get one by them or is everything they're doing legit. There's a whole suite of things they need to be able to handle.

S3: That relationship building definitely takes time, and it's time and mentoring from the senior foresters that helps out big time, for sure. You might get a little a little taste of that relationship building and trust when you have group projects, relying on your partners to get their work done and done right.

Narratives about the salience of on the job learning underscored the nuanced complexity of forestry practice, and highlighted the role of student internships and veteran forester mentorship to develop professional acumen. S3 explained that really understanding forestry is only possible after implementing the full scope operations. S5 and S2 added that idealized academic scenarios are complicated by political realities that
education doesn’t address. Student internships and mentoring bridged this learning gap. S2 credited senior staff with assisting new foresters in developing the skills for independent work, especially timber sale administration.

**Online Individual Interviews**

The individual online Qualtrics interviews resulted in nine completed questionnaires. Participants provided background information and responded to one Likert-style question and nine open-ended questions about early career experiences in forestry, addressing the second research question. Four themes emerged from coding analysis of responses to the interview questionnaire (Table 5). Interview themes parallel topics discussed during the focus group meeting however, nuanced differences reflect the perspectives of early career practitioners. The participant quotes that follow each of these emergent themes illustrate forester perceptions on their first years in the profession.

**Table 5: Themes formulated from individual interview data.**

<table>
<thead>
<tr>
<th>Theme</th>
<th>Brief Description</th>
<th>Percent of Participants Discussing Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Managing for Multiple Objectives</td>
<td>63%</td>
</tr>
<tr>
<td>2</td>
<td>Pivotal Members in Community of Practice</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td>Broad-ranging Work Readiness Competencies</td>
<td>100%</td>
</tr>
<tr>
<td>4</td>
<td>Situated Learning to Acquire Professional Knowledge</td>
<td>85%</td>
</tr>
</tbody>
</table>

**Emergent theme 1: Managing for Multiple Objectives**

Responses to the first open-ended interview question (What do you feel are the most important aspects of your job?) echo sentiments shared in the focus group meeting on the complexity of managing for multiple objectives. One subtle distinction was explicit reference to managing for sustainability. Even statements that did not use the term conveyed the same commitment to land stewardship and multi-use priorities.

F1: Ensuring that county land is managed sustainably and with correct silvicultural practices.
F9: Wildland fire prevention during times of high fire danger. Managing, protecting and regenerating our forest resources in a sustainable way.

F5: Being a good steward to the land that has been entrusted to us, and promoting the local economy.

F7: State land management: not just timber but for wildlife, clean water and roads/recreation to some degree. Wildland firefighting.

Early career forester accounts of the essence of forestry practice encompassed a broad range of responsibilities with emphasis on sustainable management. F1 and F9 expressed this directly, while F5 referred to it as stewardship. F7’s reference to managing for wildlife, clean water, recreation, and wildfire reflects Leopold’s community-based land ethic, which recognized the interconnectedness of ecological and human systems (Aldo Leopold Foundation, 2020b).

**Emergent theme 2: Pivotal Members in Community of Practice**

Interview questions 10-10b inquired about the nature of forester interactions with the general public and resource management partners. Description of their various responsibilities as liaisons and collaborators positioned foresters as pivotal members with the community of forestry practice. Human relations comprised a substantial portion of everyday work operations. Early career foresters reported interacting “A moderate amount” (56%) with members of the general public and “A great deal” (44%) with other resource managers (Table 6).

Table 6: *Responses to Likert-style question #10.*

<table>
<thead>
<tr>
<th>Question</th>
<th>A great deal</th>
<th>#</th>
<th>A lot</th>
<th>#</th>
<th>A moderate amount</th>
<th>#</th>
<th>A little</th>
<th>#</th>
<th>None at all</th>
<th>#</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much do you interact with the general public?</td>
<td>0%</td>
<td>0</td>
<td>11%</td>
<td>1</td>
<td>56%</td>
<td>5</td>
<td>33%</td>
<td>3</td>
<td>0%</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>How much do you interact with other</td>
<td>44%</td>
<td>4</td>
<td>22%</td>
<td>2</td>
<td>33%</td>
<td>3</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>9</td>
</tr>
</tbody>
</table>
Responses to the open-ended follow-up questions added depth to understanding the context of these interactions and substantiated the need for interpersonal communication skills discussed at length during the focus group meeting with forestry supervisors. Early career forester responses to interview question 10a (Describe the typical nature and general tone of interactions with the general public) and 10b (Describe the typical nature and general tone of your interactions with other resource managers) included:

F3: I get calls about land management/ incentive programs. Also intersect with landowners on their property to discuss management. Field questions at front desk regarding various topics our office works with.

F4: The general public is curious about what we’re doing, and the tone is variable. I volunteer at a lot of public outreach events (fairs, fishing days, career days, etc.) to share knowledge with interested parties.

F7: Usually people are looking for burn permits or fuelwood/special use permits. Sometimes they're just looking for directions to campsites or information on the surrounding area or DNR rules/regulations as a whole. I find that many people don't seem to know that State, county, and Federal land are all administered by different agencies, so we deal with a lot of questions that may not even pertain to us exactly.

F1: The resource managers I deal with tend to be helpful and willing to collaborate when their jobs allow it.

F2: The general tone is respectful, understanding, and flexible. Willingness to help out or aid other resource managers goes a long way, because you may have to ask for their help later.

F7: As a forester, a major part of the job is supervising loggers and making sure they're following sale prescriptions and not causing any damage to sites. In my experience, these interactions tend to be pretty good natured and friendly, but as a regulatory agency our duty is to protect the land. Sometimes that may lead to uncomfortable conversations with loggers or contractors. Working with biologists/ecologists is overwhelmingly positive, however there have been occasions even in my young career where interests/objectives don't align. In those instances you have to be sure to follow agency policies/procedures to come to a compromise.

Accounts of typical interactions with the general public shared by F3, F4, and F7 depict foresters as central figures in the interconnected community of forestry practice, providing both information and resource use permits to stakeholders. F1, F2, and F7 described interactions with resource management partners as...
cooperative and amicable, with F1 and F2 specifically noting a willingness to collaborate. F7 observed that enforcing regulations had the potential to incite uncomfortable conversations. In cases of differing interests or objectives, F7 relied on agency policies and procedures to negotiate a compromise.

Emergent theme 3: Broad-Ranging Work Readiness Competencies

Responses to interview question 11 (Describe the knowledge, skills, and abilities that you feel are most important to have in your position; what do you find that you need/use most?) illuminated the breadth of work readiness competencies required of foresters. As mentioned by forestry supervisors during the focus group meeting, foresters are called upon to wield technical, field, ecological, and interpersonal abilities.

F1: It's hugely important to understand how trees reproduce, their shade tolerance, and their ability to deal with competition. If you can understand that, you should be able to apply a prescription that results in adequate regeneration. Social skills and problem solving ability is critical when dealing with loggers. View your relationship with loggers as a partnership, and not a supervisor/contractor role.

F2: Technical skills usage of GPS, Garmin, data recorder, measuring tools, GIS. Understanding competition, species characteristics, species ages, what does well in specific areas, longer lived species, seed dispersal. Communication is what's key or most important, without communication, flexibility and adaptability are unattainable.

F4: The ability to adapt to changing policies and directives, and again forest identification and mensuration techniques. Ecologically, the ability to recognize different forest types and look ahead into that stand’s future, as well as understand the timber markets and how they will affect what management strategies you are able to employ.

F5: Interpersonal communication is important, but so is technical skills like GPS and especially species identification. Using the actual equipment like prisms, logger’s tapes, and clinometers was very important. Understanding ecological functions is more important to understanding "why" we're doing what we are doing.

F7: Knowledge of forest measurements and plant identification are a must. A good understanding of BMPs [best management practices] for site and landscape level management are helpful. You should be a good communicator - I thought getting into natural resources meant I wouldn't have to deal much with people, but that isn't the case. It's beneficial to be good with mechanics, as we use a lot of ATVs/snowmobiles/chainsaws/brush saws/pumps/heavy equipment. I wish I had more knowledge that department. One of the biggest things is you must be ok with working alone in remote places.

F8: Definitely an understanding of cruising and scaling methods along with a good knowledge of silvicultural/management ideas. ArcGIS is a big tool we use with setting up timber and is a must know. Also
good to know the loggers side of things mainly being there equipment and how it will affect your stand and its prescription. Communication skills are important working with loggers and the general public.

F9: Knowledge of our tree and plant species and use of forestry tools like BAF [basal area factor] prisms, clinometer, diameter tape, increment borer, compass, GPS, etc. Also use of fire prevention tools such as pumps, hose and hose fittings, nozzles, fire hand tools, drip torch / fusee [ignition device], etc. All of these are very important to a NR [natural resources] Technician and used often.

