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Producing 'Society-ready' Foresters: A Research-based Process to Revise the Bachelor of Science in Forestry Curriculum at Stephen F. Austin State University

*Steve Bullard, Dean Coble, Theresa Coble,
Ray Darville, Laurie Rogers, and Pat Stephens Williams*

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skills **ethics**
communication
water, personal, gis, timber, organizations, technology, field, experience, professionalism, basics, urban, landowners, learn, ownership, business, knowledge, public-service, industry, forest, leadership, resource

Producing ‘Society-ready’ Foresters: A Research-based Process to Revise the Bachelor of Science in Forestry Curriculum at Stephen F. Austin State University

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We thank past and current faculty members in the Arthur Temple College of Forestry and Agriculture, as well as BSF alumni and past, current, and future employers of our graduates who participated in our survey and focus groups, and who continue to help in the ongoing process of revising the BSF curriculum.

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Executive Summary



Background. The national accrediting body for forestry academic programs in the U.S., the Society of American Foresters (SAF), defines the term ‘curriculum’ as *“the sequence of courses leading to a degree that prepares an individual for entry into the profession of forestry”* (SAF 2011). According to the National Association of University Forest Resources Programs, forestry curricula must be designed to *“provide opportunities for students to acquire the knowledge, skills, abilities, and behaviors that clearly reflect employer, societal, and environmental needs”* (Layton *et al.* 2011).

Today, major forces of change at global, regional, and local levels are dramatically affecting forest resources, forest ownership and use patterns, and the forestry and natural resources professions in general. These forces include growth in hu-

man population, climate change, fundamental changes in timber and fiber markets, and the explosion of invasive plants, pathogens, and insects in forests and landscapes across the globe.

In times of great change, college curricula must adapt to meet the current and projected needs and challenges of employers, society, and the environment. The interacting, accelerated forces of change affecting forests and related resources at all geographic levels create a compelling need to carefully evaluate, refocus, and strengthen undergraduate curricula in forestry and related disciplines.

Our overall goal in the Bachelor of Science in Forestry (BSF) degree program at Stephen F. Austin State University (SFASU) is to produce foresters who are ‘society ready,’ i.e., capable of dealing effectively

‘Society-ready’ forester – capable of dealing effectively with the complex economic, ecological, and social issues involving forest resources today.

with the complex economic, ecological, and social issues involving forest resources today. Combining words from Aldo Leopold and our college mission statement, our BSF graduates must be prepared to effectively enhance the integrity, stability and health of the environment through sustainable management, conservation, and protection of forests and natural resources.

To produce society-ready foresters, we know that BSF curricula must continue to be rigorous, but we also know that rigor isn’t sufficient. Rigor has to be carefully combined with relevance, yet what are the knowledge areas, skill sets, abilities, and behaviors that are most relevant and that should be emphasized in a 21st-century forestry curriculum?

To address this key question, we used a research-based process to inform decisions and actions to re-

vise the BSF curriculum at SFASU in 2012-2013.

This monograph shares our curriculum revision and research processes, our research results, and both general and specific curriculum revisions we are submitting for approval and implementation.

Research-based Process. In May of 2012 the forestry faculty at SFASU began a research-based process to revise the BSF curriculum. The BSF degree at SFASU is accredited by the SAF through 2021, and the curriculum has been updated with important revisions in recent years. The curriculum had not been through a major, complete revision process since 1999, however.

To oversee and guide the BSF curriculum revision process, a faculty committee with 13 members was named. A six-person subcommittee led the research phases of the work, including analyzing and summarizing research results.

The research subcommittee included two faculty members with expertise in human dimensions, and two faculty members with expertise in statistical analysis. An education research specialist worked full time from May of 2012 through May of 2013, to help guide the research process and to help ensure high quality, timely results.

The BSF revision process involved both quantitative and qualitative research phases. The *quantitative* phase included a survey of our alumni and current and prospective employers of

our alumni. The survey was designed to assess the importance of 48 specific skill sets for foresters, and also to evaluate our success at SFASU in producing foresters with those skills and abilities. The survey's 48 skill sets, or "competency items," were grouped in six focus areas, which can be placed into three broad areas of competency – technical, general, and personal (Figure i). The survey also asked respondents to assess the relative importance of major forces, challenges, and issues affecting U.S. forests in the 21st century.

The survey was distributed in paper and electronic formats in November 2012. Eight hundred responses were obtained through the closing date in February 2013, a response rate of about 24 percent. Just over 600 (75 percent) of our survey respondents were BSF alumni from SFASU. Survey data were analyzed using Importance-Performance Analysis (Martilla and James 1977), and also by examining mean weighted discrepancy scores (Borich 1980).

The *qualitative* phase of our research involved a series of 15 focus group sessions, with a total of 58 participants. The 15 groups represented major categories of employers of BSF graduates, including forest industry, state and federal agencies, and consulting firms. Focus groups also represented major subject areas for employment of BSF graduates, including wildlife, forest health, urban forestry, and forest recreation.

The first focus group session was held in December 2012, and the final session was held in February 2013. Sessions were recorded and transcribed, and qualitative data analysis software and research methods were used to determine themes relating to general and specific competencies. The focus groups allowed more in-depth discussion of competencies, with an opportunity to compare results for employer categories and subject areas of employment.

Survey and focus group results were analyzed, summarized, and present-

Figure i. The 48 competency items in the survey were grouped for analysis, discussion, and action in revising the curriculum.

The 48 'competency items' in the survey are statements that represent specific skill sets such as "*Use oral communication effectively.*" These 48 items were grouped for analysis in the six curriculum focus areas listed below, which can be further grouped in three broad areas of competency: **Technical**, **General**, and **Personal**.

1. Managing Forest Resources (16 **Technical** items)
2. Applying Reasoning and Critical Thinking (6 **General** items)
3. Managing Self (6 **Personal** items)
4. Communicating and Collaborating (9 **General** items)
5. Leading and Managing People (5 **General** items)
6. Engaging in Transformative Learning and Leadership (6 **General** items)

ed to the faculty and professional staff, as well as to external groups. Through these presentations and discussions, we obtained additional insight on interpreting and using both survey and focus group results.

Results and Proposed Revisions. In general, survey and focus group results both indicated that BSF graduates from SFASU are well-prepared for entry-level employment in terms of technical knowledge and skills relating to forestry and wildlife management disciplines. Technical competencies include subjects like dendrology, forest mensuration, silviculture, and forest and wildlife management. Our survey results, for example, indicated relatively high levels of importance and also relatively high levels of performance for all 16 of the technical competencies we grouped under Managing Forest

Resources.

A need for improvement was indicated, however, in competencies that are people-related. Survey and focus group results both indicated that BSF graduates needed greater preparation in general competencies like oral and written communication, and personal competencies such as managing one's schedule, taking initiative, and being able to work effectively on multiple projects.

These general findings, i.e., relatively strong performance in technical competencies, combined with the need to strengthen general and personal competencies, are consistent with results from previous studies of curricula in forestry and natural resources (see Sample *et al.* 2000, for example). In our research at SFASU, these general findings were also con-

sistent across employer categories and when analyzed based on the year of graduation of our BSF alumni.

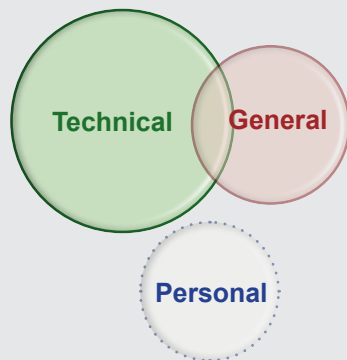
Research results, findings, and recommendations from stakeholders were considered in detail by SFASU's forestry faculty in a series of six three-hour meetings in April and May of 2013, followed by topic-specific small group meetings, leading to significant proposed changes in the BSF curriculum. The curriculum is being revised to strengthen general and personal competencies, for example, while maintaining a strong focus on technical knowledge and skills.

Figure ii illustrates technical, general, and personal competencies in a traditional curriculum model and in the revised curriculum model at SFASU. In general, the new cur-

Figure ii. Traditional and revised curriculum models based on three broad areas of competency.

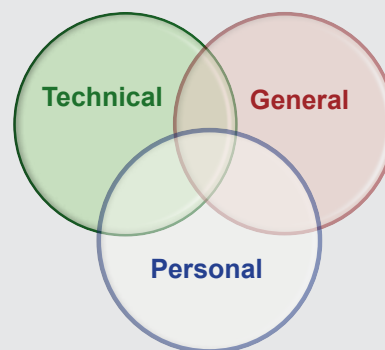
(Adapted from Leth *et al.* 2002.)

Traditional Curriculum Model



*Traditionally, BSF curricula have tended to emphasize **technical** competencies, overlapping with **general** competencies that were not as strongly emphasized throughout the curriculum. Traditional curricula often weren't designed to actively build **personal** competencies.*

Revised Curriculum Model



*Based on alumni and employer input, the BSF curriculum at SFASU is being revised to expand the emphasis on **general** and **personal** competencies, while maintaining a strong emphasis on **technical** competencies that have traditionally been a strength of our graduates.*

riculum we are submitting for university and state approval enhances opportunities for internships and other employment before graduation, and it provides greater opportunities to develop communication skills, leadership and management skills, and other abilities relating to people – knowledge, skills, abilities and behaviors that were specifically highlighted as needs in our survey and focus group analyses.

The top 10 competency items to strengthen in the curriculum based on mean weighted discrepancy scores (Borich 1980) are presented in Figure iii. Survey results for each of the 48 technical, general, and personal competencies are presented in Figure iv. Eight of the 10 competencies highlighted in Figure iii are in the general competency area, including four in the area Communicating and

Collaborating, and three in Leading and Managing People (Figure iv).

Of the 48 competencies in our survey, the highest mean score for importance was “*Conduct oneself in a professional manner*,” with a mean score of 4.73 on a 5-point Likert scale (item 27 in Figure iv).

The quantitative results from the survey were also summarized using Importance-Performance Analysis (Martilla and James 1977). The results are presented in seven charts in Appendix B, each showing performance scores on the *x* axis and importance on the *y* axis. The Importance-Performance Analysis, the qualitative research summaries of themes, and word clouds of focus group sessions (shown in Appendix C) are in full accord with the findings broadly summarized in Figures

iii and iv.

Survey and focus group results provided insight on critical topics to emphasize throughout courses in our BSF curriculum. In our faculty discussions we referred to “weaving” these topics in the curriculum since they would be emphasized in entry-level courses as well as in sophomore, junior, and senior-level courses to help address society-ready needs and challenges. In addition to skills and abilities that are people-related, these knowledge areas include:

- invasive plants, insects, and diseases and their impact on forest diversity, productivity, health, and regeneration;
- changes in water availability and quality;
- changes in fire regimes, including the amount, intensity, aerial extent, and seasonality of fire;
- bioenergy and other market changes for both new and traditional forest products;
- forest fragmentation and ownership parcelization trends; and
- climate change and its effects.

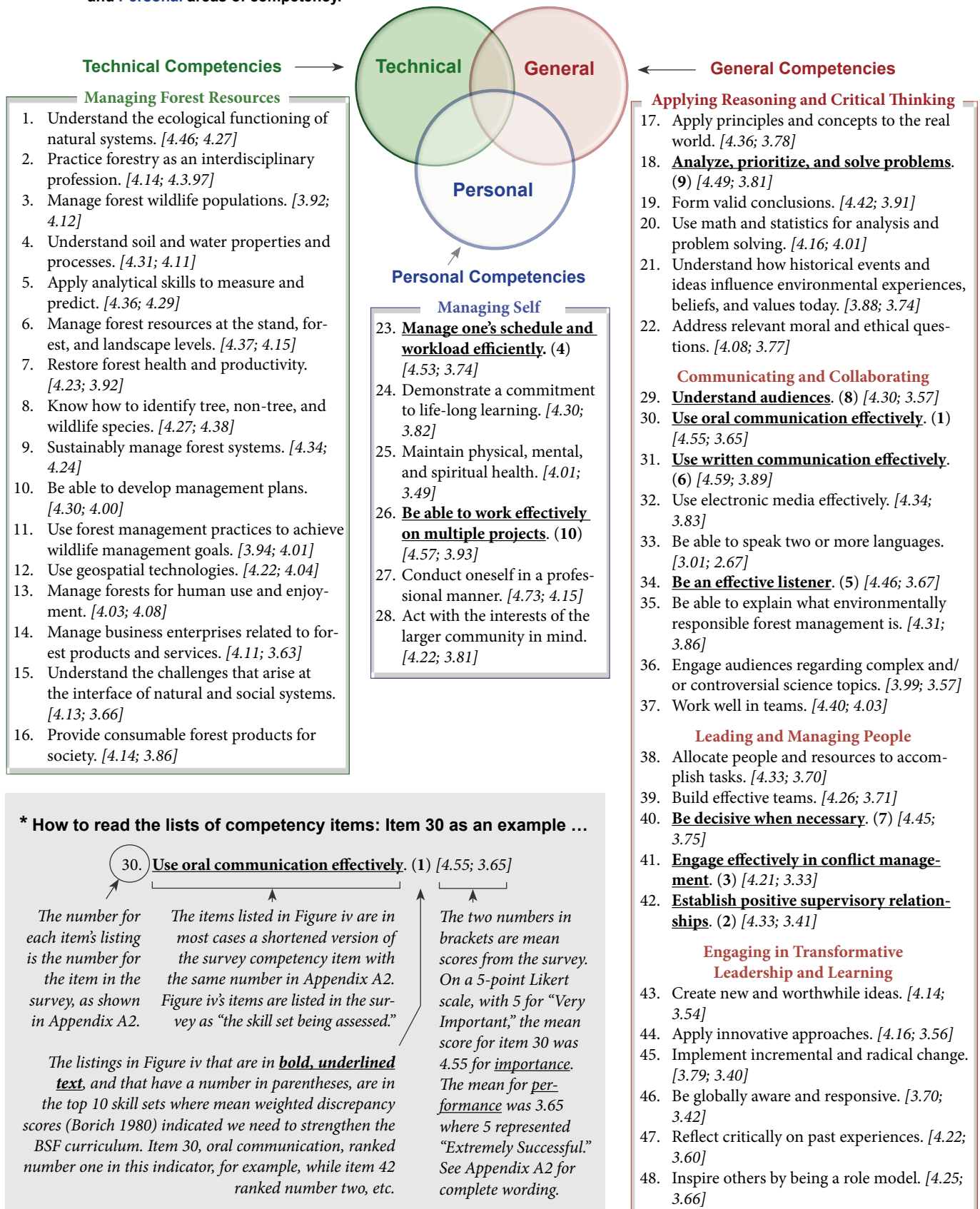
These and other major issues and trends are interacting, of course, impacting forest resources and society in combination and over time. They are critical to the ability of entry-level forestry professionals to be society-ready, and therefore are being threaded throughout the BSF curriculum.

Figure iii. The top 10 list of competency items to strengthen in the new BSF curriculum, ranked by mean weighted discrepancy scores*.



*Mean weighted discrepancy scores were calculated and ranked as presented by Borich (1980). More detail is provided in section II.

Figure iv. Mean scores for importance and performance for the 48 competency items in the survey grouped in **Technical**, **General**, and **Personal** areas of competency.*



Some of our proposed revisions are course-related, of course, so they are direct revisions to the BSF curriculum. Other changes, however, are extra-curricular, since they relate to student employment, student organizations, and other opportunities and activities that may not be course related.

Highlights of the proposed BSF degree program at SFASU using the new curriculum model include:

- changing the timing of our six-week summer Field Station from after the junior year to after the sophomore year;
- updating the focus of both entry-level and capstone courses to enhance the general and personal competencies highlighted in Figure iii;
- weaving people-related skills in existing courses throughout the curriculum;
- maintaining a strong emphasis on forestry technical skills, while weaving knowledge and skills on specific, high priority issues such as invasive plants, pathogens, and insects in courses throughout the curriculum;
- building a student-led mentoring program to establish and cultivate connections among entry-level students and more senior-level students, as well among students and forestry professionals; and
- creating an advising process with

extra-curricular tracks to build leadership and people-related skills and abilities.

In this monograph, we present background information on why curriculum revision is critical today, and we include a brief review of relevant literature. Our main focus, however, is on the BSF revision process, including research results and how they were used to develop and propose a new curriculum at SFASU.

Lessons Learned. Our intent in presenting the research process and analysis techniques in this monograph, as well as the results and revision of the curriculum, is to have a record to refer to as we implement revisions at SFASU, and also to assist other university programs that may be considering research to assess and revise their curricula. The *process* of curriculum revision can be just as important as the *product*, and others may learn from our research-based process, as well as from specific results of the research at SFASU.