Early career forester descriptions of the skills essential to forestry mirror the accounts of supervisors and forestry literature (Bullard et al., 2014; Sample et al., 2015). Participants F2, F5, F7, and F8 explicitly mention the importance of ecological knowledge of forests, proficiency with forestry tools and technology, and effective communication. F7 recalled thinking that a natural resources career would limit dealing with people, but discovered otherwise. This is a common misconception among forestry students (McGown, 2015). F4 recognized the ability to adapt to changing policies and directives as important, expanding the definition of necessary social aptitudes. Reflecting a recurrent narrative in the focus group discussion, F7 and F9 listed a variety of specialized tools, equipment, and machinery used in forestry, and F7 emphasized the importance of being comfortable with remote independent work.

**Emergent theme 4: Situated Learning to Acquire Professional Knowledge**

Brown (2003) asserted that forestry students must learn to think like a forester through practicing forestry. Early career forester perspectives on work readiness and forestry education validate this appeal for applied and situated learning. Responses to interview question 12 (How well prepared with these knowledge, skills, and abilities did you feel when you first began your position?) corroborate forestry supervisor narratives about the value of on-the-job training and senior forester mentorship of new professionals.

F1: I think I was properly prepared. There are just some things you won't be able to know until you experience them. Forests change so much depending on what part of the country, state or even county you are in. On the job, I gained the ability to understand the loggers and their operation and work with them better. Through past forest management, I was able to view what works and what doesn't in my part of the county.

F2: Tree species specific to the area you will be working in is more suited to on the job learning than a classroom setting.
F3: I was nervous about telling folks how to manage land that they knew much better than I did. My understanding of ecology was strong, but I was still not really confident after school. On the ground training and shadowing veterans and asking them questions helped tremendously.

F6: Most of my skills were first initiated working with the Forest Service. School somewhat refined them but I owe a lot to previous work experience.

F9: I had most of the necessary skills before I started my current position. Between graduation and being hired with the DNR, I worked a few temporary jobs in forestry where I gained a ton of knowledge/experience.

Interview questions 13-15 explored the strengths and shortcomings of forestry education in preparing new foresters with relevant competencies. Responses to question 13 (What aspects of your forestry education program were most useful in developing these essential knowledge, skills and abilities?) reinforced the importance of applied learning specific to forestry practice.

F3: In field experience, vegetation ID [identification].

F4: Applied field techniques. In my BS, we took maybe two field trips and classes were not natural resource-based until a couple years in. During my subsequent AAS, we spent a lot of time out in the forest learning through application. We cruised trees, identified twigs, and got out of the traditional classroom.

F5: The hands on, in the field, using the equipment to gather data, and then preforming an analysis of that data.

F6: Field camp, dendro and some of the forest ecology classes.

F7: Field days and hands on experience with tools of the job and field measurements. I also think it's important to have a summer job or internship in the natural resources field so you know you can handle the weather, bugs, and remoteness if that is what you anticipate doing in the future.

Conversely, interview question 14 (What aspects of your forestry education program were least relevant to your current work as a forester?) critiqued general, decontextualized coursework as extraneous for its lack of future application.

F1: I remember taking trigonometry and calculus, but recall nothing from those classes as I have never used that knowledge in this job.
F2: Some things I learned in my degree now longer apply to what I do, like remembering scientific names of things I may never even look at again.

F5: The "liberal arts" classes that colleges make you take because they want you to be "well rounded". My Greek farm poetry literature class doesn't benefit me when I'm doing a prescribed burn, but I had to take it.

F8: A lot of general classes come to mind when thinking about classes that were very un-relevant towards my forestry career. Two examples being history of western art and chemistry. I get that classes like this make us better well rounded people in society but it felt very forced upon me while in college. Classes like that should be there for people that have interest or curiosity in that but shouldn’t be forced upon certain majors that don’t need it. Let people follow their interests on their own rather than force it upon them but I get it’s a cash grab for a lot of colleges which is why I’ll always tell people to attend community or technical colleges first.

Responses to interview question 15 (What things have you encountered in your work that your education did not prepare you for?) describe early career experiences that indicate a more applied and more contextualized forestry-specific curriculum may have better prepared foresters to participate in the complex and dynamic realm of forestry practice.

F1: There's been a learning curve with the technology, but that's hard to prepare for since every agency uses something a little different. There's a lot of equipment use in forestry and I felt I learned very little about that in college. Whether it's logger’s equipment or simple things I use every day like truck, snowmobile, ATV, etc.

F4: How different positions in forestry can be and the differences between working for all the major agencies and industries. I work for the Feds and my best friend works for the State, and our jobs are vastly different. There is something for everyone but I didn’t even know what types of foresters and jobs were out there when I started out.

F5: The actual process from start to finish of a timber sale, from road management to hydrological planning to the economics of the sale.

F6: Agency policies/procedures.

F8: I never learned certain computer programs until I started working with the state, but those computer programs are only used by the state.

F9: I had a tough time with learning state software and procedures but that's more of an agency and division learning curve.
Question 16 (What suggestions would you offer forestry educators to improve upon the career readiness of new foresters?) concluded the individual interview. Participant responses offer forestry educators insights to consider, particularly with regard to the value of integrating hand-on, field-situated learning experiences.

F1: More in field activities. Forestry isn't overly complicated, but it's hard to get a good grasp on it when all you do is talk about it in the classroom. People go into this profession because they like to work outside and work with their hands.

F3: Encourage field work. I thought I was 'too good' to cruise timber, but that would have been beneficial.

F4: Do as much to get hands-on class experience for students. Get them invested and passionate about their education by showing them the possibilities their degree will open.

F5: Actually get students out to timber sales, and talk to loggers and foresters in the field.

F6: It is challenging but the more field time students get, the better.

F7: Coursework should be the right balance of broad conservation/ecology background and specialized forestry training. I am a big proponent of on the job training/experience. I think students should be encouraged to spend time in the field before they complete their degree. Educators should do their best to build relationships with forestry professionals and do anything they can to connect their students with potential employers.

F9: During my time doing technical research writing and composition [courses] it would have been nice if I could write about something forestry related. We wrote about important subjects but I think I would have had more interest if I could make it about trees.

Distilling the responses to questions centered on work readiness and forestry education reveals the significance of Brown’s (2003) assertion that “learning to think like a forester” required practicing in a professional context. Restated, this is Lave and Wenger’s (2012) Situated Learning Theory applied to forestry education. F1 felt properly prepared for a position in forestry, but qualified this statement by explaining some things can’t be known without experiencing them. Attesting to forestry supervisor perspectives on internships and mentoring, F1, F3, F6, and F9 all referenced the importance of prior experience or on the job training, with F3 specifically attributing increased confidence to shadowing veteran foresters. Similarly, respondents F3, F4,
F5, F6, and F7 reported that applied field experiences, hands-on learning, and field camps using tools and practicing the work of forestry were most useful in developing essential knowledge, skills, and abilities. By contrast, decontextualized coursework without direct application in forestry was deemed unhelpful and irrelevant. For example, F1 noted trigonometry and calculus and F5 scientific names of nonresident species, while F5 and F8 referred to general and liberal education courses. F1, F8, and F9 reported being unprepared for agency-specific software. F6 agency mentioned policies and procedures, and F4 elaborated that state and federal positions were vastly different. Nearly all participants suggested incorporating more hands-on and field-based activities in forestry education. F9 offered that writing about forestry topics in technical research writing and composition courses as a solution to make general education courses more relevant.

**Document Review**

Document analysis supplemented data collected from the semi-structured focus group and individual interviews (Bowen, 2009). Following participant comments stressing the importance of applied learning to accrue field competence and interpersonal skills, the researcher reviewed forestry accreditation and program documents to gain additional insight on how forestry education prepared future forestry professionals. Findings of document review point to re-engineering that may strengthen forestry education programs. Society of American Foresters (SAF) is the accrediting body for all postsecondary degree-granting forestry programs in the United States (SAF, 2016). Documents reviewed included the current SAF Accreditation Handbook and selected forestry program guides. The Accreditation Handbook defines the programmatic structures and curricular standards required for SAF accreditation. However, forestry schools may implement these standards in various ways. Program information of forestry schools recognized by interview participants as providing relevant and adequate career preparation were also reviewed. Reviewing these documents provided enhanced understanding of the relationship between forestry education and the career readiness of new foresters.
SAF Accreditation Standards

Forestry program curriculum standards were reviewed for components related to field-based, hands-on instructional activities. Among the overarching standards for SAF accreditation was a requirement for diverse student learning experiences. Requiring a wide array of pedagogies intended to cultivate student aptitude in applying scientific knowledge to sustainably manage forest resources. Standard V, page 27 of the Handbook states:

The curriculum must provide a variety of educational experiences, including lectures, discussion, simulations, computer applications, and individual and group projects in laboratories and field experiences. The purpose of these experiences is to ensure that graduates of the program can knowledgeably develop, apply, and execute management plans that adequately address matters of ownership goals, forest health and sustainability, and the legal and regulatory environment. Students must be able to apply scientific methodologies to attain an array of sustainable forest products, services, and conditions.