When we began this process, we knew it would be important to engage all of our faculty at every stage; the faculty must *own* the curriculum. One of the keys to success in our overall process was having a collectively-shared guiding vision for *why* curriculum revision was needed, *what* the primary objectives were, and *how* the objectives would be reached. We consistently communicated these messages with our faculty using what we called a *Summary Document*; we discussed *why*, *what*, and *how*, including our principles and processes, at the beginning and

at all stages of the revision process.

A significant finding in our literature review was that skills and competencies that are needed to work effectively with people have been considered critical in the forestry profession in the U.S for 100 years. We also learned that in spite of 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 in BSF programs. We believe this finding reflects a systemic problem in forestry educational programs; there is a need to address the problem through research and outreach that is highly focused on this specific issue.

In our research process, it was very encouraging to learn that many employers, landowners, and other forestry stakeholders greatly appreciate being asked what they think about the importance of technical, general, and personal competencies. When done well, we believe work of this type will strengthen both *rigor* and *relevance* in a curriculum, and the process will also strengthen *relationships* with alumni, employers, and other key constituents. It is extremely important to report and discuss actions taken based on their input.

We hope that leaders of undergraduate degree programs in forestry, wildlife, and related natural resources will benefit from our processes, results, and actions, just as we have benefited greatly from previous work in this important field in the scholarship of teaching and learning.

I. Background

A. Why bother?

B. Literature Review

“In times of change, learners will inherit the earth, while the learned find themselves beautifully equipped to deal with a world that no longer exists.”

– Eric Hoffer

Our overall goal in the Bachelor of Science in Forestry (BSF) degree program at Stephen F. Austin State University (SFASU) is to produce foresters who are ‘society ready,’ i.e., capable of dealing effectively with the complex economic, ecological, and social issues involving forest resources today. Combining words from Aldo Leopold and our college mission statement, our BSF graduates must be prepared to effectively enhance the integrity, stability and health of the environment through sustainable management, conservation, and protection of forests and natural resources.

How do we do this? That is, how do we produce society-ready foresters? Our primary vehicle is through the forestry curriculum, defined by the

Society of American Foresters as “*the sequence of courses leading to a degree that prepares an individual for entry into the profession of forestry*” (SAF 2011). We also engage and prepare undergraduates in many ways that are *extra-curricular*, e.g., through student organizations, mentoring programs, and involvement with forestry associations and practicing professionals.

According to the National Association of University Forest Resources Programs’ (NAUFRP) Undergraduate Educational Enhancement Strategy, our BSF curriculum and our overall undergraduate forestry program must be designed to “*provide opportunities for students to acquire the knowledge, skills, abilities, and behaviors that clearly reflect em-*

ployer, societal, and environmental needs” (Layton et al. 2011). What are those needs today and in the future? That is, what are the knowledge areas, skill sets, abilities, and behaviors that are most relevant for society-ready forestry professionals in the 21st century?

At SFASU, we addressed those key questions through a research-based process to see what our BSF alumni and their employers had to say. Our faculty then discussed important findings in the context of previous studies, and we are currently making significant changes to the BSF curriculum based on these results.

Before we considered *how* to revise the BSF program, though, we first considered *why* we should make this

effort. In this **Background** section of the monograph, therefore, we address the issue of **Why bother?**, and we also include a brief **Literature Review** to show the context of previous work.

A. Why bother?

The overall, compelling reason to examine and potentially revise the BSF curriculum at SFASU is to make sure our sequence of courses is truly focused on the knowledge areas, skill sets, abilities, and behaviors that are most needed by entry-level forestry professionals today. The BSF degree at SFASU is accredited by the SAF through 2021, and the curriculum has been updated with important revisions in recent years. The curriculum had not been through a major, complete revision since 1999, however.

To address the question *Why bother?*, we began by considering the magnitude of the changes, issues, and challenges affecting forest resources, the forestry profession, and forestry education today (Figure 1). Overall, taking the issues summarized in Figure 1 collectively, we considered *Why bother?* to be an existential question for our BSF program. To survive and thrive in the long term, we knew that adapting and refocusing our program would be essential.

In our curriculum revision process, therefore, from beginning discussions to final actions and specific course revisions, we sincerely focused on embracing change, as recommended by Sir Winston Churchill: *“We must take change by the hand or rest assuredly, change will take us by the throat.”*

To continue to thrive, our process was necessarily focused on continu-

Figure 1. Major changes, issues, and challenges affecting forest resources, forestry professionals, and forestry educators in the 21st century.

- (a) Major forces of change that are dramatically affecting forest resources at all geographic levels include (Wear and Greis 2013; USDA Forest Service 2012):
 - human population growth, creating increased pressures on water demand and availability, and resulting in increased ownership fragmentation, and an expanding wildland-urban interface;
 - changes in markets for forest-based goods and services, from traditional markets for lumber and other wood products, to new markets for bio-based energy;
 - climate change, particularly in areas where water is a limiting factor, and where fire and other disturbances may accelerate change in species composition; and
 - invasive plants, pathogens, insects, and other animals, forever altering the ecology of forest resources at landscape levels.
- (b) There is an increasing disconnect between many members of U.S. society and natural resources. We have an increasingly urbanized population that generally has less experience with, and little knowledge of, the economic, ecological, and social value of natural resources (Gordon and Berry 2006).
- (c) Demographic and cultural changes in the U.S. population are creating new needs to communicate and work effectively in natural resource-related professions. Forestry schools continue to seek effective means to increase the diversity of student enrollments and the future workforce.
- (d) Current and future enrollments are overwhelmingly made up of millennial generation students, “digital natives” with fundamentally different perspectives on educational methods and content (Prensky 2001a, 2001b). Non-traditional student enrollments are also increasing.
- (e) Many new technologies are available for use by forestry professionals, including new geospatial software and hardware, for example, as well as online resources for information, communication, and training. The pace of change in these technologies has accelerated in recent years.
- (f) Major trends and forces that are affecting higher education in general include (Flynn and Vredevoogd 2010; Selingo 2013):
 - financial deficits at many universities;
 - reduced public funding for higher education in some states;
 - lower numbers of students who pay full tuition; and
 - increased opportunities for ‘unbundled’ learning.
- (g) Many states have imposed limits on the total number of credit hours in college curricula, forcing forestry curricula at many institutions to be revised in order to reduce the total number of hours.

ing to enhance the *rigor* and *relevance* of our BSF program, while also continuing to build strong *relationships* with alumni, employers, and other important stakeholders.

B. Literature Review

Our literature review is not exhaustive on the topic of forestry education, or on curriculum revision, but is primarily focused on published work that helps establish the context for designing and revising BSF curricula today. Later, in Section II. B. **Research Process and Results**, we include references on specific research methods and related literature.

Forestry education in the U.S. has been an important topic of conferences and symposia, and reports and publications since the early 1900s. Although terms like ‘society-ready,’ and ‘rigor, relevance, and relationships’ weren’t used, as early as 1914 Gifford Pinchot stated a need for foresters to work effectively with people: “*The usefulness of the Supervisor (Forest Service) depends as much upon his good judgment, his ability to meet men and do business with them, and his knowledge of local needs and local affairs as it does upon his knowledge of the forest itself.*”

The Pinchot quote (above) was cited by Barrett (1953), who added: “*At the turn of the century, it was observed, in effect, that the forester must work with people as well as trees.*” In the early 1900s, clear arguments were made for refocusing and broadening the training of foresters to meet the evolving needs of employers and of society in general (Winkenwerder 1918).

At the second national conference on “*Education in Forestry*,” held in

1920, a four-year Bachelor of Science curriculum was developed and recommended to forestry schools across the nation (see Hosmer et al. 1922). The curriculum was developed by a committee of leaders from academia, forest industry, and state and federal agencies with forestry responsibilities.

In overall organization and basic course content, the curriculum recommended in 1920 is remarkably similar to many four-year forestry curricula today. The curriculum was 140 credit hours of course work plus two summers, including:

- two semesters of English, chemistry, and botany in the freshman year;
- dendrology, wood technology, and plant physiology in the sophomore year;
- a summer involving three months of “*practical experience with a forestry party or in forest industry*” (required after the sophomore year);
- technical courses in forest mensuration, silvics, and protection (fire, entomology, and pathology) in the junior year;
- forestry camp in the summer after the junior year, involving 4-8 weeks of forestry work under faculty supervision; and
- silviculture, utilization, and forest management in the senior year.

The curriculum developed and recommended at the forestry education conference in 1920 didn’t explicitly recognize the importance of communications and other people skills, but one of the reports at the conference was titled “*Should ‘Public Relations’ Receive a Place in the Professional Training of Foresters?*” In this report, Smith (1922) stated that “*You can not*

build high on thin foundations;” and cited a conversation with the dean of the school of journalism at the University of Montana, who “*instructs the forest school students in newspaper work. The reason, he told me, is because a forest officer who does not know how to furnish the press with the kind of information that it wants, who does not understand the function of the press in our national life and does not appreciate the importance of establishing good relations with his local newspaper editors, lacks proper equipment for his work.*”

The people-related concepts and comments made by Pinchot (Barrett 1953), and Smith (1922) were prescient in the early 1900s. In fact, similar comments have been made by forestry leaders throughout the decades since 1920, differing only in that they emphasize a much broader array of general and personal competencies in more recent years.

The forestry literature includes many references to the technical skills and competencies needed by entry-level foresters. See Chapman (1935, 1942), for example, for an early review of technical subjects necessary for BSF programs. During the 1930s, SAF accreditation standards were developed by Chapman and other leaders, clearly establishing technical standards and requirements. See Dana and Johnson (1963) for a review.

The needs of society evolved over time, of course, from fire protection to regeneration, for example, and from a utilitarian emphasis to encompass the full breadth of ecological and social values of forests (Fisher 1996). Overall, BSF curricula have adapted to meet changing technical needs and to stay up-to-date in the application of new technologies for

entry-level forestry professionals.

Reviewing the literature on forestry curricula and undergraduate education over nearly 100 years, however, it is striking that the central, overriding theme is the lack of overall preparedness in general and personal competencies – the knowledge, skills, abilities and behaviors needed to work with people effectively. The literature includes many anecdotal references, as well as research-based findings on the need to strengthen general and personal competencies.

Woods (1943), for example, stressed the need to emphasize “*public relations*” and other “*essential activities of the job*,” while Cleverdon (1946) recommended that forestry schools combine a “*cultural (general) and a technical education*.”

Brandenberry (1947), also stressed this general need, stating that foresters should be prepared “*to handle personnel problems, to understand to some degree human psychology, and to master the art of letter-writing*.”

Brandenberry was also more specific in citing “*The ability to work with other people, the appreciation of the other fellow’s point of view*” and the ability to “*express himself clearly and concisely*” as “*highly imperative*.” He went further by stating “*One glaring weakness in the preparatory work for foresters has been the lack of attention to develop ease in speaking before a group and to use simple English correctly*.”

A comprehensive review of forestry education conducted in 1947 concluded that foresters needed a broad generalized knowledge and “*acquaintance with the local ecological, social, and economic environment in which forest policies must be*

made” (cited by Gilbert *et al.* 1993). Writing in 1993, Gilbert *et al.* recognized a consistent theme in the 1947 comment, stating “*These sentiments are remarkably parallel to those expressed in many commentaries on the profession today*.”

In 1949-50, a survey of 700 practicing foresters was conducted, asking them to rate the importance of 57 general and technical competencies, from forest management to foreign language (Barrett 1953). The highest rated competence was “*Speaking and Writing*,” out-ranking “*Principles of Silviculture*” and all other technical and general competencies in terms of overall importance to the “*success of a forester*.” As Barrett (1953) stated: “*... our sample believes the ability to speak and write effectively is the most important attribute a forester may possess. This skill ranks above all others. Further, Human Relations, Citizenship-Government, and Personnel Management are all included in the top half of the ranked subjects*.”

Dana and Johnson’s book *Forestry Education in America, Today and Tomorrow*, published by SAF in 1963, provides an excellent perspective on the development of forestry as a profession, including curricular requirements in “professional” and “nonprofessional” subjects. They state that the “*task of forestry schools is to educate men possessing*” eight characteristics, one of which was “*a comprehension of people and human institutions that makes him at home as an individual, a citizen, and a professional man in the community in which he lives and works*.”

To effectively incorporate written and oral communication skills into forestry curricula, Dana and Johnson

(1963) recommended that forestry faculty insist on high levels of speaking and writing skills in their “professional” courses. They considered the ability to communicate well to be so important a “*professional and personal asset that its development should be a concern of the entire forestry faculty*.”

For additional references on forestry education before 1964, including a section with 70 publications specific to “*Curricula and Degrees*,” see Dana and Johnson (1964).

In 1969, SAF sponsored a “National Symposium on Undergraduate Forestry Education,” where speakers recommended alignment of technical content in BSF curricula to new issues and technologies. Speakers also emphasized the need for “*leadership*,” and an “*orientation to people*” (Greeley 1969), as well as “*more stress on speaking and writing*,” including “*putting our resource use philosophy across to laymen*” (Towell 1969).

Forestry education continued to be an important topic of debate, applied research, and publication in the latter half of the 20th century, particularly as the year 2000 approached. Brown and Lassoie (1998), for example, commented that during the 1980s and 1990s the growing number of controversies arising from forest management in a “*modern, pluralistic society*” prompted forestry professionals to reexamine the relevance of forestry curricula to meet the needs of the profession and society.

Duncan *et al.* (1989), stated that “*today’s practicing professional must have effective communication, interpersonal, problem-solving, and conflict resolution skills*.” Salwas-

ser (1990) described the forestry profession as being in a “crossfire” of conflicting demands, calling for education to include a grounding in humanities, followed by programs to “*educate the ecosystem forester.*”

In 1991, SAF sponsored another national symposium on forestry education, titled “Forest Resource Management in the 21st Century: Will Forestry Education Meet the Challenge?” (SAF 1992). Cortner (1992) and Gilbert *et al.* (1993) summarized the symposium’s results that relate to revising and refocusing BSF curricula, which included recommendations to:

- place resource managers in an international context, or at least offer increased global awareness;
- stress that resource managers have a responsibility to society as well as to their professional area and employer;
- produce critical thinkers and problem solvers who are more than just “*biological technocrats*;”
- impart the ability to participate in the sociopolitical process;
- provide hands-on, experiential learning to integrate theory with practice;
- reflect a commitment to diversity; and
- prepare students for lifelong learning.

In 1993-94, SAF established an *ad hoc* study group on occupational competencies in forestry. The study group found that forestry academic programs had continued to evolve in response to perceived needs of BSF graduates, but that limited input had been obtained from employers of those graduates (Brown and Lassoie 1998).

Two major studies were conducted in the late 1990s that addressed the lack of input from forestry employers in forestry education and curriculum development. The first was by Brown and Lassoie (1998), published as “Entry-level Competency and Skill Requirements of Foresters, What Do Employers Want?” In 1994 the authors surveyed forestry employers in four groups: federal agencies; state and local government agencies; private industry; and consulting companies. Of the respondents who indicated that additional courses and skills were necessary, the areas mentioned most frequently were “*personnel management and supervisory skills,*

“... our sample believes the ability to speak and write effectively is the most important attribute a forester may possess. This skill ranks above all others.”

– J.W. Barrett (1953)

communication skills, understanding of organizational structures, project management, and foreign language skills.” (The authors also indicated that during this time a substantial number of entry-level foresters were hired by the Peace Corps).

In the late 1990s, the second major study of forestry education to incorporate input from employers was conducted by the Pinchot Institute for Conservation; results were published as “Forestry Education: Adapting to the Changing Demands on Professionals” (Sample *et al.* 1999, 2000). The Pinchot Institute conducted a survey of forestry employers, educators, and recent graduates in 1998, a survey that was predicated on changes in the practice of forestry that were

“linked to changes in the public’s perception of sustainability and to developments in science, communications, and global markets.”

A significant finding of the Pinchot Institute study was that other than tree and plant species identification, all of the competencies for which gaps exist between importance and performance involved “*communicating with and managing people.*” In the Pinchot study, these competencies included “*written and oral communication, managerial leadership, collaborative problem solving, organizational development, alternative dispute resolution, and government relations*” (Sample *et al.* 1999).

In the views of both forestry employers and recent graduates, a strong foundation in technical forestry skills was no less important than in the past. However, “*public scrutiny of forest management and the importance of broad social, economic, and ecological considerations in forestry decisionmaking have greatly increased the need for competency in communication, ethics, collaborative problemsolving, and managerial leadership*” (Sample *et al.* 1999). Similar results have been found for entry-level professionals in wildlife and fisheries disciplines (Stauffer and McMullin 2009).

Robison (2005) called for BSF programs to avoid the pitfalls of technical specialization, maintaining the “*expertise of breadth*” in forestry curricula. Robison states that the “*very breadth of this integrated learning experience is ... the foundation on which foresters develop as professionals.*”

Major findings of our non-comprehensive literature review are summarized in Figure 2.