Forestry curriculum standards also included requirements for general education and professional education. General education standards spanned three areas: Communication, Science and Mathematics, and Social Sciences and Humanities. Each area delineated specific learning outcomes; however, there was no requirement that standards were met via completion or inclusion of forestry-specific coursework. SAF accreditation standards for general education were outlined as follows in the Handbook:

Communications
Oral and written communication skills must be developed throughout the curriculum. Students must have the following:
1. the ability to prepare and deliver effective oral presentations;
2. proficiency in English composition, technical and business writing, and writing for nonprofessional audiences; and
3. the ability to read with comprehension and to understand, communicate, and critically evaluate multiple viewpoints.

Science and Mathematics
The curriculum must include mathematics and the biological and physical sciences.
1. Biological sciences. Students must understand the following:
   a. the components, patterns, and processes of biological and ecological systems across spatial and temporal scales;
   b. and molecular biology, cells, organisms, populations, species, communities, and ecosystems.
2. Physical sciences. Students must have an understanding of physical and chemical properties, measurements, structure, and states of matter.

3. Mathematics. Students must know and be able to use the basic approaches and applications of mathematics and statistics for analysis and problem solving, as appropriate for the program’s stated outcomes.

Professional education standards mandated breadth, depth, and balance among four subject categories:

Ecology and Biology, Measurement of Forest Resources, Management of Forest Resources, and Forest Resource Policy, Economics, and Administration. Learning objectives for professional education required that students demonstrated a number of specific competencies in each subject area. These included:

A. Ecology and Biology
Students must demonstrate the following competencies:
1. an understanding of taxonomy and an ability to identify forest and other tree species, their distribution, and associated vegetation and wildlife;
2. knowledge of soil properties and processes, hydrology, water quality, and watershed functions;
3. an understanding of ecological concepts and principles, including the structure and function of ecosystems, plant and animal communities, competition, diversity, population dynamics, succession, disturbance, and nutrient cycling;
4. an ability to make ecosystem, forest, and stand assessments; and
5. knowledge of tree physiology and the effects of climate, fire, pollutants, moisture, nutrients, genetics, insects and diseases on tree and forest health and productivity.

B. Measurement of Forest Resources
Students must demonstrate the following competencies:
1. an ability to identify and measure land areas and conduct spatial analysis;
2. an ability to design and implement comprehensive inventories that meet specific objectives using appropriate sampling methods and units of measurement; and
3. an ability to analyze inventory data and project future forest, stand, and tree conditions.

C. Management of Forest Resources
Students must demonstrate the following competencies:
1. an ability to develop, apply, and understand the effects of silvicultural prescriptions appropriate to management objectives, including methods of establishing and influencing the composition, growth, and quality of forests;
2. an ability to analyze the economic, environmental, and social consequences of forest resource management strategies and decisions;
3. an ability to develop management plans with specific multiple objectives and constraints;
4. an understanding of the valuation procedures, market forces, processing systems, transportation and harvesting activities that translate human demands for timber-based and other consumable forest products into the availability of those products;
5. an understanding of the valuation procedures, market, and non-market forces that avail humans the opportunities to enjoy non-consumptive products and services of forests; and
6. an understanding of the administration, ownership, and organization of forest management enterprises.

D. Forest Resource Policy, Economics, and Administration

Students must demonstrate the following competencies:

1. an understanding of forest policy and the processes by which it is developed;
2. knowledge of how federal, state, and local laws and regulations govern the practice of forest resource management;
3. an understanding of professional ethics, including the SAF Code, and recognition of the responsibility to adhere to ethical standards in decision making on behalf of clients and the public; and
4. an understanding of the technical, financial, human resources, and legal aspects of public and private enterprises.

In addition to these professional education standards, accreditation also required technological literacy sufficient for students to “use contemporary electronic technologies in professional life,” though specific learning outcomes were not defined for this standard.

It’s important to note that the Forest Technology degree held the most rigorous standard for instruction that facilitated situated learning. As stated in the SAF Handbook on page 38:

Students must complete a forestry-related work experience of at least 80 hours, such as on-the-job training or a comprehensive field project. The experience should simulate working conditions of typical employers and include full-day schedules with appropriate assignments.

Interview participant F8 recommended forestry students attend a community college or technical school prior to progressing into a four-year program for the purpose of attaining a more relevant and more applied education. Similarly, focus group participant S4 perceived that technical college graduates were more comfortable and more competent in the field, in part as a result of these situated learning experiences.

Brown (2003) argued that professional education derived from a detailed understanding of a specialized knowledge and learning how and when to apply it through accumulated experience. SAF accreditation standards reflected the knowledge, skills, and abilities mentioned by interview participants, with notable exceptions for specialized forestry equipment and situated instruction. Proper use of forestry implements is presumably integral to meeting professional education learning outcomes. Field-based instructional components, revered by both new and seasoned foresters, received limited definition among the listed standards.
Selected Forestry Programs

Program guides of forestry schools specifically mentioned by interview participants were reviewed to identify applied and field-based learning components. Forester positions generally required an SAF accredited four-year degree. Focus group participants remarked that most recently hired foresters were graduates of University of Wisconsin Stevens Point (UWSP) and Michigan Technological University (MTU). S2 observed “right now, it seems like most of them are coming from Steven’s Point or Michigan Tech, those are the two big ones” to which S5 and others concurred. S2 went on to explain that UWSP and MTU were locatees to facilitate situated learning because these campuses were “out there, close to where the rubber hits the road” making it easier to visit logging sites and forests to practice fieldwork. Forest technician positions requiring an accredited two-year degree were filled by graduates of local community and technical schools. Interview responses from new foresters indicated that four of the nine participants graduated from UWSP (N = 2) and MTU (N = 2). Participants from MTU completed the master’s program, and those from UWSP completed a bachelor’s degree in forest management. Two participants (F8 and F4) earned an associate’s degree in forest resources from Itasca Community College (ICC), then completed a four-year forestry program.

Given this study’s primary focus on accredited four-year programs, the researcher selected forestry program documents from UWSP and ICC for review. Reviewing published information from both schools provided context to understand participant opinions that two-year programs offered superior hands-on learning that enhanced work readiness. Digital documents included the UWSP College of Natural Resources Forest Management webpage (UWSP, 2021) and program guide (Appendix G), and the ICC Natural Resources program webpage (ICC, 2021) and Forest Resources Associate of Applied Science program guide (Appendix H).

UWSP boasts ample opportunities for learning experiences outside the classroom at one of three field stations. The Forest Management webpage states:

You will gain additional hands-on experiences in all areas of natural resource management during a required summer field experience generally taken between your sophomore and junior years. You can choose between our six-week, hands-on summer field experience held at our Treehaven field station or on-campus, or
take part in our European Environmental Seminar and learn how European natural resource management compares to the United States.

Field station descriptions posted on the UWSP Forest Management program webpage support participant accounts of proximity to forested settings facilitating opportunities for situated learning experiences. The largest among these, Treehaven, “rests on a glacial ridge overlooking 1,400 acres of forest and wetlands” and serves as an outdoor classroom of native wetland and forested habitats native to the northern forest biome. Forestry students are required to complete a six-week summer field practicum at one of the field stations or take part in a European equivalent to hone essential skills.

Contextualized learning is further cultivated through a required adviser-approved summer internship or employment in forestry. Supervisors and early career foresters revered internships and mentored, on the job training for marshalling necessary field competence and interpersonal skills. Incorporating a summer job or internship as part of the standard forestry curriculum provides a venue to practice “skilled action and deliberative analysis in decision making, problem solving, and planning” (Brown, 2003, p. 1). Acquiring such process knowledge (knowing how) affords new professionals confidence and the capacity to “hit the ground running,” as S2 observed.

Review of the UWSP Forest Management program guide also reflected participant comments, namely regarding the relevance of coursework. The guide was divided into eight semesters and two summer sessions with suggested courses in each to complete a total of 122-126 credits. General Education Program (GEP) courses, such as Math, English, and Chemistry, contributed 44 of those credits (~35%), most covered in the first two semesters. Of these, Plant Biology, Resources Economics, and Environmental Ethics have overarching relevance as cognate subjects. Including these as forestry courses left 33 credits (~26%) dedicated to general subjects. Courses in cognate fields highlighted an effort to meet general education requirements with forestry-related topics, as F9 suggested, to contextualize learning.

To explore participant assertions that two-year schools offered more applicable hands-on learning, the ICC Natural Resources program webpage and Forest Resources program guide were also reviewed. ICC’s
The Natural Resource program provides students with the knowledge and skills to be proficient in the technical aspects of management and protection of forest resources. Graduates will successfully perform as natural resource technicians using a science based approach, with an understanding of social, economic, and environmental issues within the natural resources field.