Figure 2. Literature review findings that are relevant to revising BSF curricula today.

Our review of literature on BSF curricula and the educational changes necessary to meet evolving professional and societal needs yielded findings that help establish the context for reviewing and revising forestry curricula today.

1. There is a strong, consistent theme in BSF curricula studies, symposia, and reports over nearly 100 years in the U.S. The theme is two-pronged – BSF programs must:
 - (a) continue to emphasize current, well-focused technical forestry knowledge and skills; and
 - (b) achieve much higher levels of competence in areas like oral and written communication, management, leadership, and other general and personal competencies needed to work effectively with people.

2. Although point 1(b) has been stressed by forestry educators and other leaders for nearly 100 years, anecdotal comments as well as survey results through the years show a consistent, continuing need for improvement. This key point – the continuing need for enhanced people skills – was made by Barrett in 1953, yet it is still a basic issue 60 years later, after many studies and significant, national symposia on forestry education. Also, it is significant that this finding is still true in spite of decades of emphasis on general competencies in SAF accreditation guidelines (SAF 2011). See Davidson (2013), for example, for a very recent statement that foresters today have little or no preparation in “*people skills, political savvy, and problem-solving agility.*”

3. Points 1 and 2 are true for BSF curricula in the U.S., but the same statements are true in other countries where forestry is taught at the undergraduate level. For example, similar findings have been reported in Denmark (Leth *et al.* 2002), England (Brown 2003), Brazil (Arevalo *et al.* 2010), and Australia (Vanclay 2007).

4. There are inherent biases against making major changes in BSF curricula, resulting in relatively minor “tinkering” with course changes rather than major efforts to review and revise the full sequence of courses (Gilbert *et al.* 1993). The basic BSF curriculum tends to remain intact over decades for many reasons, including institutional and faculty biases toward the status quo (Tagg 2012). Seeing “*no dramatic, drastic changes in the average forestry curriculum over the past ten years,*” Burns (1969) stated that “*This is understandable since forestry is a rather conservative profession.*” He went on to comment that the pace of change is so slow that “*changing a curriculum is like moving a cemetery.*”

5. Although major curricular changes are relatively rare in BSF programs, forestry educators have generally done well at maintaining the rigor and relevance of the technical content of curricula. This is apparent in employer surveys that show relatively high satisfaction with entry-level technical skills and knowledge. This reflects decades of close attention to technical content in SAF accreditation standards. Also, forestry faculty members are in most cases Ph.D. scientists, well versed in and prepared to emphasize specific technical subjects in their teaching, but often leaving general and personal competencies to other courses or to other aspects of the educational experiences of undergraduate students.

6. Solutions to the 100-year-old problem of how to effectively cultivate general and personal competencies in BSF programs have been proposed and implemented, but quantitative assessment is needed. For example, BSF curricula can be designed to be “*learning centered*” rather than “*teaching centered,*” with guided collaborative experiences that engage student peers as well as faculty in addressing forestry issues and challenges (Thompson *et al.* 2003). For related discussions of using “*problem-based learning*” in natural resources and forestry programs see Lobry de Bruyn and Prior (2001) and Brown (2003). It is encouraging that in coming years McIntire-Stennis Cooperative Forestry Research funds may be used to develop research-based solutions to this problem, in alignment with recent recommendations of NAUFRP (Layton *et al.* 2011) and national program leaders in the USDA National Institute of Food and Agriculture (Blanche 2013).

II. Curriculum Revision Process and Results

A. Overall Process

B. Research Process and Results

1. Survey of Alumni and Employers

2. Focus Groups



“The man who knows how will always have a job. The man who knows why will always be his boss.”

– Ralph Waldo Emerson

A. Overall Process

To help guide the process of revising the BSF curriculum at SFASU, we first assembled an ad hoc committee of 13 faculty members. Eleven of the faculty members were from the Arthur Temple College of Forestry and Agriculture (ATCOFA), including the dean, the associate dean, three professors, five associate professors, and one instructor. We also engaged a professor from the Department of Social and Cultural Analysis in the College of Liberal and Applied Arts, and we employed a full-time educational research specialist who had recently received an Ed.D. from the James I. Perkins College of Education at SFASU.

The 13-member ad hoc curriculum revision committee helped guide the overall process, and also helped in interacting with the full faculty in the forestry program at SFASU, as well as with external stakeholders.

A six-person research sub-committee was formed to lead the research phases of the work, including analyzing and summarizing research results. The research sub-committee included the dean of ATCOFA, two faculty members with expertise in human dimensions research, two faculty members with expertise in statistical analysis, and an educational research specialist with experience in qualitative research.

Our process began in May 2012, with the research and faculty discussion phases completed in May 2013. We followed the eight basic steps outlined in Figure 3.

To complete our curriculum revision process, proposals for course changes were submitted in the fall of 2013 requesting university and state approval to implement revisions in the fall of 2014. The process of revising the BSF curriculum and improving the overall undergraduate experience at SFASU isn't over, of course, but will continue in the future as we find new approaches and changes needed in specific courses, and also as we discover more effective ways

to build competencies through co-curricular and extracurricular means.

Here we discuss each of the eight steps in Figure 3, as well as the steps we are continuing to take in developing and implementing a revised BSF curriculum.

Step 1.

To help ensure that our committee work and discussions would be well-focused and productive, and to help ensure that we had faculty “buy-in” through a collectively-shared guiding vision, we created (and kept updated) what we referred to as a *Summary Document*. This document included the outline in Figure 3, but it also included sections titled:

- Why bother?*
- Primary Goal and Objectives;*
- Principles to Guide our Process;*
- and
- Sources of Information.*

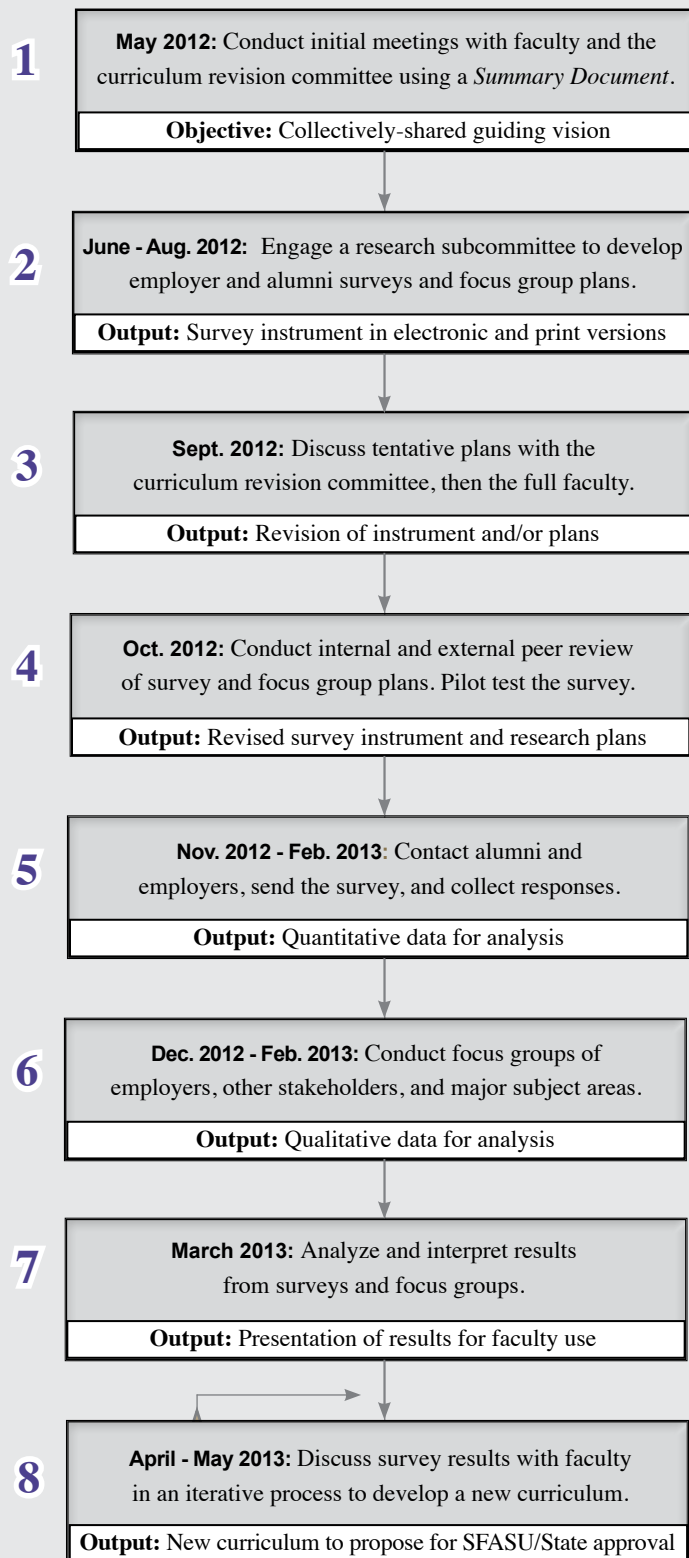
Our discussion of Step 1 in Figure 3 matches the *Summary Document* sections.

Why bother?

Why should we undertake a major process to revise and refocus the BSF curriculum? We started our discussions with the ad hoc committee and the full faculty with a review of the information presented in section I. A. **Why bother?** This step is critical to any process to revise a curriculum, of course, so that the faculty will have a full understanding of why such a process is needed.

As discussed in section I. A., given the magnitude of changes, issues, and challenges affecting forest resources, forestry professionals, and forestry educators in the 21st century, our faculty discussed the need to fully embrace new issues and

Figure 3. Eight basic steps in the BSF curriculum revision process at SFASU.



competencies in our BSF program as existential. The need to “sharpen the saw” in our academic programs is clearly much more than just something we do periodically to address accreditation standards.

Primary Goal and Objectives

We defined a primary goal and four objectives for our process:

Primary goal. The BSF program at SFASU will continue to produce graduates who are ‘society-ready,’ i.e., capable of dealing effectively with the complex economic, ecological, and social issues involving forest resources in the 21st century. In Texas and beyond, our graduates must be prepared to effectively enhance the integrity, stability, and health of the environment through sustainable management, conservation, and protection of forests and natural resources.

Objectives. Given our primary goal for the BSF program, our objectives for the curriculum revision process were to:

1. more effectively prepare our BSF graduates for success in meeting current and prospective needs of society and of forestry employers;
2. continue to meet and exceed SAF accreditation standards;
3. complete our process in time to submit approval forms during the fall 2013 semester, so a new curriculum can be implemented in the fall of 2014; and
4. provide leadership at regional and national levels in the scholarship of teaching and learning in BSF curriculum development.

Principles to Guide our Process

Our list of principles included statements that were similar to the following eight points. In our BSF revision process it was understood at the beginning and throughout the process that we would:

1. use the latest SAF guidelines for accreditation;
2. assess general, technical, and personal competencies needed for our graduates to be society-ready;
3. learn from recent BSF revisions at other SAF-accredited schools, as well as from relevant reports and studies in the literature;
4. engage faculty and staff fully and appropriately, in our college as well as in other programs at SFASU;
5. engage important stakeholders, including alumni, current and prospective employers, and forest landowners;
6. be open-minded and creative in considering course placement in the curriculum, as well as in developing new courses and in considering the need to revise current courses – this included understanding that the curriculum changes needed may be revolutionary rather than just evolutionary;
7. consider the need to make courses learner-centered, experiential, and service-related where apropos; and
8. follow applicable university and state guidelines for curriculum revision.

Sources of Information

The final section in the *Summary Document* we used in Step 1 was a list of relevant literature that helped guide our discussions and actions. These references involved forestry and natural resources topics, as well

as relevant research methods and analytical techniques.

Sources of information are cited in context in this monograph. Having references in the *Summary Document*, however, helped the research subcommittee and the faculty in general to see the context of our BSF revision process in relation to previous work in this field. In our process it was important to show the nature and extent of previous research in curricular issues, particularly for faculty members without a background in the scholarship of teaching and learning.

The *Summary Document* was critical to our process of curriculum revision. It helped establish and communicate a collectively-shared, guiding vision for *where* we were going in this process and *why*, and it also helped provide a blueprint for *how* we would proceed. Case studies have shown these are crucial factors for faculty “buy-n” and engagement in curriculum revision at U.S. institutions of higher education (Oliver and Hyun 2011).

Step 2.

Our six-person research subcommittee met twice a week from June through August 2012, to develop a survey instrument for employers and alumni, and also to develop plans to conduct focus group sessions of employers and other stakeholders. This work and our research results are detailed in the next section (**II. B. Research Process and Results**).

Step 3.

At each step in our process, we knew it would be important to engage all of the forestry faculty who teach in the BSF program. We therefore made sure that all planned actions

were fully discussed; in each meeting we continued to use the *Summary Document* referred to in Step 1, since this information helped reinforce and remind all participants of why we were doing this, what our goals and objectives were, and what our basic outline of steps involved.

Step 4.

It was critical that our research be of high quality, so we used external review and pilot testing to help ensure our results would be accurate and defensible. Details are presented in the next section (**II. B. Research Process and Results**).

Step 5.

To contact our alumni and employers, we needed accurate contact information. We invested significant staff time to update our alumni database, and to create a database of employers and prospective employers of our graduates.

We distributed the survey of competencies and issues in both paper and electronic versions, as presented in the next section (**II. B. Research Process and Results**). The survey was first distributed in November 2012; February 14, 2013 was the cut-off date for responses to be included in our database and analysis of survey results.

Step 6.

The qualitative phase of our research process involved a total of 15 focus group sessions. The primary purpose of these sessions was to obtain more in-depth input on the knowledge, skills, abilities and behaviors most needed for BSF graduates to be society-ready in the 21st century. The first session was in December 2012, and the final session was in February 2013.

Our focus groups represented major categories of employers of BSF graduates, including forest industry, state and federal agencies, and consulting firms. Focus groups also represented major subject areas for employment of BSF graduates, however, including wildlife, forest health, urban forestry, and forest recreation. We also held a focus group session that was comprised of BSF alumni who graduated within the last five years, and a session that was comprised of female alumni.

Step 7.

Quantitative data from the survey of alumni and employers were analyzed and summarized using Importance-Performance Analysis (Martilla and James 1977) and also using methods first presented by Borich (1980) involving mean weighted discrepancy scores. Analysis details are in the following section (**II. B. Research Process and Results**).

Focus group sessions included a script of questions, as detailed in the next section (**II. B. Research Process and Results**); sessions were recorded, transcribed, and assessed for thematic content relating to technical, general and personal competencies. Focus group transcripts were made available to faculty, and written summaries were prepared and used in our faculty meetings. Also, to help interpret focus group results, word clouds were created to visually highlight key discussion points for the individual focus group sessions.

Step 8.

To help interpret our research findings, they were shared in summary form with about 80 forestry professionals at the annual meeting of the Texas Society of American Foresters in April 2013. Many of the profes-

sionals in the room were respondents to the survey, and some had been focus group participants. These practicing foresters showed very significant interest in the survey and focus group results.

Forestry professionals in general expressed a sincere appreciation for being asked for their input in helping prepare BSF graduates for future employment. Many respondents did, however, tell us that the survey instrument was too long, and that response rates would have been much higher if the survey had been shorter.

The most significant part of Step 8 of our overall process involved facilitated meetings of the forestry faculty. Faculty meetings were scheduled and held in six three-hour sessions, for a total of 18 hours of focused discussion. The meetings were held on Friday mornings from 8:30 to 11:30 a.m., beginning in early April and continuing through mid-May 2013.

The faculty meetings were facilitated by the education research specialist member of our research subcommittee. Having expertise in education research was an advantage throughout our BSF revision process. During our faculty meetings, it was particularly important to have someone to facilitate discussions who was completely familiar with our work (processes and results), but who had no subject matter biases in terms of technical forestry expertise or in terms of what courses or content should be added, deleted, or refocused in our curriculum.

The first three-hour faculty meeting included a review of the *Summary Document* summarized in Step 1, including a discussion of the context of our work to date, including why the

BSF curriculum was being reviewed for revision, and how the research process was conducted. This meeting also involved adopting “ground rules” for the discussions to come. Specifically, we agreed that in our meetings we would:

1. respect self and others;
2. build trust;
3. only disagree agreeably;
4. listen with an open mind;
5. speak concisely;
6. ask what’s possible, not what’s wrong, and keep asking;
7. not interrupt;
8. state a solution along with a problem;
9. stay focused and save side comments for later;
10. be in the moment;
11. reflect on issues where appropriate (silence would not necessarily mean agreement);
12. support the final decisions made by the group;
13. not be defensive of our own turf; and
14. use the days between meetings for constructive dialogue with colleagues.

We present the ground rules here because they turned out to be important. They were posted at each meeting, and they did help our meetings to be well-focused and productive.