The mission statement specifically emphasizes proficiency with the technical aspects of forest management and protection, suggesting commitment to applied learning. Additional program features include sharing a campus with the USDA Forest Service Research Station and University Research Center, access to a 500-acre outdoor classroom, and affiliation with forestry practitioners. Such resources afford students access to field sites for situated study and practical internship opportunities. As stated in the Program Features section:

Fieldwork & Labs
Classes incorporate field labs that allow students to apply what they have learned in the classroom out "in the field." You will work together with your classmates on a variety of crews to conduct a variety of field labs. These labs require students to carry equipment (up to 30 pounds) through varied forest conditions. To achieve the learning objectives for field based classes, students should be in good physical condition and come prepared to work outdoors in rough terrain, heavy brush and adverse weather conditions. Most student recall the field labs as one of the highlights of their education, and employers identify these labs as the number one tool to prepare students for jobs.

Internship
Students will complete a Natural Resource internship that provides valuable career experience in their chosen field. These internship interactions with natural resources professionals provide excellent contact to future employers.

Review of the Forest Resources program guide yielded information consistent with participant narratives. The guide outlined coursework in four semesters to complete 64 credits and provide “graduates with broad based knowledge for the management of forest based resources.” Considering courses with a prefix other than ForT (Forest Technology) superfluous to the emphasis, 24 credits (~38%) were dedicated to general coursework. Adjusting for courses in cognate fields, such as Plant Biology, Forest Ecology, and Environmental Science, left 14 credits (~22%) in non-forestry subjects. The slightly lower proportion of coursework dedicated
to general education supported F8’s perception that two-year programs were more focused than four-year programs. Notions that two-year programs offered more applied learning experiences than four-year programs, while more elusive to quantify, are less apparent in this case.

Situated learning experiences were evident in the published documents of both UWSP and ICC forestry programs. While not a standard for SAF accreditation of four-year forestry programs, the UWSP Forest Management degree required a field practicum and internship or work experience. Comparison of other two- and four-year forestry programs may yield very different findings. It’s also important to point out that ICC’s more technically-focused Forest Resources degree prepares graduates for employment as forest technicians. Forester positions typically require a four-year degree. ICC’s program guide noted transfer opportunities to four-year schools, including UWSP. Supervisors and early career foresters recommended this educational pathway for situated learning to acquire field competence.

Chapter Summary

Chapter IV reviewed the research design and questions, participant selection, data collection and analysis methods, and findings of this study. Findings presented in Chapter IV emerged from data acquired through one online interview questionnaire, focus group interview, and document review. The researcher hosted an online focus group interview with forestry supervisors and conducted online individual interview using a Qualtrics questionnaire. Eight themes emerged from coding analysis of the textual data: Dynamic Complexity of Forest Management, Enhanced Interpersonal Skills, Essential Field Familiarity and Competence, Value of Applied Learning and Mentorship, Managing for Multiple Objectives, Pivotal Members in Community of Practice, Broad-ranging Work readiness Competencies, and Situated Learning to Acquire Professional Knowledge. Study findings point to the importance of synchrony between forestry education and forestry practice. Chapter V will discuss the theoretical connections and implications of these findings, present this study’s conclusions, and offer recommendations for future research.
CHAPTER V
DISCUSSION, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Introduction

This study explored career readiness from the perspective of forestry supervisors and early career foresters using a qualitative phenomenological approach. The researcher sought to understand the role of forestry education in preparing new professionals for the community of forestry practice. Specific focus centered on deciphering the alignment between forestry education and forestry practice and identifying effective pedagogical strategies. Chapter I established the foundation of this study, Chapter II reviewed extant literature, Chapter III delineated research methodology and rationale, and Chapter IV presented study findings. Chapter V discusses key findings and theoretical connections. This chapter also presents conclusions with respect to the guiding research questions, confers the implications for practice, and offers recommendations for future research.

Overview Discussion

Qualitative phenomenology was used in this study to explore the career readiness of Minnesota’s future forestry professionals. Participants were committed to sharing perceptions and experiences to advance forestry education and enhance the preparedness of new practitioners joining this community of practice. Virtual focus group interview discussions with forestry supervisors yielded insights that led to emergent themes delineating the nature of forestry and new forester performance. Individual online interviews added depth to understanding forestry education’s role in work readiness through the experiences of early career foresters. Review of forestry accreditation standards and program documents corroborated and contextualized participant accounts of the strengths and shortcomings of forestry education. Triangulating across multiple data sources provided a confluence of evidence, adding rigor, breadth, and depth to strengthen the research (Patton, 2015).

Eight themes emerged from thematic coding analysis of the data: Dynamic Complexity of Forest Management, Enhanced Interpersonal Skills, Essential Field Familiarity and Competence, Value of Applied Learning and Mentorship, Managing for Multiple Objectives, Pivotal Members in Community of Practice,
Emergent themes illuminate the importance of alignment between the competencies instilled through forestry education and those required in the realm of forestry practice to ensure sustainable management of forest resources. Study findings connect to themes in the extant forestry education literature as well as theories on learning, work readiness, and complexity.

**Theoretical Connections**

Three theories undergirded this research: Situated Learning Theory, Graduate Work-Readiness Theory, and Complexity Theory. Each theory contributes to understanding the realm of forestry practice and the role of education in preparing new professionals for the multifaceted endeavor of sustainable forest management.

**Situated Learning Theory**

Situated Learning Theory covers various dimensions of cognitive development relevant to forestry education. The transmission of tacit knowledge and the role of expert practitioner mentorship emerged as most salient to participant narratives of educational and early career experiences. Lave & Wenger (1991) declared that learning was a situated, social process in which knowledge was co-constructed. Emphasis on the learning environment reflects Vygotsky’s (1978) assertion that culture and context played a significant role as individuals apprehended and developed identity within the community. Translating the Theory of Situated Learning to forestry, Brown (2003) insisted that generic problem-solving skills taught as part of modern curricula rarely transferred to practice. Learning to think like a forester occurred through solving contextually situated problems, where the emphasis shifted to “action and interpretation rather than theory and memory” (Brown, 2003, p. 7). Participant comments on the importance of applied, field-based (i.e., situated) instruction to develop professional confidence and proficiency demonstrate connections between Situated Learning Theory and emergent themes of Essential Field Familiarity and Competence and Situated Learning to Acquire Professional Knowledge.

Lave and Wenger (2012) further proclaimed that in situated learning environments, knowledge was co-constructed as new practitioners moved toward full “legitimate” participation within the community of practice.
Both focus group and interview participants remarked on the importance of senior forester mentorship to guide new foresters in developing essential interpersonal skills and field competence. Narratives describing guided progression toward skilled forestry practice connect Situated Learning Theory to the emergent theme Value of Applied Learning and Mentorship.

**Graduate Work-Readiness Theory**

Graduate Work-Readiness Theory provided a lens to characterize the career readiness of new forestry professionals. A work-readiness integrated competence model (WRICM) of four resource categories and associated skills (Prikshat et al., 2019) framed the competencies required of forestry professionals. Prikshat et al. (2019) defined work-readiness as an evolving, integrated suite of intellectual, personality, meta-skill, and job-specific resources that engendered specific professional abilities. Meta-skill resources of teamwork, communication, and information technology skills emerged as particularly salient in this study. Sample et al. (1999) observed that public scrutiny and the rising importance of non-timber management considerations elevated the imperative for interpersonal competencies in forestry. Years later, forestry employers still ranked effective communication, public relations, and ethical behavior among the most important skills required for contemporary practice (Sample et al., 2015). Participant accounts of the knowledge, skills, and abilities deemed most important concurred. Supervisors and early career foresters emphasized the need for effective communication skills to negotiate interactions with partner agencies and the general public. Aptitude and confidence working in remote settings and using forestry tools were likewise fundamental to job performance. Bullard et al. (2014) used the term “society ready” to describe foresters capable of handling the complex economic, ecological, and social aspects of forestry. Emergent themes of Enhanced Interpersonal Skills, Pivotal Members in the Community of Practice, and Broad-Ranging Work-Readiness Competencies connect study finding to Graduate Work-Readiness Theory.

**Complexity Theory**

The milieu that surrounds sustainable forestry was conceptualized through the lens of Complexity Theory. Complexity Theory characterized ecological and social systems as inherently interdependent and ever-
changing (Norberg & Cumming, 2008). Forested ecosystems constantly respond to environmental changes; in climatic conditions, natural disturbances, and resource extraction pressures (Sample & Bixler, 2014). Likewise, the practice of forestry is dynamic and multidimensional, and as it changes so much forestry education to remain relevant (Brown, 2003; Fisher, 1996; Sample et al., 1999). Levin et al. (2013) described these mutable relationships as complex adaptive systems. Forestry supervisor discussions of the diverse responsibilities of forester and the changing expectations of forestry depict the Dynamic Complexity of Forest Management, this study’s first emergent theme.

Forestry takes place at the nexus of ecological, social, and political systems. Achieving sustainability depends upon meeting management objectives across all three dimensions of this complex amalgamation (MN DNR Division of Forestry, 2020). Early career forester perceptions of the most important aspects of forestry illustrate a commitment to forest stewardship for provision of habitat as well as timber resources. Recognition of the broader ecological values of forested ecosystems reflects a land ethic view of the relationships between human and natural system as intertwined (Leopold, 1968). Moreover, it demonstrates connection between Complexity Theory and the emergent theme of Managing for Multiple Objectives.