In the second and third faculty meetings, survey and focus group processes were summarized; detailed summaries of both quantitative and qualitative results were presented. It was very important, of course, for members of the faculty to know that the research-based process was objective, thorough, and rigorous in terms of scholarship. To be accepted and used, the research results and analyses must be valid and appropriate.

Faculty members’ questions were addressed by members of the six-person research subcommittee. After reviewing initial summaries of survey results, for example, faculty requested additional analyses, including a comparison of survey results from alumni before and after the last major change in the BSF curriculum at SFASU.

The final three meetings of our forestry faculty involved the specific changes needed in our BSF curriculum. During these meetings, anonymous votes were held on significant decisions and actions to revise the curriculum. These action-item votes were based on discussions and faculty interpretation of research-based results regarding general, technical, and personal competencies.

We believe that the curriculum revision process is just as important as the product.

We used a 4x12-foot dry-erase whiteboard to hold magnetic tiles that were movable and that were also erasable. Each tile represented a course, from the freshman year through the senior year, including courses required in our six-week summer Field Station. This allowed us to discuss specific potential changes in the curriculum, while being able to view the full sequence of courses before and after the change. In essence, this display created a curriculum ‘map’ that facilitated all of our discussions of courses, competencies, and proposed changes.

In our overall process, including discussions during faculty meetings, we placed special emphasis on our summer Field Station (a six-week

sequence of six courses), our introductory-level courses for new students, and our capstone-level courses for seniors. Course timing, course content, prerequisites and overall sequencing were considered throughout the process.

The BSF degree at SFASU is comprised of majors in forest management, forest wildlife management, and general forestry, which allows students to tailor degree plans in urban forestry, fire management, forest recreation, agroforestry, and forest business management. All of the majors are accredited by the SAF, and in the process of revising the BSF curriculum, therefore, we also focused on impacts on students throughout our BSF majors. That is, we had to make sure that changes made in our BSF degree program were amenable to all of the majors, including forest wildlife management and each of the tailored degree programs in the general forestry major.

To promote discussion, we placed all of the required courses in our forest management curriculum on magnetic tiles in our four-year ‘map,’ i.e., not just the required courses in forestry, wildlife and related subjects. SFASU is in the process of implementing a new core curriculum based on new requirements from the Texas Higher Education Coordinating Board. However, the new requirements are expected to cause only minimal changes in our newly-proposed BSF curriculum.

In our process we also had very significant discussions on issues and topics that were *extra-curricular* – issues and actions that did not specifically involve the sequence of courses in our BSF program. For example, some of our decisions for

action involve expanding opportunities for forestry-related employment, academic advising with respect to leadership opportunities, and student mentoring activities designed to enhance core competencies. These and other actions are presented in section **III. Revision of the BSF Curriculum.**

Next Steps in the Overall Process.

Our process of BSF curriculum revision didn't end with Step 8, i.e., with a new curriculum to propose for SFASU and state-level approval to implement in the fall of 2014. Our six three-hour faculty meetings in April and May of 2013 provided key direction and decisions for change, but we have important work to do that is based on our faculty decisions.

For example, key changes are being implemented in the timing and content of intro-level courses, summer Field Station, and capstone courses, as well as in other courses throughout our BSF curriculum. We have also had focused, small-group faculty meetings to develop, refine, and implement specific changes, but the process is dynamic. It will be necessary for our faculty to take action on a continuing basis, dealing with recommended changes to address technical, general, and personal competencies, and emphasizing extra-curricular as well as curricular areas.

To ensure these discussions, decisions, and actions take place on a continuing basis, our process must continue with leadership from dedicated faculty and administrators. True and consistent commitment is needed to achieve the primary goal of continuing to produce society-ready BSF graduates, effectively meeting the evolving needs of society and forestry employers.

Another key to success in keeping our BSF curriculum well-focused in the long-run is the continuing need to interact with, and be held accountable by, the community of forestry professionals and employers of our graduates. Our faculty must continue to report to these stakeholders on changes made based on their input, and to listen to further changes as needs evolve over time. This need includes all aspects of the curriculum, but also includes extra-curricular efforts, particularly to build general and personal competencies.

SFASU is accredited by the Southern Association of College and Schools (SACS), and our BSF program is accredited by SAF. As part of both accreditation processes, we collect and evaluate information on student performance. Each year, for example, we collect evaluative information for SACS on presentation skills in an upper-level forestry course, as well as information on writing skills and technical forestry knowledge in our capstone course in the BSF degree. Faculty meet at least once each year to discuss overall results and trends, and where appropriate to develop action plans to address needs for improvement. Since our curriculum will be revised, we will also meet to discuss revising our approaches to evaluate student performance for both SACS and SAF.

Finally, in describing our overall process of curriculum revision, on page 15 we presented four objectives. The fourth objective was to provide leadership in the scholarship of teaching and learning in BSF curriculum development. This objective is a part of the college's Strategic Plan for 2011-2015. Our faculty and administration will address this objective through publications based on our

work to date, through future research and scholarly activity on this topic, and through presentations at local, regional, and national conferences. We will, for example, work with other universities to develop and share "best practices" in curriculum revision, following important recommendations in NAUFRP's Undergraduate Educational Enhancement Strategy (Layton et al. 2011).

In this section of the monograph, we describe our overall process of curriculum revision. The reason for this emphasis is because we believe the process is absolutely critical to successful curriculum revision, both short term and long term. We believe that major curriculum revision can *only* be successful and sustained in a dynamic world if the process is well-planned and implemented on a continuing basis.

In our review of forestry literature, for example, we described a 100-year history of forestry leaders placing dramatic emphasis on the need to strengthen people skills in our BSF degree programs. Why have we failed to address this need effectively? We mentioned a few potential reasons in our literature review (summarized in Figure 2), but it also may be true that we have paid too little attention to developing and using curriculum revision processes that will overcome systemic biases that tend to emphasize technical competencies and maintain the status quo. To address systemic problems effectively, systemic solutions are needed, hence we believe that the curriculum revision *process* is just as important as the *product*.

B. Research Process and Results

Our research process was designed to address three fundamental questions:

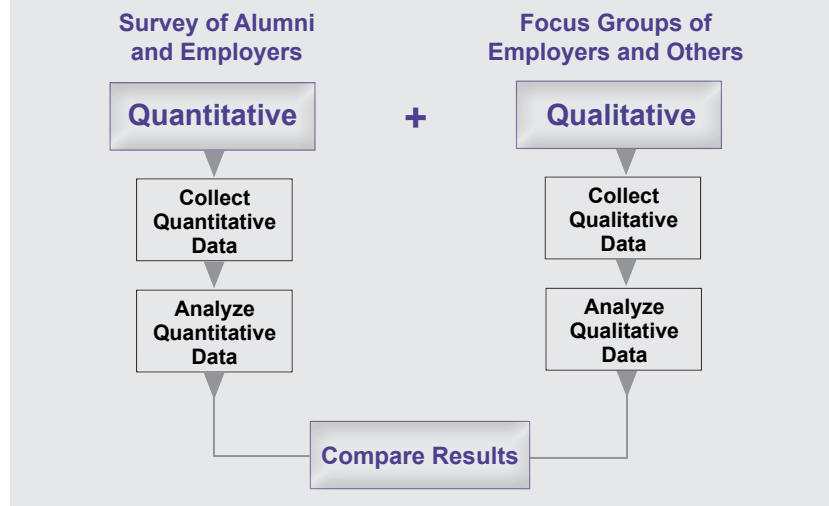
- a. What are the knowledge areas, skill sets, abilities, and behaviors that are most *important* for entry-level foresters in the 21st century?
- b. At SFASU, how are we *performing* in preparing BSF graduates with the most important knowledge, skills, abilities, and behaviors?
- c. How can we revise our BSF program to address areas of discrepancy between question 1 (importance) and question 2 (performance)?

Figure 3 provides a general outline of our overall curriculum revision process. In Figure 3, the research process includes Steps 2 through 7, from survey design and focus group planning (Step 2) in the summer of 2012, through analyzing and interpreting survey and focus group results (Step 7) in March of 2013.

Our basic *research* process is outlined in Figure 4. The research process involved mixed methods, i.e., we used both quantitative (survey) and qualitative (focus group) methods to collect and analyze data that would address the fundamental questions above. In educational research, the process we used has been called a “concurrent triangulation design” (Creswell 2009). The advantage of this approach is that important research results and conclusions can be cross-checked for support and validation using both methods.

Here we provide details of the methods we used and the results we obtained for both the survey and focus

Figure 4. Our mixed methods research approach involved a concurrent triangulation design (Creswell 2009).



group components of our research.

1. Survey of alumni and employers

The survey instrument.

Our six-person research team met twice a week during the summer of 2012, primarily to design a survey instrument that would effectively address questions a, b, and c (above). We found published work that was very helpful, particularly in terms of survey methods that could be applied to address these questions in the context of curriculum revision.

References that were helpful in designing and conducting our survey include: Berdrow and Evers (2011); Caldwell *et al.* (2011); the Coalition of Natural Resource Societies (2011); the Institute of Museum and Library Sciences (2009); Kane *et al.* (1990); Layton *et al.* (2011); Robinson and Garton (2008); Sample *et al.* (2000); Society of American Foresters (2011); Swing (2010); The Wildlife Society (2012); and Yoon *et al.* (2010).

We developed and used a survey instrument with four parts:

Part 1. Basic information on the respondent’s ties to forestry and SFASU’s forestry program.

Part 2. Perceptions regarding various knowledge, skills, abilities, and behaviors (importance and performance).

Part 3. Evaluation of education issues, procedures, and mastery.

Part 4. Employment and basic demographic information.

For peer review, a draft copy of the survey was sent to three external colleagues with extensive expertise in survey design and implementation. We made changes in the instrument based on their input, and we pilot tested the survey with graduate students and faculty in our program.

The survey cover letter and the complete survey instrument are presented in Appendix A. **Part 2** of the survey included 48 competency items that were grouped in six curriculum focus areas:

- **Managing Forest Resources** – 16 competency items (numbered

1 through 16 in question 10, **Part 2** of the survey);

- **Applying Reasoning and Critical Thinking** – 6 competency items (numbered 17 through 22);
- **Managing Self** – 6 competency items (numbered 23 through 28);
- **Communicating and Collaborating** – 9 competency items (numbered 29 through 37);
- **Leading and Managing People** – 5 competency items (numbered 38 through 42); and
- **Engaging in Transformative Learning and Leadership** – 6 competency items (numbered 43 through 48).

In **Part 3** of the survey instrument, we asked respondents to consider statements that involve the depth and breadth of the forestry profession (question 16 in **Part 3**). We also asked how involved society-ready foresters should be in major issues and challenges such as climate change and invasive species (question 17 in **Part 3**). These issues and challenges are based on relatively recent, significant studies of transformational forces affecting forests in the 21st century (see Wear and Greis 2013, for example).

The survey also included open-ended questions to ensure respondents could express complete opinions on the importance of competencies, as well as on our performance. Alumni were also asked about their overall experience as forestry students at SFASU.

Conducting the survey.

Before sending the survey, we compared several sources of information to update our contact list for BSF alumni. For employers of BSF graduates, both current and prospective, we went through several cycles

of circulating lists to our faculty. This process helped update contact information, and also helped ensure we included as many current and potential forestry employers as possible.

The process of developing and conducting the survey involved several steps, based on Dillman et al. (2009):

- A letter from the college dean was mailed to 3,250 alumni and employers on November 1, 2012, to introduce the upcoming survey, and to ask if respondents would prefer a paper or electronic version of the survey. Each letter included a self-addressed, postage-paid card to be filled out and returned, verifying contact information and survey preference (paper or electronic).
- Paper surveys were mailed to 1,728 people on November 27, 2012.
- Electronic surveys were sent to 1,551 people on December 4, 2012. Qualtrics software was used to design and conduct the electronic version of the survey.
- A reminder card was sent (mail and electronic versions) on December 12, 2012.
- A second copy of the paper survey was mailed on December 27, 2012.
- Electronic reminders were sent on December 18, 2012, and on January 2, 8, and 17, 2013.
- The closing date for responses to both paper and electronic survey versions was February 14, 2013.

Survey data and response rate.

After all mailings, we received 227 paper survey responses and 573 electronic responses – a total of 800 survey responses. The response rate was just over 24%, and our sampling error was estimated to be 3% at a 95% confidence level.

We used Statistical Analysis System (SAS) software to run a data imputation procedure (Allison 2001) to address missing data, a common problem in social science research. Data imputation is a Bayesian statistical technique that creates estimates of missing data based on all the other data that are not missing. In this analysis, we used a combination of Maximum Likelihood estimation and Markov Chain Monte Carlo simulation to generate five datasets from which the mean values of all missing data were estimated. Our data included a total of 4,000 observations from which to calculate mean missing data values.

A total of 671 of the 800 survey responses had missing data. Respondents who did not provide complete *importance* rating data for all 48 competency items in **Part 2** of the survey omitted, on average, 5-10% of the items (min = <1%, max = 33%). Respondents who did not provide complete *performance* rating data for all 48 competency items in **Part 2** of the survey omitted, on average, 20-30% of the items (min = <5%, max = 67%). Responses to open-ended survey questions suggest that those who were not recent graduates may have omitted performance ratings due to concerns that their experience may not reflect current conditions.

Relative efficiency (%) is a measure of the effectiveness of the data imputation process. Data efficiency should exceed 80%. In this survey, data efficiency exceeded 90% for all importance and performance questions. The lowest efficiency score for any item was 87%, so even questions with relatively high missing data percentages showed high efficiency following the imputation procedure. Based on these results, we conducted

further analyses using the imputed dataset with all 800 survey responses included. Only missing data were imputed, i.e., all observed data were used as recorded on the survey instrument.

Who participated in the survey?

To assess the overall pool of survey response information we received, we reviewed several statistics on respondents.

- *Academic Background:* Respondents graduated from college over a range of 64 years, from 1948 to 2012; the median year of graduation was 1986. About 21% of respondents graduated from college between 2000 and 2012, 21% in the 1990s and 21% in the 1980s. About 28% graduated in the 1970s, and less than 10% in the 1960s. Six hundred and four respondents, just over 75%, were graduates of the BSF program at SFASU.
- *Retirement Status:* Seventeen percent of respondents indicated they were retired.
- *Sociodemographic Background:* The respondent pool was fairly homogeneous in terms of gender, race, and ethnicity. However, survey respondents represented a variety of ages and levels of educational attainment. About one-third were less than 45 years old; the median age category was 45-54. About 84% were males and 16% females. Twenty-six respondents (about 4%) self-identified as Hispanic or Latino. Nearly 96% indicated that they were white. Sixty-five percent reported their highest level of educational attainment as a bachelor’s degree, and another 34% reported having a master’s or doctoral degree. Household income for respondents in 2011

ranged from less than \$15,000 to over \$250,000. The median income category was \$75,000-\$99,000. About 41% reported an annual income of \$100,000 or more.

Survey results: Self-assessment.

In question 15, **Part 3** of the survey, we asked respondents the extent to which they believed they currently demonstrated the knowledge, skills, abilities, and behaviors that were grouped into six curriculum focus areas. Our five-point Likert-scale included:

- (1) *Do Not Demonstrate at All;*
- (2) *Somewhat Demonstrate;*
- (3) *Moderately Demonstrate;*
- (4) *Demonstrate Quite a Bit;* and
- (5) *Fully Demonstrate.*

For this question, mean responses for the six curriculum focus areas were highest for **Applying Reasoning and Critical Thinking** (4.48), **Managing Self** (4.47), and **Communicating and Collaborating** (4.39). The mean was lowest for **Managing Forest Resources** (3.47), but this curriculum focus area also had the highest variability.

Survey results: Breadth of expertise.

In question 16, **Part 3** of the survey, we asked respondents their opinions on the relative value of a specialist’s skill set and the skill set of a forester with a broad-based forestry education. Each of the seven subparts of the question asked for respondents’ perspectives on the importance of depth versus breadth of knowledge and skills for practicing foresters. The five-point Likert scale response options for each statement were:

- (1) *Strongly Disagree;*
- (2) *Somewhat Disagree;*
- (3) *Neither Agree nor Disagree;*
- (4) *Somewhat Agree;* and

- (5) *Strongly Agree.*

Results of our survey are very much aligned with a basic tenet of SAF (2011), that “*Forestry is an interdisciplinary profession.*” This statement received the highest mean score (4.61) of the seven items listed, and the standard deviation for this item was the smallest for this subset of statements, indicating a relatively high level of agreement among respondents. These results also support comments made by Robison (2005) and others that the strength of a professional forestry degree is the “*expertise of breadth.*” All four of the items listed in this subset that specifically involve breadth of expertise received mean scores above 4.

Meanwhile, respondents gave the statement “*To meet the challenges of the future, foresters should have a single disciplinary focus*” the lowest mean score for this subset of questions.

Survey results: Breadth of issues.

Question 17 in Part 3 of the survey asked respondents how involved they think foresters should be in addressing each of eight different issues. Respondents were given five possible responses:

- (1) *Not Involved At All;*
- (2) *Somewhat Involved;*
- (3) *Moderately Involved;*
- (4) *Quite Involved;* and
- (5) *Extremely Involved.*

Results for the eight issues are listed below by mean score, from highest to lowest:

	Mean (<i>Std. Dev</i>)
<i>Invasive plants, insects, and diseases</i>	4.27 (0.783)
<i>Changes in water</i>	4.23

<i>availability, water quality, and instances of water stress</i>	(0.798)
<i>Controversy surrounding land management decision making</i>	4.10 (0.921)
<i>Changes in wildfire regimes</i>	4.10 (0.888)
<i>Bioenergy development</i>	3.95 (0.891)
<i>Forest fragmentation and ownership parcelization</i>	3.93 (0.937)
<i>Population growth and redistribution</i>	3.61 (1.067)
<i>Climate change and its effects</i>	3.53 (1.154)

Respondents' ratings show that they feel foresters should be at least "moderately involved" in all eight issues. The item with the highest mean score was "Invasive plants, insects, and diseases," indicating that foresters should be very actively involved in preventing, monitoring, and controlling invasives. The challenge of invasives was followed very closely in importance by water issues. The two items with the lowest mean scores, population growth and climate change, also had the highest standard deviations, indicating the most disagreement among respondents on how involved foresters should be in these issues.

Survey results: Competency groupings and internal consistency.

The 48 competency items in question 10, **Part 2** of the survey, reflected six curriculum focus areas that we believed were essential to functioning as a full performance forestry professional in the future. Some of these

skill sets may seem non-traditional. Truthfully, we felt that we should incorporate skills long-recognized as essential for foresters and natural resource professionals, as well as emerging skills related to business entrepreneurship, globalization, and the digital age.

Factor analysis was used to *explore* (exploratory factor analysis) and *confirm* (confirmatory factor analysis) how the 48 competency items grouped together into factors that explained the variance observed in the survey data (Yoon *et al.* 2010). Through factor analysis we expected to find that the six curriculum focus areas would break out into six separate groups; instead, factor analysis revealed that all 48 competency items can be grouped into *one* group. That is, all 48 competency items were present in the First Factor, which represented 75% of the variability explained. This is an unexpected result, but it suggests that the 48 competencies explain more of the variability associated with what respondents consider to be essential for society-ready foresters than they do if broken into separate groupings.

Next, we conducted a Cronbach's alpha analysis (Cronbach 1951) to examine the internal consistency of each of the six curriculum focus areas. From factor analysis, we knew that we had one factor. However, is it possible that each curriculum focus area could maintain its own identity (so to speak) within the whole? Results showed that the six focus areas have very good to excellent internal consistency – Cronbach's alpha scores for each curriculum focus area varied from 0.87 to 0.93 on a scale from 0 to 1.

Cronbach's alpha analysis indicated

that 47 of the 48 items contributed to higher alpha scores within their respective curriculum focus area. The only item that did not improve the internal consistency of the survey groupings was "Be able to speak two or more languages." If this item were to be omitted from the **Communicating and Collaborating** curriculum focus area, the Cronbach's alpha score for the focus area would go up, from 0.89 to 0.91.

Survey results: Mean weighted discrepancy scores.

To help assess areas we need to strengthen in the BSF curriculum, we calculated and compared mean weighted discrepancy scores (MWDS) using survey results for importance and performance for the 48 competency items (Borich 1980). This is a mechanism for what Borich called "needs assessment" in training programs, in our case an undergraduate curriculum.

For each competency item, the MWDS is calculated by taking the difference between importance and performance (the discrepancy), and weighting this difference based on the level of importance for the item.

If a specific competency's importance score is high, but the performance score is low, for example, the discrepancy will be relatively high and the weight given to the discrepancy will also be high. This will result in a relatively high ranking compared to competencies with lower importance, or where the level of discrepancy between importance and performance is less.

We ranked the 48 competency results in question 10, **Part 2** of the survey, by mean weighted discrepancy scores, and the 10 highest priorities

to strengthen in the BSF curriculum were:

1. *Use oral communication effectively.*
2. *Establish positive supervisory relationships.*
3. *Engage effectively in conflict management.*
4. *Manage one's schedule and workload efficiently.*
5. *Be an effective listener.*
6. *Use written communication effectively.*
7. *Be decisive when necessary.*
8. *Understand audiences.*
9. *Analyze, prioritize and solve problems.*
10. *Be able to work effectively on multiple projects.*

This analysis also showed that for four competency items our performance scores were higher than the importance scores. These items were:

- *Manage forests for human use and enjoyment;*
- *Use forest management practices to achieve wildlife management goals;*
- *Know how to identify tree, non-tree and wildlife species; and*
- *Manage forest wildlife populations.*

We also averaged the MWDS for each of the six curriculum focus areas. Each of the six averages was negative, indicating that overall, importance scores were higher than performance scores for each of the six areas. The biggest gaps were in people-related skills and competencies as shown below (the number in parentheses below is the average MWDS):

- **Leading and Managing People** (-3.2)
- **Managing Self** (-2.5)
- **Communicating and Collaborating** (-2.4)

rating (-2.4)

- **Engaging in Transformative Learning and Leadership** (-2.1)
- **Applying Reasoning and Critical Thinking** (1.7)
- **Managing Forest Resources** (-0.7)

Survey results: Importance-Performance Analysis. In Question 10, **Part 2** of the survey, we asked two main questions for each of the 48 competencies:

- (1) *How important is it that foresters demonstrate competence in this skill set?*
- (2) *How successful is SFA in producing foresters who have the knowledge, skills, abilities, and behaviors that make up this competency?*

Since there are two scores for each competency, i.e., *importance* and *success* (or *performance*), the results can be illustrated in a chart with two axes. This type of analysis is termed Importance-Performance Analysis (IPA), and has been used in many academic and business settings; the original reference, Martilla and James (1977), is in the Journal of Marketing.

IPA charts for the 48 competency items are presented in Appendix B, with one overall chart (all 48 competencies) followed by a chart for each of the six curriculum focus areas. In these charts we plotted the mean scores for *importance* on the Y axis, and mean scores for *performance* on the X axis. [Recall that all mean scores are included in Appendix A, where the survey instrument is presented.]

In an IPA analysis, there are various ways to determine what values to use for the X-Y intercept. In our case,

we calculated the grand mean for all the importance items (4.23) and the grand mean for all the performance items (3.8) and then took the mean of the two scores (4.01). We decided to place the origin for each chart, i.e., the X-Y intercept, at (4.0, 4.0) so that, in our survey, anything that rises above “*Somewhat Important*” in importance ratings and above “*Quite Successful*” in performance ratings would fall in the upper right quadrant. This quadrant has been labelled “*Keep Up the Good Work*” in the literature. Similarly, any items that rise above “*Somewhat Important*” for importance ratings but do not achieve a “*Quite Successful*” rating or higher for performance would fall in the upper left quadrant. This quadrant has been labelled “*Concentrate Here.*”

To help detect trends through visual inspection, the IPA charts in Appendix B highlight all of the data points for each of the six curriculum focus areas. The numbers and color coding on the IPA charts correspond with the numbers and color coding of competency items in the survey instrument in Appendix A.

Survey results: Open-ended questions.

Three questions in the survey were open-ended, allowing respondents to provide additional comments on the “*importance of competencies*” (Question 11); additional comments on SFASU’s “*success in producing society-ready foresters*” (Question 12); and for alumni, additional comments on “*your experience as a forestry student*” at SFASU. These three questions generated a total of 40,355 words of text, reflecting a high level of interest and engagement on the part of alumni and employers who responded to the survey. Respondent comments are a rich source

of data to strengthen the BSF program in the future.

Some respondents emphasized the importance of technical skills: *“For a bachelors degree, I think the focus should be on the basics such as dendrology , silviculture, pathology, entomology, ecology, fire, wildlife, GIS, soils, hydrology, mensuration, etc. I have trained a lot of recent grads from different schools and they are all weak in dendrology, many can’t read aerial imagery, and some haven’t even learned how to use clinometers or increment borers.”*

Other respondents emphasized the importance of integrating technical skills (e.g., conducting forest inventory) and general skills (e.g., applying reasoning and critical thinking): *“[the] ability to assess, inventory, forecast, identify problems, develop alternatives, compare and evaluate alternatives, and then provide meaningful, concise results with clear and pertinent analysis—with a recommendation—in a manner that fully informs decision makers.”* Respondents also recognized that beyond *“basic competencies thoroughly understood,”* graduates also need *“drive, determination and a willingness to put their boots on the ground”* (personal skills).

Some respondents viewed technical, general and personal competencies as working together in a mutually reinforcing fashion: *“I work now as an arborist, but my forestry training at SFA has been invaluable...The real work is with the trees and the people that own them, and we need individuals who understand tree biology, physiology, mechanics, pathology and pest management, etc. Produce these skills along with a healthy dose of business acumen and public rela-*

tions skills. Above all, they need to be able to communicate verbally on the individual level as well as group presentations. They need to be able to write well, both in popular article style and technical paper style.”

Respondent comments suggest that then (and now) forestry schools may not train students in all areas required for success: *“I checked ‘do not know’ on many, many questions. It has been some time since I graduated, so I can only speak from experience. When I graduated I had no idea how much public interaction I would be required to undertake, and quite frankly I was not prepared. I manage a large public property—interactions with people are crucial to success and being able to deal with many different mindsets cannot be overstated.”*

One respondent identified a gap between the importance of communication skills and the extent to which it is evident in the workplace: *“By far the most important and somewhat uncommon skill is effective verbal and written communication.”* Another respondent highlighted the importance of communicating, collaborating, and managing people: *“Forest management is a business. There needs to be more emphasis on business management, working together as teams, and communication, both internal and external. Managing timber, managing wildlife equals managing people.”*

Respondents also felt that communicating effectively through face-to-face and digital formats may become increasingly important: *“In general, forest managers are increasingly required to be tech savvy communicators...[foresters have to] communicate complicated scientific principles to a wide range of people with varying abilities to understand them.”*

Considering global level challenges, one respondent summarized what he believes will be required of future foresters: *“To work for the betterment of society, not just forest profits. To be aware that we are now a global culture (and global economy) and be able to work within these large parameters.”*

In sum, responses to the open-ended survey questions highlight the importance of an interdisciplinary, integrated forestry curriculum that builds competence and capacity to apply technical, general, and personal skill sets to address ever more challenging environmental and social needs.

Survey results: Overall messages

The fundamental, overall messages resulting from our survey are remarkably similar to the results of surveys of forestry professionals in 1949-50 (Barrett 1953), and during the 1990s (Brown and Lassoie 1998, and Sample et al. 1999, 2000). The basic message is that we are doing relatively well in terms of preparing graduates with technical knowledge and skills, but we need to strengthen skills, abilities, and behaviors that relate to working effectively with people.

Comparing our results with earlier surveys, one of the most striking findings is that the top-ranked and the bottom-ranked skills in 1949-50 (of 700 foresters surveyed regarding 57 skill sets) were *identical* to our results in 2012-13 (with 800 foresters and 48 skill sets). In the 1949-50 survey, Barrett (1954) reported *“Speaking and Writing,”* as the highest ranked skill, while in our 2012-13 survey the highest MWDS was *“Use oral communication effectively,”* and the sixth-ranked was *“Use written communication effectively.”* The lowest-ranked skill set in 1949-50

was “*Foreign language*,” while ours was “*Be able to speak two or more languages*.”

If you only consider *importance*, i.e., if you don’t include performance in the analysis, the highest-ranked of the 48 skill sets in our survey was “*Conduct oneself in a professional manner*,” with a mean Likert score of 4.74 on our 5-point scale.

In the next subsection, we describe our focus group process and results; both survey and focus group results were used to extensively revise the BSF curriculum, as summarized in section III. **Revision of the BSF Curriculum**. In section III we include a more extensive summary of our survey results for the 48 skill sets, in the context of redesigning our curriculum using a model that focuses on three broad areas of competency: technical, general, and personal.

2. Focus Groups

The focus group process.

The methods we used to plan and conduct focus group sessions is based on recommendations in *Designing and Conducting Mixed Methods Research* (Creswell and Plano Clark 2011) and *Focus Groups: A Practical Guide for Applied Research* (Krueger and Casey 2000).

Our six-person research subcommittee developed an initial script for conducting the focus group sessions; the script was refined based on faculty input. The order of information and the basic list of focus group question are presented in Appendix C1.

In general, in focus groups we concentrated on the same knowledge areas, skill sets, abilities, and be-

haviors that were in our survey, but we encouraged participants to bring specific technical and general competencies to the discussion. All focus group participants had completed a survey, so they were familiar with the basic outline of our questions, and also with specific competency items we were assessing for the BSF curriculum. Participation was voluntary, and all participants understood that they could refuse to respond to any questions and/or to end their involvement in the session at any time.

We wanted to use these sessions to obtain more in-depth information than we would obtain in our survey, and for most topics we allowed participants to lead the direction of the discussion. All sessions were facilitated, however, to ensure that our basic outline of topics was covered and to ensure consistency from session to session. Where appropriate, questions were followed by additional questions to obtain more in-depth information. Rather than simply discussing “communication skills,” for example, we had the ability to ask about specific types of communication skills.

The sessions were facilitated by the educational research specialist member of our research subcommittee. This ensured that we followed best practices in terms of focus group protocol, and participants would also know that the facilitator had no personal interest in the outcome of discussions. Each session was also attended by a forestry subject matter expert, who recorded audio for each session (with permission from all participants), took notes, and recorded observable demographic information. A forestry faculty member who was also a member of the research subcommittee attended focus group

sessions, providing additional logistical and subject matter support.

The discussion of each question was allowed to continue in each focus group until the facilitator felt the point of theoretical saturation had been reached (Lindlof and Taylor 2011). This was also true for any side topics that were brought up in the discussions. The focus group sessions ranged in length from 60 to 90 minutes.

We conducted focus groups with individuals in each of the following categories, based on major career pathways of our BSF graduates:

Employer/employment Sector

- Texas A&M Forest Service
- Forestry consultants
- USDA Forest Service
- Timberland Investment Management Organizations (TIMO)
- Forest industry

Special Areas of Expertise

- Wildlife
- Forest health
- Forest recreation

Other Key Stakeholders

- High-level forestry leaders
- Forest landowners
- Female forestry professionals
- SFASU alumni (BSF) within 5 years of graduation

We conducted 15 focus group sessions, plus two single-person interviews, for a total of 58 participants and an average of four participants per focus group.

For consistency, the audio recording of each session was transcribed by a member of our college’s administrative staff. Transcripts of the focus group sessions were made available

to forestry faculty, so that any faculty member with an interest could review the “raw” qualitative data before or after the faculty meetings in Step 8 of Figure 3.

Who were the participants?

Our goal was to include “information rich” participants in these sessions, consisting of past, current, and potential employers of SFASU’s BSF graduates. Potential participants were identified through placement records, supplemented through iterative input from faculty, staff, and other forestry professionals.

Potential participants were contacted by e-mail or telephone. Each person who agreed to participate received reminders to complete the written survey and attend their focus group session. Sessions were held in multiple locations across Texas to enhance convenience for participants.

Of the 58 focus group participants, 50 were men and eight were women. They represented a wide range of ages, sectors of employment, geographic locations within Texas, and positions within their agencies and organizations. Participants ranged from two years out of college to more than 70 years old. They included self-employed consultants, entry-level hourly employees, and high-level administrators and managers from all Texas regions. Thirty-two of the 58 participants were SFASU BSF alumni, and all participants were current or prospective employers of BSF graduates.

Analysis of focus group results.

To begin the qualitative data analysis, we read the transcripts to obtain an overall sense of participant comments. Beside each line or paragraph, we generated labels to reflect poten-

tial coding categories (e.g., competencies, curriculum dimensions, current and future hiring needs, etc.).

Next, using ATLAS.ti qualitative analysis software, we coded segments of interview text according to the preliminary coding category list, adding new coding categories as necessary to fully code all transcripts. We then sorted the coded text into coding categories. A careful review of the text within each category allowed us to discern the similarities, differences, and the frequency of participant responses.

We then re-read the focus group transcripts and field notes, seeking content that may have been overlooked, material that was unexpected or counterintuitive, and additional comments that might help to illustrate the range of participant experiences and perspectives.

The process of analyzing the focus group transcripts, described above, was based on Glaser and Strauss’s (1967) method of constant comparison, and Miles and Huberman’s (1994) and Creswell and Plano Clark’s (2011) suggestions for coding qualitative data. We also created word clouds from the focus group transcripts to visually depict the major topics discussed during each session.

Focus group results: Themes.