**Research Conclusions**

Findings that emerged from qualitative inquiry suggest three conclusions that provide answers to the research questions explored in this study.

**Conclusion 1: Field and Interpersonal Skills are Fundamental to Sustainable Forestry**

The first conclusion relates to research question one: what are employers’ career readiness expectations of early career forestry professionals?

Discovery of the first research conclusion was primarily based on focus group interviews and supported by individual interviews. Forestry supervisors from county, state, and federal agencies had similar broad-ranging expectations of early career foresters. Supervisors commented on valuing employees with sufficient field familiarity to “hit the ground running” and be self-reliant in remote work environments. Field competence
is somewhat unique to forestry, but relates closely to the Intellectual and Job-Specific Resources categories of the work-readiness integrated competence model (WRICM) in having problem-solving, planning and strategic thinking, and organizational skills to (Prikshat et al., 2019). Comments from forestry supervisors on the need for basic field competence and the observation that this is sometimes lacking contradict the findings of previous surveys. Sample et al. (2015) framed this ability as remote sensing using GPS and GIS, but this does not fully represent the breadth of aptitude necessary to safely and confidently conduct remote fieldwork. Forestry supervisors explained this required thinking strategically to plan ahead and prepare accordingly. In this regard, study findings correspond to national survey results indicating that employers ranked the professional skill of strategic thinking among those of highest importance, and one that graduates fell short of meeting in terms of preparedness (Sample et al., 2015).

Meta-skill resources of communication, teamwork, and information technology likewise factored prominently. Supervisors and early career foresters remarked on the importance of effective interpersonal skills to negotiate frequent interactions with other resource managers and the general public. Study findings corroborate national surveys ranking effective communication in the workplace and with clients, ethical behavior, and conflict resolution among the most important skills, and those with the greatest preparedness gap among graduates (Sample et al., 2015). Sustainable forestry requires interpersonal skills to negotiate across diverse stakeholder interests and meet multiple management objectives (Sheppard et al., 2020). The breadth of expectations placed upon Minnesota foresters span the WRICM and track with those reported at a national level (Bullard et al., 2014; Sample et al., 2015). These findings support the conclusion that foresters are expected to poses broad-ranging work-readiness abilities with particular emphasis on field and interpersonal skills to effectively practice sustainable forestry.

**Conclusion 2: Foresters are Pivotal members in a Complex Community of Practice**

Conclusion two addresses this study’s second research question: how do recent graduates describe their first years in the profession?
The second research conclusion was discovered through individual interview responses to questions about the nature of forestry and reinforced by focus group interview dialogs. Early career foresters reported “ensuring that county land is managed sustainably,” “wildland fire prevention,” “promoting the local economy,” and managing “not just timber but for wildlife, clean water, roads, and recreation” among the most important aspects of forestry. Statements of managing for multiple objectives illustrate the complex interconnected social-ecological system within which the practice of forestry occurs (Norberg & Cumming, 2008). Further, the responses demonstrate a land ethic view of the professional responsibilities of foresters to maintain the ecological integrity of forested resources while also satisfying the interests of human stakeholders (Leopold, 1968).

Forestry supervisors described foresters as “carrying a lot of different hats” and forestry as involving many aspects of resource management beyond tending trees. These include social engagements such as managing tax forfeited land, negotiating with private landowners, and surveying ownership boundaries. Additionally, foresters conducted wildlife projects, reflecting accountability for the broader ecological function and value of forested ecosystems. Forestry supervisors also commented on the ever-changing context of forestry practice. In particular, supervisors noted “more outside influence” on management decisions, a shift in the conceptualization of forest communities through ecological classification systems (ECS), and evolving logger education as salient to forestry operations. Narratives of transformation reflect a fundamental feature of complex adaptive systems; that of change (Levin et al., 2013). Engagement across the social and ecological spheres of forestry depicts foresters a pivotal members in a dynamic and complex community of practice.

Conclusion 3: Situated Learning Enhances the Career Readiness of New Foresters

This study’s third conclusion resolves research question three: what organizational re-engineering is needed to strengthen forestry education programs?

Discovering the third and final research conclusion progressed through a review of forestry education documents and triangulation with interview transcripts. Narratives from forestry supervisors and new foresters
indicated that situated learning experiences enhanced career readiness. New foresters face a steep learning curve in apprehending agency-specific computer programs, policies, and procedures. Comments such as “some things you won’t be able to know until you experience them” conveyed the significance of applied learning situated within the milieu of forestry. Mentored learning on the job training was credited with building confidence to conduct forestry activities that involved interpersonal interactions, especially those resulting in tense conversations such as supervising loggers and negotiating compromise with partner agencies to reconcile dissimilar management objectives. One new forester made this poignantly clear in recalling “My understanding of ecology was strong, but I was still not really confident after school. On the ground training and shadowing veterans and asking them questions helped tremendously”. Lave and Wenger (2012) asserted that knowledge was co-constructed as new practitioners progressed toward “legitimate” participation within the community of practice. Participant accounts of acquiring essential knowledge, skills, and abilities through hands-on experiences under the mentorship of senior practitioners illustrate the core principles of Situated Learning Theory (Lave & Wenger, 2012).

Observations new forester background predisposed field abilities depict the role of personal knowledge in job performance. Eraut (1985) contended that personal knowledge (experiences, beliefs, memories) conditioned learning, recasting Bruner's (1979) notion that intuition and existing repertoire affected the integration of new information. Supervisors noted that early career foresters with a “tie to the land” were more comfortable and more capable working independently in remote settings. Internships were viewed as a surrogate means to build field familiarity by providing a venue for the development of tacit “knowing-in-action,” or spontaneous comprehension (Schön, 1987). Process knowledge, as Eraut (1985) termed this, was best acquired through practice to learn “how” to negotiate the nuances of interpersonal interactions and the rigors of fieldwork.

Brown (2003) contended that forestry education programs traditionally emphasized core academic disciplines and technical training, reflecting an implicit belief in technical rationality when ultimately “most problems in real-world practice cannot be solved by the application of factual knowledge” (p. 3). Further, this
reality disconnect warranted broader integration of applied learning experiences to promote in graduates the ability to “think like a forester” through the accumulation of process knowledge. Field activities and similar contextually situated instruction received sparse attention in the Society of American Foresters (SAF) Accreditation Handbook. Forest Technology held the highest standards for situated learning, requiring that students completed a “forestry-related work experience of at least 80 hours” to “simulate working conditions of typical employers” (SAF, 2016, p. 38). SAF (2016) Forestry program standards for providing situated instruction were more nebulous than Forest Technology standards, but included a physical facilities requirement for access to outdoor laboratory sites and curriculum provision of experiences “to ensure that graduates of the program can knowledgeably develop, apply, and execute management plans that adequately address matters of ownership goals, forest health and sustainability, and the legal and regulatory environment” (p. 27). Greater attention to the contextually situated development of practical skills in the Forest Technology degree (typically a two-year program) validated participant perceptions and Brown’s (2003) claim of forestry education’s focus on academic disciplines (propositional knowledge). Forestry supervisors observed that new foresters with both applied two-year degrees and four-year forestry credentials were more familiar and competent with forestry tools and fieldwork operations. Early career foresters advised attending community or technical colleges prior to entering a four-year program to secure a more relevant and applied education. These perceptions, authenticated by SAF accreditation standards, support the conclusion that situated learning opportunities enhance the career readiness of new foresters.

**Implications for Practice**

This study revealed new findings on situated learning relevant to the sustainable management of forests. The current wood supply crisis depicts the complex and interdependent social-ecological system within which professional foresters practice. Recent increases in home construction raised the demand for wood building materials and correspondingly, timber harvesting activities (Olick, 2021). Society needs well-trained foresters educated in the dynamic complexities of sustainable forestry to shepherd forested ecosystems through the
lurching demands placed upon them. Forestry education must deliver relevant and situated learning to instill the field and interpersonal skills foresters use in managing for multiple objectives.

Research conclusions point to three implications for educational practice. First, creating situated learning experiences that mimic the social interactions a practicing foresters encounters may enhance interpersonal skills. Forestry supervisors and early career foresters alike commented on the importance of effective communication. This skill is required beyond just working with other foresters, as narratives about cooperating with loggers, assisting the general public, and collaborating with partner agencies depicted. Forestry necessarily involves interacting with people, navigating the human dimension of the complex social-ecological system that envelopes the practice, to negotiate sustainable management outcomes. Engaging in these scenarios would model legitimate peripheral participation (Lave & Wenger, 2012) and provide context for students to begin “thinking like a forester” (Brown, 2003).

Second, offering instructional experiences situated within the forest may promote field competence. Foresters use a wide array of specialized equipment and technologies. Forestry supervisors observed that being unaccustomed to working with these presented a steep learning curve for early career employees, whereas new foresters skilled with the implements were more autonomous at the outset. Likewise for the level of remote and independent fieldwork that new foresters were comfortable with. Employees with prior experience, through an internship or seasonal employment, exhibited greater confidence and self-reliance. Exposing forestry students to field-based learning activities provides exposure to the nature of forestry and all its accompanying nuances: inclement weather, biting insects, remote settings, and a host of specialized tools, machinery, and equipment. Forest-situated learning activities facilitate development of process knowledge (Eraut, 1985) and acquisition of professional and meta-skill resources (Prikshat et al., 2019), attributes that classroom learning cannot deliver.

Third, inviting forest practitioners to speak in forestry courses may serve as a proxy for veteran mentorship. Participants remarked on the value of initially working with a senior forester to develop tacit professional knowledge. While not entirely the same as directly engaging in forestry activities, candid
conversations with practitioners would enlighten students on the milieu of forestry. Foresters from different agencies discussing roles and responsibilities would inform career decisions and familiarity with policy. Supervisors and early career foresters noted that education had not prepared them for the politics of forestry; this topic in particular would be salient to learn about from the perspective of a practicing forester. Firsthand accounts of routine forestry operations would provide important insight on the broad-ranging skills required of foresters. Combining these implications, practitioner forester engagement in situated social and field-based learning activities would lend authenticity to these experiences, and potentially provide a conduit for future internships or employment.

**Future Research Recommendations**

The findings of this study reveal prospects for future research related to forestry education and pedagogical strategies to improve career readiness. Recommendations for future research include a comparative study to examine the situated learning experiences offered by different forestry schools, a replication of this study that explores forestry educator perspectives on situated learning pedagogies, and repeating this study in other forestry communities.

Study participants noted differences in the field competencies acquired through different forestry schools. Observations were particularly salient with respect to two-year vs. four-year programs. SAF accreditation standards related to situated instruction leave ample room for interpretation and implementation as befits the resources of the program. New foresters echoed supervisors in recommending two-year programs for superior hands-on, forestry-specific instruction. Accreditation standards supported this observation. Two-year technical programs required a situated work experience, while four-year forestry programs did not. Document review findings of this study yielded little difference between the schools compared. Broader analysis of multiple schools may illuminate opportunities for re-engineering the curriculum to integrate more situated instruction at the four-year level.
Participants of this study commented on the value of situated learning experiences to hone essential forestry skills, both field and interpersonal. In related studies, faculty reported accreditation concerns among the barriers to curriculum changes in forestry that may promote experiential learning pedagogies (Sample et al., 2015). However, the standards for implementing situated instruction allow for novel approaches within the required coursework. Exploring the perspectives and experiences of forestry faculty may reveal strategies for operationalizing unique situated learning experiences to infuse the existing curriculum without expanding it.

Lastly, recognizing that ecological and sociopolitical context vary across the landscape, affecting interconnections within communities of practice, the researcher recommends replicating this research in other geographic regions. Participants remarked on the diversity of forests and the change in species even within a county. This represents just one dimension of the complex social-ecological system that envelops forestry practice (Levin et al., 2013). Land ownership and the attending management regimes likewise vary greatly, as noted by early career foresters explaining the challenge of learning new policies or the marked differences between state and federal forestry. The findings of this study answer questions regarding forestry education and career readiness based on the perceptions of forestry practitioners in north central Minnesota. Important differences may exist in other communities of forestry practice.

**Summary**

This phenomenological study on the career readiness of new forestry professionals yielded encouraging results. Findings contributed new insights on the role of forestry education in preparing graduates for the dynamic and multifaceted endeavor of sustainable forest management. The research demonstrated connections to the literature and theories related to situated learning, work readiness, and complexity. Study findings highlighted the importance of situated learning to develop essential field and interpersonal skills. Recommendations for educational practice and future research included expanding situated learning experiences and exploring faculty perspectives on integrating these pedagogies. Adequately preparing students for sustainable forest management has global implications. This study reinforced the significance of higher
education’s role in forest stewardship – educating career-ready future professionals to ensure sustainable forestry.
https://www.aldoleopold.org/about/aldo-leopold/

https://www.aldoleopold.org/about/the-land-ethic/


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https://doi.org/10.2277/0521663636


https://doi.org/10.4324/9781315743141-5


https://in.bgu.ac.il/humsos/politics/Documents/Ethics/Yin Qualitative Research from Start to finish.pdf


Appendix A: Focus group invitation email

Greetings!
My name is Samantha Jones; I’m an Assistant Professor in the Center for Sustainability Studies (CSS) at Bemidji State University (BSU), and a doctoral candidate in the Education program at Winona State University (WSU).

I’m writing to invite your participation in a study that I am conducting for my dissertation research. The purpose of the study is to explore forestry education and the career-readiness of new forestry professionals. I’m inviting you to participate because as a supervisor you have valuable first-hand insights to offer on your experience with new forestry professionals. I’m not looking for facts or statistics; just your experiential wisdom on what skills are most needed, most lacking, and how forestry education might be improved to meet the needs of practice.

Although research has been conducted on forestry education and career-readiness, there is a limited body of knowledge on the education and performance of Minnesota’s early-career foresters. Part of the impetus for this study is also to inform the direction of a Society of American Foresters (SAF)-accredited Forestry program at BSU, a possibility that a core team of faculty are currently exploring.

Your participation will involve contributing to a 1-hour long virtual focus group meeting with other forestry supervisors in the northcentral MN region, hosted using Zoom videoconferencing software. To schedule that meeting, I’ll create an online poll to determine the most convenient date and time for everyone. A follow-up email will provide the information to join the meeting on the scheduled date. For full disclosure, the meeting will be recorded and transcribed so that I can accurately analyze our discussion afterwards.

Additionally, in a separate email, I will ask you to provide me with the names and email contacts of new foresters in your work area, those who graduated within the last five years. These foresters will be invited to complete an emailed questionnaire relating to their forestry education and early career experiences to understand career-readiness from the perspective of new forestry professionals. The questionnaire should take no more than one hour to complete, and all responses will be kept anonymous.

Rest assured that the information and opinions you offer will be kept confidential. Anything you share will be anonymized so that names and position titles are not disclosed in the final dissertation. You also have the option to join the virtual meeting using an alias and without video, should you prefer to remain anonymous during the focus group meeting.

The intent of this study is to contribute to our knowledge on forestry education, in particular identifying educational best practices to improve the career-readiness of new professionals. Study findings will be shared with participants as well upon completion, I’ll email you a copy of the finished dissertation.

Taking part in this study is completely voluntary. You have the option to stop participating at any time. Should you elect to participate, please respond to this email. Your reply will establish consent and no further acknowledgment is needed. I’ll be in touch thereafter with follow-up communication to select a date and time for the focus group meeting.

Please feel free to contact me via phone or email, listed below, with any questions or concerns. Thank you for your time and consideration of this invitation. I look forward to your response and the insights you have to share about forestry education and career-readiness.

Sam

Samantha M. Jones
WSU Doctoral Candidate, EdD
Assistant Professor, CSS
222 Settgast Hall
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Email: samantha.jones@go.winona.edu
Mobile: 575-740-6100
Zoom: https://minnstate.zoom.us/my/smjones
eProfile: https://samanthajones2.sfclomn.com/Home
Appendix B: Focus group scheduling poll invitation

Forestry meeting poll

Jones, Samantha M <samanthajones@go.winona.edu>
Tue 2/23/2021 10:45 AM

Hello all, and thank you again for participating in this study!

Please use the Doodle poll link below to select the days and times that you would be available to meet online for our focus group discussion.

Should you prefer to remain anonymous, you can enter an alias in place of your name when completing the poll. It won’t be much matter who is free when as finding a combination that works for (hopefully) everyone.

The current date range is set for next week (March 1-5), and this can be extended if necessary. Likewise, should finding a single date prove too unwieldy, we can arrange two separate meetings. Please select all date/time combinations that could work for you, and we’ll go from there.

The poll will remain active through this Friday (2/26). After the poll closes, I will be in touch with the instructions for joining the Zoom-hosted focus group meeting.

Please let me know if you have any questions or run into any technical snags. Thanks!

Sam

https://doodle.com/poll/5x5h3upikcin53a6s/?utm_source=poll&utm_medium=link

Doodle: Forestry Career-Readiness
Virtual meeting to discuss the career-readiness of foresters and improvements to forestry education.
doodle.com

Samantha M Jones
WSU Doctoral Candidate, EdD
Assistant Professor, CSS
133 Sartega Hall
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Mobile: 575-740-6100
Zoom: https://minnstate.zoom.us/my/smijones
eProfile: https://samanthajones2.efoliomm.com/Home
Greetings!

My name is Samantha (Sam) Jones, I’m an Assistant Professor in the Center for Sustainability Studies (CSS) at Bemidji State University (BSU), and a doctoral candidate in the Education program at Winona State University (WSU).

I’m writing to invite your participation in a study that I am conducting for my dissertation research. The purpose of this study is to explore forestry education and career-readiness. I’m inviting you to participate because you have valuable first-hand insights on your forestry education and early career experiences as a new forestry professional. I’m not looking for facts or statistics; just your practical wisdom on what knowledge/skills/abilities you needed most, those you felt you were lacking, unexpected learning curves, and how forestry education may be improved to better meet the needs of forestry practice.