An analysis of the focus group transcripts generated four themes (Figure 5). That is, to ensure that the BSF curriculum fosters the technical, general and personal competencies required for graduates to become society-ready foresters or natural resource professionals, SFASU must:

1. Maintain curricular breadth;
2. Promote skillful communication;

3. Challenge comfort zones; and
4. Foster the ability to “connect the dots.”

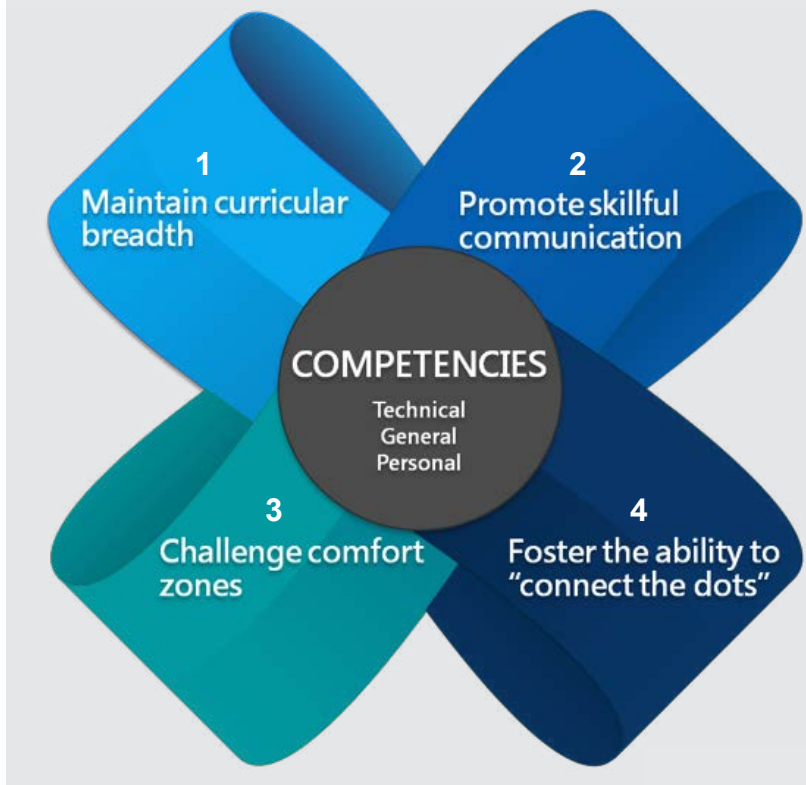
Theme 1 – Maintain curricular breadth.

Focus group respondents identified a wide array of knowledge, skills, abilities and behaviors that future foresters will need, including: soils, soil chemistry, water, watersheds, insects, forest pathology, wood chemistry, maps, topography, navigation, GIS, economics, business skills, how to use technology, dendrology, silviculture, logging operations, how to make a budget, math, ecology, regulations, how to conduct negotiations and write contracts, forest mensuration, ecological restoration, hydrological restoration, time management, range management, statistical sampling, how to use spreadsheets, desktop publishing ... The list goes on.

When asked what they would look for in a forestry graduate, one member of a joint Texas A&M Forest Service / Federal Agency focus group indicated, “[We want] somebody that is really a master of nothing, but [has a] wide range. We want somebody who...if you need to go help a forester cruise timber, you can do it. If you need to sit down and write up a professional permit, you can do it. We are looking for a wide range all across the board. That is what I do like about SFA—there is everything there.” Another person in that focus group echoed this sentiment, “We are looking for that Jack or Jill of all trades.”

How then should forestry and natural resource curricula be developed? What topics should be included? What sidebars should be erected? One wildlife professional responded,

Figure 5. Four themes from focus groups sessions that provide context for technical, general, and personal competencies for society-ready BSF graduates.



"I just don't think you could ever teach a broad enough curriculum. I know there's got to be a practical balance of depth and width. Width is really important." A wildlife colleague concurred, *"Having a diverse background makes someone well-rounded, and might make them more capable of doing more things."*

When participants wrestled with breadth versus depth, their answer was less philosophical and more practical: *"A lot of times the depth of your knowledge just comes with time"* (Wildlife professional). One Texas A&M Forest Service / Federal Agency focus group participant suggested that it was essentially the employer's job to provide depth: *"I would much rather have somebody that has a breadth to their knowledge, because I can take that individ-*

ual, I can zero in on specifically what they need to know for their job, and we can train them. We can give them the depth." Similarly, a forest health professional remarked, *"I would lean more toward a broader base because they don't know what the job situation is going to be. With the broader background, they may find better opportunities ... Once they decide they want to continue with their education, that's when [they] go more in-depth and specialize in something. So I'd like to see more of a broad-based background on an undergraduate level, then more specialized."*

Finally, the availability of almost limitless online resources may support a broad-based curriculum: *"You don't need a great depth of knowledge to be aware of the basics of dif-*

ferent biological systems, social systems, economics or whatever. It's in our ... everyday careers that I think we can specialize and dig down just as deep as we need to ... with new technologies, it's just getting easier and easier to find the resources and information we need" (Wildlife professional).

A broad-based curriculum may strengthen versatility, while also bundling more skill sets into fewer employees. One forestry consultant emphasized, *"You need to be versatile."* Another forestry consultant highlighted why versatility is so important: *"People have to have more skills. [It used to be that] you could hire one guy who was going to be your woods guy. He would do all your work in the woods. The other guy, he might interface with your clients ... Now you have to find all of that in one guy."*

Beyond the financial imperative of bundling more skills into fewer people, a broader curriculum may produce the higher-order thinking skills required to, for example, read the landscape: *"Environmental awareness. You are not just looking at trees when you go out there. You are looking at soils. [You're] going to need to know watersheds, and understand the lay of the land, and topography, and why it is doing what it is doing"* (Forest health professional). One wildlife professionals' comments suggest that the challenges of reading the landscape may transpose to the challenges of reading and responding to global systems: *"I look at the globalization of the world just in our everyday lives, and how we're connected to all different points of the globe ... we do need that broad perspective and finding people that have that broad perspective. State*

game agencies or wildlife agencies have suffered from tunnel vision, but boy, times have changed.”

In the end, maintaining curricular breadth may be a way to counter the tendency to emphasize natural systems over social systems that one high-level forestry leader identified: “*We’ve lost the art. Sometimes we pour too much science into them. It’s definitely about managing the people.*”

Theme 2 – Promote skillful communication.

Participants highlighted a range of communication skills that were viewed as essential. A high-level forestry leader commented, “*Technical writing skills are critical.*” A forest recreation professional urged graduates to “*Go out there and look somebody in the eye. Carry on a conversation to get your point across.*”

In an era of social media, web 2.0, and user-generated content, one high-level forestry leader indicated that it is not just communication skills, but communication filters that are necessary: “*The pictures they put out there, and the things that are on Facebook—they have no filter. They have no concept what that says about them.*”

When participants assessed communication skill levels among graduates and employees, there were mixed reviews. One participant in a joint Texas A&M Forest Service / Federal Agency focus group suggested, “*Most graduates are at least competent at writing, and a lot of them are good at it. That is part of college experience, learning how to write. But it is the speaking skills that quite often are insufficient.*” A forest health professional, however, did not agree

with this baseline assessment: “*They need a balance between technical skills and communication skills, particularly the writing aspect. A lot of the graduates don’t seem to be picking up the writing skills that they should have.*”

A high-level forestry leader provided his assessment and hinted at a possible cause: “*What I see lacking in a lot of forestry graduates, no matter where they come from, is that they’re technically sound but they can’t communicate. They’re not good writers. They’re not good speakers. And maybe sometimes they don’t even want to be—they don’t want to speak.*”

One TIMO representative indicated that his day-to-day communication challenges include “*communicating my thoughts with people all the*

“What I see lacking in a lot of forestry graduates, no matter where they come from, is that they’re technically sound but they can’t communicate.”

– High-level Forestry Leader

way from my bosses and their bosses about budgetary items and things going on in the unit, and then in contrast, I had to be able to talk to the guy that was running the cut machine out in the woods, or the guy ... that was loading a stump truck with a stick loader. I [also] had to be able to communicate with the fellow who was planting foreman for a crew of people who barely spoke English. All that is to say, there is a wide range of things that you can define as communication.”

This TIMO spokesperson highlights the wide range of *internal* audiences

to which one must respond. However, many participants pinpointed challenges related to communicating with *external* audiences, from clients to members of the general public. For example, a forest health professional cautioned, “*You can’t just jump out there and say, ‘Let’s cut these trees.’ Not anymore. You have to be conscious who you are talking to. He’s not just your landowner. You never know who your landowner is going to be. They need to be taught first, up front, to get to know the person. That’s part of personnel management. It’s your customer/client management. Figure out who they are first.*”

Thus, a forest recreation professional urged, “*Be able to tailor a message to your group,*” while a forest industry professional stressed “*the ability to communicate to varying styles and groups of people.*” This may sound vague until you hear a wildlife professional taking us to task, “*When you are out there dealing with a landowner who has a cow-calf operation, you’ve got to understand what he is up against.*”

Given the often controversial nature of communications in the public arena, one forest health professional remarked, “*... as much as I hate to say it, there ought to be an understanding of PC [or political correctness]—whether you like it or not, and I hate it. But there has to be an understanding of why and when it has to be used ... This is a hard class to teach ... but I think it can be done and I think it should be done.*”

A Texas A&M Forest Service / Federal Agency focus group participant interjected, “*I think the communication skills that we are talking about here are all important. But it’s the*

application of communication skills when you have to talk to somebody who doesn't agree with you, who doesn't like what you're doing [that's where the challenge comes in]."

A forest industry representative alluded to a communication imperative: being able to tell others what we do and why we do it, and doing so under challenging or even hostile circumstances: *"I think it is very important that graduates be able to talk to others about what we do, because [we're in a] climate where sometimes that is not always well-received. So I think that communications skills are definitely necessary."*

In some cases, the ability to address controversial topics under fire is assessed as a condition for employment: *"When I got the job I have now, I was already working for a company. I had to do a 15-minute talk on myself. Then I had to do a PowerPoint presentation. I was assigned the subject—and it was a controversial subject. How would I handle that? ... [Afterwards] I had to answer questions in front of a panel. We probably wouldn't do that when we are interviewing for interns, but we are already doing that for some jobs"* (Forest industry professional).

Theme 3 – Challenge comfort zones.

A Texas A&M Forest Service / Federal Agency focus group participant made the following observation: *"A successful curriculum is going to get people out of their comfort zones."* To which another participant quipped, *"[In a job interview,] I want to hear more than that you spent your free time hunting and fishing. What did the curriculum do that forced you to break the mold?"*

Participants offered numerous suggestions for how to provide developmental challenges to students. A high-level forestry leader advised, *"Encourage them in all those extra-*

"Maybe it's not so important that you have a public speaking class, but that you incorporate a little bit of it into almost every class you have."

– TIMO Representative

curricular activities. Try to cultivate it. It's a whole package. They need to be mentors." A TIMO participant also encouraged extra-curricular involvement: *"Push people to that end of things. Take them out of the educational realm to some extent and push [them] into a different realm. You know, it creates acquaintances and associations they won't get otherwise."*

A Texas A&M Forest Service / Federal Agency participant advocated for leadership and service that extends beyond the boundaries of one's job: *"[We look for] leadership in their fields ... go getters, highly motivated individuals, but also people who can be leaders in their community, who will get out and work in their community, do civic and volunteer work, put themselves out where they are not just being confined to the boundaries of their job."*

Public speaking may not make many top ten "favorite things about college" listings. Speaking in front of any audience, but especially in front of those whom you perceive to be unlike you, can be nerve-wracking. One TIMO representative confessed, *"I was scared to death of public speak-*

ing." Having conquered this fear, he now suggests *"Maybe it's not so important that you have a public speaking class, but that you incorporate a little bit of it into almost every class you have."* A 5-year alumnus proposed, *"There should be more opportunities and more of a push for students to present at the national level."*

Many forestry majors prefer hands-on activities over abstract concepts, yet a wildlife professional reminded us, *"One of the paradigms that's changed in national forest management is they don't manage for timber, for fiber production anymore."* Rather, *"They are managing for other things that aren't quite as tangible ... they are managing for diverse forests, a healthy forest, one that is sustainable for whatever use."*

In addition to dealing with abstract management goals, students may have to become more comfortable with ambiguity. That is, there isn't always one right answer, one right

"[We look for] people who can be leaders in their community, do civic and volunteer work, put themselves out where they are not just being confined to the boundaries of their job."

– Texas A&M Forest Service / Federal Agency Representative

way to do something. A Texas A&M Forest Service / Federal Agency participant suggested, *"Be creative in finding solutions to problems. A person who comes in and says this is the right way to do it, is probably going to have challenges. We need to look for more than one right way to do it."*

To equate “getting foresters out of their comfort zones” with “getting foresters out in the woods” may seem ridiculous. Many forestry faculty assume that students have had ample experiences in large, undeveloped natural areas, ample opportunities to acquire and develop skills that are woods-related. One TIMO representative, however, related a cautionary tale: “*It doesn’t take long to learn a compass, so I wouldn’t throw that out if you haven’t [already]. There are various types of canopy cover where you don’t get a GPS [signal], and if you’re lost when the battery runs out, you need to be able to get back to the truck. Quite frankly, some of the graduates we hired last year, when they started with us, we couldn’t leave them out in the woods alone. They would get lost.*”

A Texas A&M Forest Service / Federal Agency focus group participant commented, “*That’s one issue that kind of concerns me a little bit. Some of these newer foresters coming out of school are really computer savvy. They can run circles around me. But then we get out in the woods and they’re not quite as comfortable with some of the basics.*”

A wildlife professional reflected on a hunter’s education class that he attended recently, saying, “*Every kid in there had a cell phone and was working on games or sending text messages. They weren’t interested in looking at Field and Stream magazines.*” Another wildlife professional wondered aloud, “*Where are we going to spend our quality recreational time? Is it going to be in front of a computer?*”

Theme 4 – Foster the ability to “connect the dots.”

Participant comments revealed the importance of being able to integrate

technical, general and personal skills. One wildlife professional indicated that the kind of graduate they seek can “*apply common sense—practical sense—to a scenario or a situation, [moving from] problems to solutions. And then [they] have the ability to clearly communicate that [to others].*”

A wildlife professional indicated that they need “*geospatial analysts who can do more than just snap lines on a map, but actually analyze and develop tools to use for long-range planning.*” Another wildlife professional reinforced this claim, indicating a need for employees who can “*do more than pursue specialized projects, but [rather] ... coordinate science among other agencies and organizations.*”

Participants identified key questions for curriculum development and key needs for professional development. A high-level forestry leader com-

“[What we need is a] true fundamental understanding of the connectedness of the things we do when we manage. It’s the intricacies of the system. It’s not thinking single-threaded management. It’s that true understanding of all the components of the system.”

– Wildlife Professional

mented, “*Universities maybe spend too much time on classifications and less on the interrelationships in the natural world.*” One wildlife professional asked, “*How do you tie together functional landscapes from the Gulf Coast to the Great Plains for continuity of habitat? How do you*

work with private landowners and other land managers to connect the dots?”

Beyond simply adding new tiers to one’s knowledge pyramid, another wildlife professional suggested that we may need to pursue transformative learning and leadership: “*[Employees need the] ability to work across exactly what they know to beyond what they have been trained in, to develop other skill sets, to see those needs and to have the desire to further develop themselves—and [also to] be someone who has the ability to make some decisions.*”

Participants identified the need to foster critical thinking/transformational learning that transcends artificial boundaries. But what if barriers to this kind of thinking and learning exist within the architecture of institutions of higher learning? One 5-year alumnus notes, “*Taking all these different and varied classes gives you the ability to really understand what’s going on once you get out into the real world. I feel like maybe, at some other universities, they departmentalize the subjects more. So you’re not thinking how related they are to each other—when [in fact] they’re really, really integral to each other.*”

Does departmentalization limit one’s ability to think beyond one’s formal training? If so, the university model may work at cross purposes with future hiring needs: “*I think someone who will be successful ... will have the ability to think beyond just their formal training. The days of the specialist may be [numbered] ...*” (Wildlife professional). Agency work teams might offer a promising model for interdisciplinary collaboration: “*We have interdisciplinary teams. We’ll have a forester, wildlife biolo-*

gist, and archeologist, and they're all working together to solve a problem. I don't know if there's an opportunity to do that kind of interdisciplinary approach, [but from] what you are describing with some of those [issue] scenarios, I think it would be a good thing" (Texas A&M Forest Service / Federal Agency employee).