Although research has been conducted on forestry education and career-readiness, there is a limited body of knowledge on Minnesota’s early career foresters. A secondary impetus for this study is to inform the direction of a Society of American Foresters (SAF) accredited Forestry program at BSU, a possibility that a core team of faculty are currently exploring.

Your participation will involve responding to an interview delivered through a Qualtrics questionnaire, and possible email or video-conference follow-up for clarification, as necessary. The questionnaire will primarily consist of open-ended questions and should take no more than about 30 minutes to complete.

You will be able to save your responses and return to the questionnaire later to make changes and/or complete remaining questions, within 3 days. Once you begin the questionnaire, it will close automatically after 72 hours (3 days) of no activity and record your responses. The questionnaire will be open through next week Friday (March 5). Please finish entering your responses before this closing date.

Rest assured that your responses will be kept confidential. Anything you share through the questionnaire or follow-up communications will be anonymized so that names and position titles are not disclosed in the final dissertation.

The intent of this study is to contribute to our knowledge on forestry education, in particular identifying educational best practices to improve the career-readiness of new professionals. Study findings will be shared with participants as well; upon completion, I’ll email you a copy of the finished dissertation.

Taking part in this study is completely voluntary and you have the option to stop participating at any time. Please use the link below to access the Qualtrics interview questionnaire. Responding to the questionnaire constitutes your consent and no further acknowledgement of such is needed.

Please feel free to contact me via phone or email, listed below, with any questions or concerns. Thank you for your time and consideration of this invitation. I look forward to your responses and the insights you have to share about your forestry education and early career experiences!

Sam

Qualtrics interview questionnaire:
https://winona.a21.qualtrics.com/jfe/form/JV_S6fm1H_thdOqfZZ9e

Forestry Education | Qualtrics questionnaire

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Appendix D: Institutional Review Board (IRB) approval letter

Winona State University Institutional Review Board (IRB)  
Human Protections Administrator  
Maxwell 161  
Winona, MN 55967  
507.457.5519 or bayers@winona.edu

DATE: February 9, 2021  
TO: Samantha Jones, EdD  
FROM: Winona State University IRB  
PROJECT TITLE: [1717912-1] Educating for Sustainable Forestry: Perspectives on the Career Readiness of New Professionals  
SUBMISSION TYPE: New Project  
ACTION: DETERMINATION OF EXEMPT STATUS  
REVIEW TYPE: Exempt Review

Thank you for your submission of New Project materials for this research study. The Primary Reviewer has determined this project is exempt from further review according to federal regulations and you may begin your research.

While your project is exempt from further review, you must report to the IRB any significant modifications in your protocol, consent form, and/or data collection tool(s). All serious and unexpected events, non-compliance, or complaints must also be reported to this office. Use the report form in IRBNet Forms and Templates and refer to the file reports section in the "How to" guidelines.

We will retain a copy of all your submitted materials and a copy of this correspondence within our records.

If you have any questions, please contact the Human Protections Administrator at 507.457.5519 or bayers@winona.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within the Winona State University IRB records.
Appendix E: Focus group interview questions

**Focus group interview questions**: Educating for Sustainable Forestry: Perspectives on the Career Readiness of New Professionals

RQ3: How do employers describe the preparedness of new forestry professionals?

Background: Participant information “Bit of an introduction”

a) What organization are you employed by?

b) What is your position within that organization?

c) How long have you been in this position?

Enquiry 1: Nature of forestry positions

a) What degree is required for the forestry positions you supervise?

b) Are accredited degrees required/preferred?

Enquiry 2: Most important competencies (consider technical, ecological, interpersonal, etc.)

a) What are the most important knowledge, skills, and abilities that foresters need?

b) Why, or in what instances, are these knowledge, skills, and abilities most necessary/important?

Enquiry 3: New forester (within 5 years of degree completion) competencies

a) In what areas are new foresters generally most competent?

b) What knowledge, skills, and abilities do new foresters generally seem to lack?

c) What suggestions would you offer forestry educators to improve the career-readiness of new foresters?

d) What techniques do you use to fill competency gaps?
Appendix F: Individual interview questions

**Individual email interview questions:** Educating for Sustainable Forestry: Perspectives on the Career Readiness of New Professionals

**RQ2.** How do recent graduates describe their first year in the profession?

**Participant background information:**

1. Are you male or female?
2. What is your race or ethnicity?
3. Which decadal category includes your age (20s, 30s, 40s, 50s, 60s)?
4. What is your degree/major?
5. From what institution did you earn this degree?
6. Which level of forest mgmt. do you work in (county, state, federal)?
7. What is your current position/title?
8. How long have you been in this position?

**Individual Interview Questions:**

1. What do you feel are the most important aspects of your job?
2. How much do you interact with:
   a. The general public, e.g., private land owners, recreational land users?
   b. Other resource managers, e.g., loggers, wildlife biologists, ecologists?
   c. Describe the typical nature and general tone of your interactions with the general public.
   d. Describe the typical nature and general tone of your interactions with other resource managers.
3. Describe the knowledge, skills, and abilities that you feel are most important to have in your position (consider technical, ecological, interpersonal, etc.).
4. How well prepared with these knowledge, skills, and abilities did you feel in your first few years as a forester?
5. What aspects of your forestry education program were most useful in developing these knowledge, skills and abilities?
6. What aspects of your forestry education program were least relevant to your current work as a forester?
7. What things have you encountered that your education did not prepare you for?
8. What suggestions or insights would you offer forestry educators to improve upon the career-readiness of new foresters?
### Sample Graduation Plan

#### Forestry (BS)

**Forest Management Option**

This graduation plan illustrates the type of curriculum a new student would take to complete a degree in four years. It is not meant to serve as an official document. Students should consult their academic adviser or the CNR Student Success Center if they need assistance developing a personalized plan of study. Refer to the University Catalog for a complete list of requirements:

https://catalog.uwsp.edu/

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<th>Semester 1</th>
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<th>Semester 2</th>
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<td>Chem. 101 or 105: Basic or Fundamental Chemistry (NSC)</td>
<td>5</td>
</tr>
<tr>
<td>Math 112: Basic Trigonometry and Applications</td>
<td>2</td>
<td>Math 111: Applied Calculus (or Math 109) (QL)</td>
<td>4</td>
</tr>
<tr>
<td>NRES 1: CNR Freshman Orientation</td>
<td>5/U</td>
<td>Forestry 120: Preparing for a Career in Forestry</td>
<td>1</td>
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<tr>
<td>Total credits</td>
<td>14-15</td>
<td>Wellness (WLN)</td>
<td>1-2</td>
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<table>
<thead>
<tr>
<th>Semester 2+</th>
<th>Credits</th>
<th>Semester 3</th>
<th>Credits</th>
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<tbody>
<tr>
<td>English 202 (WC)</td>
<td>3</td>
<td>Forestry 321: Natural Resources Data Analysis</td>
<td>4</td>
</tr>
<tr>
<td>Forestry 232: dendrology &amp; silvics (Fa)</td>
<td>3</td>
<td>Economics 110: Macroeconomics (55)</td>
<td>3</td>
</tr>
<tr>
<td>Geography 341: GIS1</td>
<td>5</td>
<td>*Arts (ART) (GA)</td>
<td>5</td>
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<tr>
<td>Forestry 224: Fire Operations (Fa) or Forestry 326: Wildland Fire Management</td>
<td>1</td>
<td>Total credits</td>
<td>14</td>
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</table>

**Summer Term - Field Techniques In Nat. Res. Forestry 319, 320; NRES 405; Soils 359, 360; Water 330, Wildlife 340 (7 cr.) or NRES 475 (8 cr.) (XL) (Su)**

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Credits</th>
<th>Semester 6</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Forestry 322: Forestry Measurement (Fa)</td>
<td>3</td>
<td>Nat. Res./Geography 377: Remote Sensing 1</td>
<td>2</td>
</tr>
<tr>
<td>Natural Resources 372: Resource Economics (IS)</td>
<td>3</td>
<td>Forestry 331 (Fa), 335, 385 (Fa), or 444 (Sp) (Choose 1)</td>
<td>3</td>
</tr>
<tr>
<td>Philosophy 380: Environmental Ethics (HU)</td>
<td>3</td>
<td>Forestry Direct Elective (See Catalog)</td>
<td>3</td>
</tr>
<tr>
<td>Forestry 332: Forest Ecosystem Ecology (Fa)</td>
<td>3</td>
<td>Forestry 324 (Sp), 424 (Sp) or 426 (Fa)</td>
<td>2-3</td>
</tr>
<tr>
<td>*Historical Perspective (HP) (USD)</td>
<td>3</td>
<td>Forestry 570: Forest Products 1</td>
<td>2</td>
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<tr>
<td>Total credits</td>
<td>15</td>
<td>Total credits</td>
<td>13 - 14</td>
</tr>
</tbody>
</table>

**Summer Term - Required Forestry Internship or Employment**

2.25 GPA is required for graduation and a 2.0 cumulative GPA.

Apply for graduation one semester before you plan to graduate.