Participants identified a wide range of issues that foresters and natural resource professionals will face in the coming years: forest fragmentation, land use conversion, global markets, invasive species, plant pathology, water quality and quantity, water rights, population growth and redistribution, urbanization, bioenergy production, climate change, wildfire, air quality, solid waste, threatened and endangered species, and even trying to maintain a level of optimism. "We are going to be focused on major problem solving. You know, where is the water going to come from? Where is the food going to come from? ... Maybe this is a dire vision, but I think it's going to boil down to some hard choices" (Wildlife professional).

A wildlife professional also highlighted the need to understand the interconnected parts of the system. He said, "[What we need is a] true, fundamental understanding of the connectedness of the things we do when we manage. It's the intricacies associated with the system. It's not thinking single-threaded management. It's that true understanding of all the components of the system." Understanding a system means understanding its capability, resiliency and vulnerability. A Texas A&M Forest Service / Federal Agency focus group participant indicated, "The role that we should be playing is that we understand the capability of the

natural resources well enough that we can say, 'Here's where you can operate. Here are the sideboards.' But now we need to work together."

Equipping students with the critical thinking, management tools, ethical insight, and empathy required to solve natural resource issues in the

"[Employees need the] ability to work across exactly what they know to beyond what they have been trained in, to develop other skill sets, to see those needs and to have the desire to develop themselves ..."

– Wildlife Professional

future represents a huge challenge. Aware of the scope and importance of the issues to be addressed, a Texas A&M Forest Service / Federal Agency focus group participant urged, "We need to be understanding and empathetic, to try and put ourselves in their shoes, and then figure out how we solve [the problem] together."

The ability to internalize resource capabilities, cultivate empathy and understanding, and commit to collaborative processes may be the crux for everyone on the delivery end, and the receiving end, of forestry and natural resource curricula in the future.

Focus group results: Word clouds.

We created word clouds for 13 of the focus group sessions, primarily for use in faculty discussions. Two of the word clouds are presented in Appendix C2 – one for all focus group transcripts combined, and one for the focus group of consulting foresters.

These graphics simply show the relative dominance and weight of specific words that were used in focus group discussions, based on transcripts of the audio recordings. The visuals are not quantitative measures, of course, but they do have impact. In the two word clouds in Appendix C2, for example, you can easily see the dominance of words like "people," "management," "skills," and "communication." This general pattern was consistent throughout the employer types and areas of expertise represented in the focus groups.

Applying research results.

The major themes from our focus group analysis are completely consistent with our survey results. The qualitative data was in full accord with our survey findings regarding major competencies to emphasize in our BSF program. The focus groups also provided in-depth comments and information specific to our BSF program that will directly affect changes in the courses we require and offer as electives, as well as course content and timing.

The qualitative, focus group information, combined with the results of the three open-ended questions in our survey provide strong support for specific changes to improve the overall effectiveness of our BSF program.

In the next section, we summarize how we grouped the quantitative and qualitative research results into a new curriculum model in three broad competency areas – technical, general, and personal. We describe how this new model has helped us revise the BSF curriculum at SFASU, and we also discuss changes that are extra-curricular but that have a strong impact on our effectiveness in producing society-ready foresters for

entry-level positions or for graduate-level education.

III. Revision of the BSF Curriculum

A. Revised Curriculum Model

B. Changes in the Curriculum at SFASU



As described in **II. A. Overall Process**, we discussed summaries of our survey results with professional foresters at the annual meeting of the Texas Society of American Foresters in April 2013. This discussion helped ensure that our interpretation of survey findings was accurate, and it also helped ensure that many employers, alumni, and other stakeholders knew that we were taking their input seriously in actions to revise the BSF curriculum.

Our primary use of both survey and focus groups results, however, was with forestry faculty, during the six facilitated faculty meetings held in April and May of 2013. These fo-

cus discussions led to decisions to significantly revise the BSF curriculum, which we present in this section. First, however, we describe a general model of curricula that helps establish the context for developing and implementing our revised curriculum.

A. Revised Curriculum Model

In our review of literature on curriculum change and forestry education, we discovered a way to illustrate the relationship among broad areas of competency that increases understanding. The illustration was presented by Leth *et al.* (2002), describing curriculum development in Danish forestry education. They referred to three broad areas of compe-

“Changing a curriculum is like moving a cemetery.”

– Paul Burns (1969)

tency: *“Specific, General, and Personal.”* In our work at SFASU, we use *“Technical”* instead of *“Specific,”* but we define these three broad areas of competency in a way that’s very similar to Leth *et al.*

Technical competence relates to the technical knowledge and skills necessary to effectively practice forestry. SAF (2011) refers to these competencies as *“professional;”* they include curriculum competencies in ecology and biology, measurement of forest resources, management of forest resources, and forest resource policy, economics, and administration. In our summary of survey results, we include the 16 competencies in the

curriculum focus area “**Managing Forest Resources**” in the broad area of *technical* competence.

General competence is associated with what Leth et al. (2002) called “a broader understanding of the context of practice/work.” SAF (2011) includes curriculum standards in “*General Education*” that include communications, science and mathematics, and social sciences and humanities. In our summary of survey results, we include the skill sets in four of our curriculum focus areas under the broad label of *general* competence: “**Applying Reasoning and Critical Thinking**,” “**Communicating and Collaborating**,” “**Leading and Managing People**,” and “**Engaging in Transformative Learning and Leadership**.” These four curriculum focus areas include a total of 26 of the 48 competency items in our survey.

Personal competence includes “*competencies that are necessary for car-*

rying out tasks, but are closely related to the individual’s own personality” (Leth et al. 2002). In our summary of survey results, we included the six competencies in the curriculum focus area “**Managing Self**” in the broad area of *personal* competence.

Traditionally, forestry curricula in the U.S. have tended to emphasize technical knowledge and skills, established on and overlapping with a foundation of general education. Traditional curricula have often not been designed to actively build personal competencies. Although we haven’t collected and analyzed data on this, we believe an analysis of credit-hours in BSF curricula would support this statement, and we also believe this reflects the continuing call for forestry programs to strengthen curricular emphasis on knowledge, skills, abilities, and behaviors that would be included in the broad areas of general and personal competence.

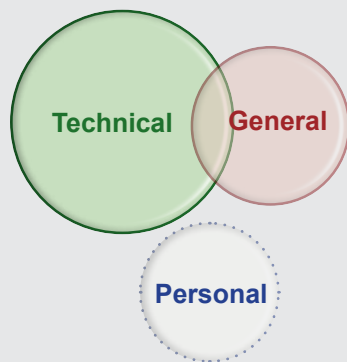
Figure 6 illustrates the traditional curriculum model as well as a revised curriculum model, a curriculum model where emphasis on technical competencies continues to be strong, but where general and personal competencies are expanded in importance and emphasis.

The revised curriculum model in Figure 6 illustrates our goal in revising the BSF curriculum at SFASU. We will retain a traditionally strong emphasis on technical knowledge and skills, while we address the challenges of effectively incorporating more emphasis on general and personal competencies.

Figure 7 summarizes the quantitative results of our survey for 48 competency items, grouped as technical, general, and personal competencies. Figure 7 shows the mean score for importance and performance for each of the 48 competency items in the survey. It also shows the top ten items (in

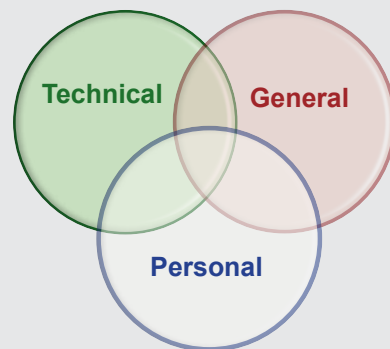
Figure 6. Traditional and revised curriculum models based on three broad areas of competency.
(Adapted from Leth et al. 2002.)

Traditional Curriculum Model



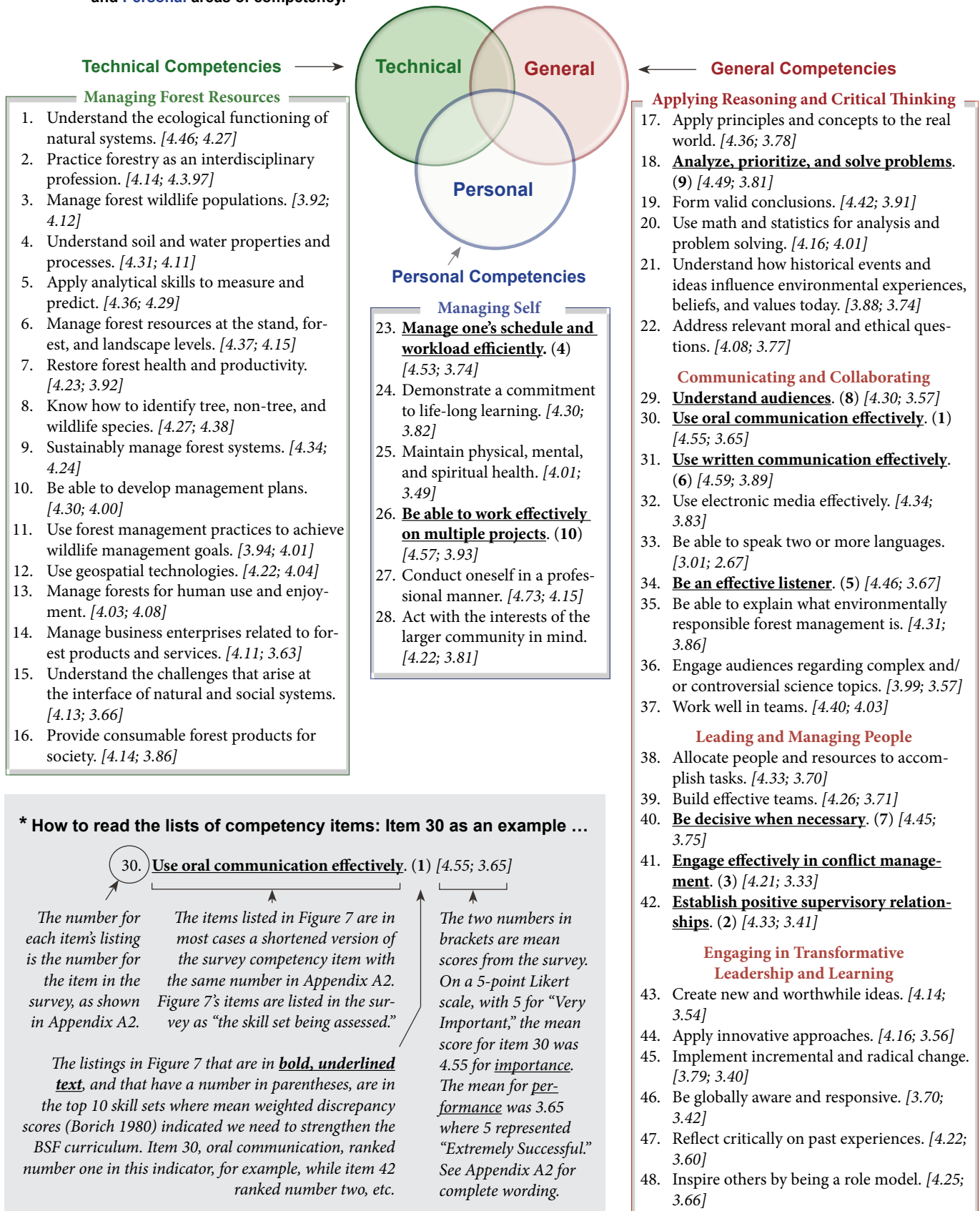
*Traditionally, BSF curricula have tended to emphasize **technical** competencies, overlapping with **general** competencies that were not as strongly emphasized throughout the curriculum. Traditional curricula often weren’t designed to actively build **personal** competencies.*

Revised Curriculum Model



*Based on alumni and employer input, the BSF curriculum at SFASU is being revised to expand the emphasis on **general** and **personal** competencies, while maintaining a strong emphasis on **technical** competencies that have traditionally been a strength of our graduates.*

Figure 7. Mean scores for importance and performance for the 48 competency items in the survey grouped in **Technical**, **General**, and **Personal** areas of competency.*



bold, underlined text) that were high priorities for strengthening based on mean weighted discrepancy scores, all within the context of the three broad areas of competency we wanted to consider in revising and refocusing our BSF program.

B. Changes in the Curriculum at SFASU

As discussed in section II. **Curriculum Revision Process and Results**, the information in Figure 7 was very strongly supported by our qualitative research results. Summaries of all of our results were presented and discussed in our six faculty meetings in April and May of 2013. That is, our faculty meetings included summaries that showed:

- mean scores of importance and performance (48 items);
- mean weighted discrepancy scores (48 items), ranked to show the top 10 areas of perceived need;
- IPA charts of the survey results, to illustrate where the data indicated we needed to concentrate among the 48 items;
- mean survey scores for eight key issues, from invasives and water availability, to population growth and climate change;
- focus group results highlighting important themes; and
- word clouds to visually represent the relative strength of topics emphasized during focus group sessions.

In our faculty discussions, it was understood that we could not increase the total number of credit hours in our BSF curriculum; currently the state-approved total at SFASU is 130 hours. The changes we are making involve course content, course timing, and other important aspects of the curriculum, but they also involve changes

that are extra-curricular.

Internships and other extra-curricular activities are specifically recommended in Transforming Agricultural Education for a Changing World (National Research Council 2009). A recent nationwide survey of employers, alumni, faculty, and students in agriculture and natural resources programs stressed the importance of extra-curricular activities in building “soft skills” (Crawford et al. 2011). All groups in the study ranked internships highly for this purpose, and they also placed a high rank on co-curricular activities and classes with collaborative, problem-based and cross-disciplinary learning opportunities.

These topics and approaches have also been recommended for educational programs in natural resources disciplines (Millenbah and Wolter 2009), wildlife (Abhat and Unger 2009), interdisciplinary environmental education (Vincent 2010), and as a high priority for U.S. employers in general (Hart Research Associates 2013).

Perhaps the most important process described in section II was the faculty discussion and decisions for action. We agree with Covey (2008) that faculty must not only have an *ownership manual* when it comes to the curriculum, they must have *ownership*.

With this in mind, guided by the motives and principles we described in section II that were consistently presented in our *Summary Document*, and using a basic curriculum ‘map’ to display current course sequences in our BSF program, our six facilitated faculty meetings resulted in significant decisions for action. An outline of the revised curriculum is presented in Appendix D for forest management and forest wildlife management BSF

degrees.

Action: Field Station.

The first significant action our faculty voted on was to move our six-week summer field program, called Field Station at SFASU, from following the junior year to following the sophomore year. The move requires changing pre-requisites to Field Station (also voted on) and refocusing content in some of the six individual Field Station courses. In general, the emphasis will be on practical, field-based knowledge and skills, i.e., *how*, with more knowledge of *why* coming in junior and senior courses. This move will also require one summer when Field Station is taught twice (post-junior year and post-sophomore year sessions).

From a technical competency standpoint, some faculty have expressed a concern that moving Field Station will break a traditionally strong link between forest measurements and silvicultural prescriptions. The instructors will re-cast these exercises, however, and will emphasize integration of forest measurements and silvicultural prescriptions in junior and senior courses with field-based laboratories.

Positive elements in the decision to move Field Station included the opening of the summer after the junior year for forestry employment and/or internship opportunities. The faculty believe that this will create a much-needed, extracurricular opportunity for students to enhance technical, general, and personal competencies. Also, by covering field techniques extensively before the junior year, we will now have two full years in the curriculum to emphasize professionalism and other personal and general behaviors and abilities, in addition to advanced technical knowledge and skill sets.

Action: Intro-level courses.

We currently require each of our BSF majors to take three 3-hour introductory courses, one course in forestry, one in wildlife management, and one in recreation and human dimensions. We voted to restructure the intro-level course in forestry, focusing content on two main topics – competencies and careers – while continuing to use laboratory periods to engage students in concepts and skills that involve working outdoors.

The technical, general, and personal competencies diagram (the new curriculum model in Figure 5) will be used in the competencies part of the course, to help beginning students (freshmen and transfer students) understand important skill sets and abilities that are non-technical but that are essential to becoming an effective forestry professional. Under the heading of “competencies,” we will also include practical “survival skills” for success in college. Our faculty who have taught freshman-level courses at SFASU that emphasize adapting to the university experience have seen the need for and the effectiveness of instruction in these basic concepts.

The “careers” component of the revised course will highlight the breadth of career pathways for BSF majors. The course will include guest speakers, many of whom will be fairly recent BSF graduates, from major employment and career sectors. The faculty instructor will establish the continuity, relevance, and connections between and among the guest speakers. Each speaker will be asked to emphasize general and personal competencies, as well as technical competencies; they will also be asked to tie their job responsibilities to one or more of the key issues that society-ready foresters will confront (e.g.,

invasives, water issues, land management controversies).

A basic goal in the intro-level forestry course is for beginning forestry students to develop a vision for their future as forestry professionals. This vision should include an entry-level appreciation of personal, general, and technical competencies that are critical for forestry professionals, as well as a basic introduction to issues that will be at the forefront of professional and societal needs during their career. While completing their BSF degree, we want them to understand how the sequence of courses they take helps achieve that personal vision.

The new intro-level forestry course will focus on career opportunities that span our BSF degree programs. The course will therefore include wildlife, forest recreation and human dimensions, urban forestry and other career and curriculum options. Faculty across the curriculum will be involved in continuing to develop the topics and content of the introduction to forestry course, as well as the intro to wildlife management and intro to forest recreation and human dimensions courses. An important action during our faculty meetings was a decision to engage all of our faculty in continuing discussions of these critical courses in future years.

Action: Curriculum Guides

To help achieve overall understanding of our curriculum among students, we are developing a series of publications we refer to as *Curriculum Guides*. These guides will be in print and electronic versions, and will be four-color, reader-friendly, documents that explain the curriculum to anyone not familiar with the basic outline or structure of our BSF degree programs.

The *Guides* are being developed for each of our BSF programs, including forest management and forest wildlife management, for example. Each *Curriculum Guide* will outline the overall sequence of courses in the curriculum, followed by the following sections:

- *Freshman year*
- *Sophomore year*
- *Junior year*
- *Senior year*
- *Student organizations*
- *Careers*

The freshman, sophomore, junior, and senior year sections of each degree program’s *Curriculum Guide* will have a one-page, basic description for each course taught by our faculty. The course-specific pages will explain in lay terms what students will do and learn in dendrology, forest measurements, and silviculture courses, for example. We believe that better understanding of the courses and their sequence in the curriculum will help students as their professional knowledge develops. We also believe this understanding, combined with a vision for future careers, will have a positive effect on student retention in our BSF degree programs.

The *Student organizations* section of the *Curriculum Guides* will highlight opportunities for BSF students to engage with their peers and faculty in extracurricular activities that have a positive impact on all areas of competency. We also believe this type of engagement has a positive impact on student retention.

The final section of each degree program’s *Curriculum Guide* will highlight alumni who hold the degree specific to the *Guide*, and who are currently working in professional positions in their discipline. As with the other sections of each *Guide*, the

alumni highlights will be in color, with many photographs, and it will be written in text that is reader-friendly for the lay person.

Three themes that will permeate the *Guides* in photographs and text – for courses, student organizations, and career highlights – are *use high technology*, *work outdoors*, and *make a difference*. These are themes that have been shown to be effective with forestry students (Hino 2006), hence our messaging and content focus.

We have developed early-stage copies of these *Curriculum Guides*, and they are proving to be popular with prospective and current students, and also with parents and others who are particularly interested in career paths associated with BSF degree programs.

A survey of over 1,200 forestry students in the South in 2009-10 showed that a relatively high percentage chose forestry as a major because of contact with family members, friends, or other acquaintances who were forestry professionals (Lhotka *et al.* 2010). This result means there is an opportunity to involve our BSF alumni in helping to spread the word about forestry career opportunities and our degree programs. Our *Curriculum Guides* will therefore be distributed in both print and electronic versions to BSF alumni who agree to help us reach prospective students with this message.

Action: Capstone course

After our faculty discussed revisions for Field Station and intro-level courses, we discussed potential revisions for our capstone course, Forest Resource Management, required in all of our BSF degree programs. Students are required to prepare and present a comprehensive forest management plan in a real-world context. As in for-

estry curricula at other universities, at SFASU this course is an excellent example of the intersection of technical, general, and personal competencies.

Our faculty are currently revising the capstone course, retaining strengths in the three broad competency areas, while expanding the number of management plans prepared. Beginning in the fall 2013 semester, our BSF students will prepare three comprehensive forest management plans, one for each of three properties, including both public and private ownerships.

During our focus group sessions, we asked participants in both public and private sectors if they would share management plan templates with us, for potential use in redesigning the capstone course. We received an excellent set of management plan examples, and faculty are actively incorporating the templates into the new course structure.

Action: People skills

As discussed in our literature review and in our research results, to prepare society-ready BSF graduates it is critical that we strengthen the knowledge, skills, abilities, and behaviors that correspond to working effectively with people. The question is: *How* can this be done? This important question has been asked at a national level, across the full spectrum of agricultural and natural resources curricula (National Research Council 2009). At SFASU, our response for the BSF program has curricular and extra-curricular elements, and both short-term and long-term perspectives.

In the short term, at SFASU we will continue to “weave” general and personal competencies that relate to working with people into the full fabric of our BSF curriculum. In

natural resources training and curricula, incorporating people skills into discipline-specific courses has been recommended, rather than requiring additional “*generic*” courses, for example in communication or leadership skills (see Berkson 2002, Dinkelman *et al.* 2010, and Morrison *et al.* 2007).

After considering our research results in these critical competency areas, our faculty went through an iterative curriculum mapping exercise, where each course was one row in a matrix with specific general and personal competencies listed as columns. The columns were headed:

- *Oral Communication Skills*
- *Written Communication Skills*
- *Problem Solving and Decision-making*
- *Managing Workload and Multipole Projects*
- *Collaboration – Teamwork, Leadership, and Conflict Resolution*
- *Ethics*
- *Computer Literacy*

After rounds of discussion and input showing which courses included an emphasis on these competencies, the faculty adopted six major skill set headings to weave into the curriculum, referred to in this subsection as “People Skills”

- *Oral Communication*
- *Written Communication*
- *Digital and Other Communication*
- *Ethics*
- *Professionalism*
- *Leadership*

We have a new commitment to work more purposefully and collectively than was done in the past to integrate these key topics into courses throughout our curriculum. For example, we agreed to have faculty meetings that

are entirely focused on how we are addressing each of the specific, people-related skill sets highlighted for strengthening. These faculty discussions will provide specific actions to more effectively thread each of these skill sets, abilities, and behaviors throughout our sequence of courses.

In these discussions, we will include a review of studies and publications on each topic. Klenk and Brown (2007) and Lewis *et al.* (1999), for example, specifically discuss issues relating to incorporating ethics into forestry curricula. Another example relates to building writing skills in forestry curricula. The Faculty of Forestry at the University of British Columbia have made available a “Writing Guidebook for the Natural Sciences” (Godsall 2006), and a forestry faculty member at SFASU has developed a style manual for forestry courses in our BSF program (Stovall 2011).

People skills will also be addressed through extra-curricular means, as discussed earlier, by expanding opportunities for internships and forestry employment, and through stronger engagement in our student chapter of SAF and other student organizations that build general and personal competencies as well as technical knowledge and skills.

We are also renewing efforts to build a student-led mentoring program. Leaders of our student organizations have approached our faculty with the idea of engaging entry-level students with juniors and seniors through a faculty- or staff-advised mentoring program. This idea is being pursued in 2013-14, using our BSF program-level academic advisors to help guide and sustain the effort. Discussions of this effort with our college Advisory Council led to strong encouragement, includ-

ing offers to help engage professionals in the mentoring program. We include mentoring in this discussion of improving people skills because such programs have the potential to cultivate oral communication, leadership skills, professionalism, and many other skills and behaviors that directly relate to working effectively with others.

In our survey of 800 BSF alumni and employers, out of all 48 competency items in question 10, the one that rated highest in its mean score for importance was one of the six personal competencies – “*Conduct oneself in a professional manner*” (item 27 in Figure 7). This item had a mean score of 4.73 for importance, and 4.15 for performance, so we were rated as doing relatively well. Given the level of importance placed on professionalism, however, we must continue to emphasize building entry-level competence in this area. As with other personal and general competencies relating to people, our curricular and extra-curricular activities will include opportunities to build skills and behaviors that enhance one’s “*professional manner*.”

Another decision that was made during our six faculty meetings was a new concept for us – we decided to develop a “leadership action template” for use with each student during regularly-scheduled sessions with academic advisors. The template will involve potential activities that may be in courses or that may be extra-curricular – activities that will help students develop leadership skills, communications skills, an ethical perspective, and other skills and abilities that are people-related.

By discussing the faculty-approved, template-listed opportunities during sessions to discuss courses and prog-

ress toward graduation, we will ensure that students receive a consistent message. The activities will not be graded, and the list will be applied and used on a voluntary basis by students. Having this discussion during routine advising sessions, however, will encourage student participation and a better understanding of why this is important to developing a competitive resumé, obtaining an entry-level job, and being successful in early career stages. Also, by having this discussion during routine advising sessions, our academic advisors will be able to collect and record reasons why students either choose or do not choose to become involved in the listed opportunities.

The need to improve graduates’ people skills is shared with forestry programs in the U.S. and internationally, and has been an issue for the last 100 years. As we discussed in the Literature Review subsection (I.B.), this is a systemic problem requiring multi-faceted, systemic approaches to effectively address. In the longer-term, therefore, we believe it is critical to address this highly significant issue using research that includes measuring outcomes of curricular, co-curricular, and extra-curricular ideas and actions, as well as effective dissemination of findings in forestry and natural resources programs across the nation.

Action: Lifelong learning

Another personal competency item that we believe should be attended to in both curricular and extra-curricular ways is “*Demonstrate a commitment to lifelong learning*” (item 24 in Figure 6.) In our survey, this item’s mean score for importance was 4.30, and the mean score for performance was 3.82. We know, of course, that many knowledge areas, skill sets, abilities, and behaviors are developed during one’s entire professional career. Becoming

a leader, for example, is clearly a life-long process of growth and development (Clark 2006).

At SFASU, our commitment is to instill in BSF graduates a mindset that upon graduation they are an entry-level, society-ready professional, but their education will be lifelong. This mindset is important enough, for example, that our advice to graduating seniors will include asking questions of potential employers on whether their employment would include expectations of and opportunities for professional development.

Action: Technical competencies

Our survey and focus group results provided excellent insights for revising Field Station, as well as our introductory level and capstone-level forestry courses. The 16 technical competencies highlighted in Figure 1 generally show relatively high importance and relatively high performance scores, and these results were mirrored in focus group sessions with employers. Our BSF graduates are considered very competent in technical skill areas, and our faculty are committed to continuing to enhance these knowledge areas and skill sets. This is why the green circle in Figure 5 is not reduced in size in the revised curriculum model.

The research results also, however, provided very meaningful information in terms of the major forces and challenges that will be faced by forestry professionals in the 21st century (see **Survey results: Breadth of issues** in section II.B.1.)

In our faculty discussions on curriculum revision, survey results on these issues were considered, along with focus group results and additional in-

formation, including the Texas State-wide Forest Resource Strategy (Texas A&M Forest Service 2010). Our faculty then used curriculum mapping worksheets in an iterative process to identify six technical competency issues to thread throughout our sequence of courses, listed here in no particular order:

- *Invasives*
- *Timber Markets*
- *Water Availability/Quality*
- *Climate Change*
- *Human Population Growth*

The faculty will weave these issues into learning objectives in courses throughout our revised curriculum. They will become part of our assessment process also, so that data will be collected to evaluate and improve our effectiveness in covering these major issues.

Action: Assessment

As discussed in section II.A. **Overall Process**, SFASU is accredited by the Southern Association of Colleges and Schools (SACS), and as part of that accreditation process we collect data on student performance in our BSF program each year. These data are used by our faculty to develop and implement action plans where needed to address concerns in student learning outcomes.

After revising our curriculum, we will need to refocus the outcomes we measure for SACS accreditation. This will be done after approval steps with the university and the Texas Higher Education Coordinating Board have been completed. Our revised curriculum assessment actions will follow recommendations in Diamond (2008).

Faculty engagement.

Our primary goal for this process was

to improve student educational outcomes. Specifically, we stated a primary goal for our curriculum revision process of continuing to produce BSF graduates who are society-ready. Our process has helped us with specific revisions in the BSF curriculum, and it has also helped guide co-curricular and extra-curricular actions that will continue to develop in coming years.

The process also resulted in what Civian *et al.* (1997) called an “*unexpected positive byproduct of curricular reform*,” relating not to students but to our faculty. Civian *et al.* state: “*By and large, faculty members who have been involved in curricular change report that they find the process of designing and implementing new curricula to be intellectually stimulating and personally satisfying. When a program is at long last hammered out, the sense of accomplishment is palpable and enhances feelings of community. If the process has been well modulated, participants are left with energy to continue the reform process through implementation and evaluation stages.*”

At SFASU, we are encouraged that our process has resulted in this “*unexpected positive byproduct*” of an engaged faculty, supportive of a dynamic, continuing process to produce society-ready BSF graduates.

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Appendices

A. Cover Letter and Survey Instrument

A1. Cover letter

A2. Survey Instrument

B. Survey Results – Importance-Performance Analysis (IPA) Charts

C. Focus Group Questions and Word Clouds

C1. Focus group questions

C2. Focus group word clouds

D. Revised Curriculum Outlines



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November 2012

Dear Forestry Alumni and Friends:

The Arthur Temple College of Forestry and Agriculture at Stephen F. Austin State University plans to revise the curriculum for the Bachelor of Science in Forestry degree. The college seeks input from forestry alumni, employers and prospective employers of forestry graduates on the competencies that society-ready, society-engaged foresters and natural resource professionals will need in the 21st century. Please help us identify which skills are essential to functioning as a “full performance professional” in this field. Participating in this survey is voluntary and responses will be completely anonymous.

We estimate that the survey will take 20-25 minutes to complete. Your input is essential to successful curriculum revision.



Before you begin the survey, please bear in mind the following key points:

- The college defines forestry broadly. For this assessment the terms *forester* and *natural resource professional* may be used interchangeably. Similarly, foresters manage a wide variety of habitats including terrestrial, coastal, aquatic, urban greenspace, and the wildland-urban interface.
- A competency is a set of *knowledge, skills, abilities, and behaviors*. As such, it represents an inter-related skill set that isn't easily defined.
- A forestry competency may have several components, and it may be applied across varying sectors and scales. The ability to apply a given skill set across widely varying contexts may signify the highest level of professional performance.
- In the attached survey, a competency item may contain two parts. The first part of the statement is the skill set that is being assessed. The second part highlights aspects considered essential for full performance. For example, consider the following two competency statements:
 - Be able to develop management plans, to maintain the productivity, biodiversity, and resilience of public and private forests.
 - Analyze, prioritize, and solve problems, while anticipating potential negative outcomes.

Thank you in advance for your support of the college and its programs. An executive summary and a complete report will be made available at the college website. If you have questions or comments, please don't hesitate to e-mail (bullardsh@sfasu.edu) or give me a call.

Sincerely,

Steven H. Bullard, Dean

Thank you for completing this survey. Please respond to each question as instructed. We estimate this survey will require 20 minutes of your time. We seek to collect input from alumni, current employers, and prospective employers to inform our curriculum revision for our undergraduate forestry degree (BSF). We appreciate your time and assistance with this important effort.

PART 1 – Your Ties to Forestry & SFA’s Forestry Program

1. Are you a graduate of Stephen F. Austin State University’s undergraduate forestry program?
 - No
 - Yes

2. What degrees did you receive from Stephen F. Austin State University’s forestry program?
 - I have not received a degree from SFA’s forestry program.
 - B.S. Forestry from SFA
 - M.S. Forestry from SFA
 - M.S. Spatial Science from SFA
 - M.S. Resource Interpretation from SFA
 - M.F. from SFA
 - Ph.D. in Forestry or D.F. from SFA
 - Other _____ (Please describe)

3. If applicable, what year did you graduate with your bachelor’s degree? _____ (List year)

4. Have you worked full-time in a forestry, wildlife, or natural resource discipline?
 - No
 - Yes — If yes, how many years? _____ years

5. Indicate the approximate percent of your time devoted to the following: (Total percentages to 100)
 - _____ % Forest/natural resource management
 - _____ % Communication and public outreach
 - _____ % Organizational management/administration
 - _____ % Training and professional development
 - _____ % Supervision
 - _____ % Other _____ (Please describe)

6. What is your current sector of employment?
 - Private for-profit
 - Private non-profit
 - City/county government
 - State government
 - Federal government
 - Other _____ (Please describe)

7. In what zip code is your work predominantly located? _____ (List zip code)

8. Have you ever or would you be willing to hire a forestry or natural resource graduate?
 - No — If no, skip to question 10.
 - Yes — Continue to question 9.

9. Have you ever employed a Stephen F. Austin State University graduate who earned a forestry degree at SFA?
 - No— If you answered “no” to questions 1 and 9, please skip column B on question 10.
 - Yes —If yes, how many? _____ (Number of graduates employed)

		Column A <i>How important is it that foresters demonstrate competence in this skill set?</i>					Column B <i>How successful is SFA in producing foresters who have the <u>knowledge, skills, abilities and behaviors</u> that make up this competency?</i>				
		1 = Extremely Unimportant 2 = Somewhat Unimportant 3 = Neither Important Nor Unimportant 4 = Somewhat Important 5 = Very Important					1 = Not at All Successful 2 = Somewhat