<table>
<thead>
<tr>
<th>Semester 7</th>
<th>Credits</th>
<th>Semester 8</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forestry 432: Silviculture (Fa) (COM) (CAP)</td>
<td>3</td>
<td>Forestry 425: Forest Management and Finance (Sp)</td>
<td>3</td>
</tr>
<tr>
<td>Directed Elective Forestry (See Catalog)</td>
<td>3</td>
<td>Forestry 433: Regional Silviculture (Sp)</td>
<td>2</td>
</tr>
<tr>
<td>Forestry 324 (Sp), 424 (Sp) or 426 (Fa)</td>
<td>2-3</td>
<td>Forestry 436: Non-Industrial Private Forest Mgmt (Sp)</td>
<td>2</td>
</tr>
<tr>
<td>Directed Elective Forestry (See Catalog)</td>
<td>3</td>
<td>Forestry 434: Functional Tree Biology (Sp)</td>
<td>3</td>
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<tr>
<td>Total credits</td>
<td>14-15</td>
<td>Forestry Direct Elective (See Catalog)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Forestry 449: Basic Forestry Skills Review and Testing</td>
<td>P/F</td>
</tr>
<tr>
<td>Total credits</td>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Fa) = offered fall semesters only  
(Sp) = offered spring semesters only  
(Su) = offered summer term only  
(Note: Class terms are subject to change.)

General Education Program (GEP) category abbreviations: Written Communication (WC), Oral Communication (OC), Quantitative Literacy (QL), Wellness (WLN), Arts (ART), Humanities (HU), Social Sciences (SS), Natural Sciences (NSC), Environmental Responsibility (ER), U.S. Diversity (USD), Global Awareness (GA), Experiential Learning (XL), Interdisciplinary Studies (IS), Communication in the Major (COM), Capstone in the Major (CAP).

*Some courses may be able to satisfy two GEP requirements. Review course catalog for complete degree requirements.

Catalog 2020  
Updated January 2020
# NATURAL RESOURCES-FOREST RESOURCES

**Itasca Community College**

**Degree:** Associate of Applied Science  
**Length:** 64 semester credits

The Natural Resources program provides students with the knowledge and skills to be proficient in the technical aspects of management and protection of forest resources. Graduates will successfully perform as natural resource technicians using a science based approach, with an understanding of social, economic, and environmental issues within the natural resources field.

Itasca Community College’s Natural Resources program, leading to the Associate of Applied Science Degree is accredited by the Society of American Foresters (SAF). The Council for Higher Education Accreditation recognizes SAF as the specialized accrediting body for forestry education in the United States.

**Program Information:** The Forest Resources emphasis provides graduates with broad based knowledge for the management of forest based resources. Students within the program complete coursework designed to develop an understanding of the interactions of society’s needs and ecological principles as they impact a variety of resource management outcomes. The Forest Resources emphasis area targets students with an interest in forest management, wildlife management and/or recreation management.

Employment opportunities are excellent within federal, state, county, and private land management organizations.

### Program Planner 2020-2021

#### Fall Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biol 1131</td>
<td>Dendrology</td>
<td>5</td>
</tr>
<tr>
<td>ForT 1201</td>
<td>Intro to Natural Resouces</td>
<td>1</td>
</tr>
<tr>
<td>ForT 1205</td>
<td>Forestry Meth</td>
<td>2</td>
</tr>
<tr>
<td>ForT 1206</td>
<td>Forest Protection</td>
<td>2</td>
</tr>
<tr>
<td>ForT 1108</td>
<td>Intro to Waters</td>
<td>1</td>
</tr>
<tr>
<td>ForT 1109</td>
<td>Properties of Forest Soils</td>
<td>1</td>
</tr>
<tr>
<td>ForT 1212</td>
<td>Forest Inventory</td>
<td>4</td>
</tr>
<tr>
<td>ForT 1301</td>
<td>Wildland Firefighting</td>
<td>8</td>
</tr>
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</table>

**Total Credits:** 17

#### Spring Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ForT 1202</td>
<td>Natural Resources Careers</td>
<td>1</td>
</tr>
<tr>
<td>ForT 1610</td>
<td>Intro to Surveying Methods</td>
<td>3</td>
</tr>
<tr>
<td>ForT 2120</td>
<td>Recreation Resource Mgmt</td>
<td>2</td>
</tr>
<tr>
<td>Engl 1101</td>
<td>Composition I</td>
<td>4</td>
</tr>
<tr>
<td>Nsci 1131</td>
<td>Principles of Wildlife Mgmt</td>
<td>3</td>
</tr>
<tr>
<td>Spch 1101</td>
<td>or 1105 or 1111</td>
<td>3</td>
</tr>
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</table>

**Total Credits:** 15

### Fall Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Biol 2131</td>
<td>Forest Ecology</td>
<td>4</td>
</tr>
<tr>
<td>Engl 1105</td>
<td>Technical Research Writing</td>
<td>5</td>
</tr>
<tr>
<td>ForT 2105</td>
<td>Forest Products</td>
<td>2</td>
</tr>
<tr>
<td>Hlth 2101</td>
<td>Basic Life Support</td>
<td>1</td>
</tr>
<tr>
<td>ForT 2112</td>
<td>Business Practices for NR</td>
<td>1</td>
</tr>
<tr>
<td>Geog 2107</td>
<td>Remote Sensing &amp; Image Interp.</td>
<td>3</td>
</tr>
<tr>
<td>Nsci 1104</td>
<td>Principles of GIS</td>
<td>3</td>
</tr>
<tr>
<td>Nsci 1101</td>
<td>Environmental Science</td>
<td>3</td>
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</table>

**Total Credits:** 16

#### Spring Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ForT 2016</td>
<td>Silviculture</td>
<td>3</td>
</tr>
<tr>
<td>ForT 2107</td>
<td>Forest Mgmt &amp; Planning</td>
<td>3</td>
</tr>
<tr>
<td>ForT 2102</td>
<td>NR Internship-Forest Resources</td>
<td>2</td>
</tr>
<tr>
<td>ForT 1110</td>
<td>or 1105 or 1111</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits:** 15

**Note:** Students must meet with their advisor/counselor prior to registering.

* Courses may have prerequisites or require placement.

** Students may choose from: Psy 1101, 1410, 2100 / Econ 2101, 2102 / Geog 1104, 1108 / Hist (World or U.S.) / Soc 1101, 2120

### Transfer Opportunity

In addition to directly entering the workforce, Itasca’s Natural Resources graduates can transfer their AAS degree to the University of Minnesota/Crookston, University of Minnesota/St. Paul or the University of Wisconsin/Stevens Point. For more information regarding transfer, please visit the Student Services office or call 218-322-2320 to schedule an appointment.

Itasca Community College is committed to a policy of nondiscrimination in employment and education opportunity. No person shall be discriminated against in the terms and conditions of employment, personnel practices, or access to and participation in, programs, services, and activities with regard to race, sex, color, creed, religion, age, national origin, disability, marital status, status with regard to public assistance, sexual orientation, gender identity, gender expression or membership or activity in a local commission as defined by law. This information is available in alternative format upon advance request by contacting Ann Vido, 34 Backes Student Center, ann.vido@itascacc.edu, 218-322-2403 or 1-800-996-6422 ext. 2433. This document is available in alternative formats to individuals with disabilities. Consumers with hearing or speech disabilities may contact us via their preferred telecommunications relay service. 03/2019
Samantha M. Jones  
Assistant Professor || Center for Sustainability Studies || Bemidji State University  
samantha.jones@bemidjistate.edu || https://samanthajones2.efoliomn.com/Home

RESEARCH INTERESTS  
Dendroecology, Geographic information systems (GIS) applications, Experiential learning pedagogy.

EDUCATION  
Doctor of Education, Winona State University, 2021  
Master of Science, Geography, Ohio University, 2013  
Bachelor of Science, *summa cum laude*, Geography/GIS, Biology Minor, Bemidji State University, 2011  

PROFESSIONAL EXPERIENCE  
ASSISTANT PROFESSOR 2014-Present  
*Bemidji State University, Bemidji MN*  
• Teach and develop undergraduate and graduate coursework in GIS and physical geography.  
• Engage in dendroecological and field-based learning research.

SUPPORT TECH 2013-2014  
*Beltrami County, Natural Resource Management, Bemidji MN*  
• Managed spatial databases and inventory records in support of forest and land resources management.  
• Prepared timber and land sale maps and provided technical assistance with geospatial projects.

FORESTRY AID/ GIS TECHNICIAN 2008-2013 (Intermittent)  
*USDA Forest Service, Northern Research Station, Grand Rapids MN*  
• Collected forest structure and composition data in support of long-term research and monitoring.  
• Provided technical support in geospatial data acquisition, analysis, and mapping.

PUBLICATIONS  


PRESENTATIONS  
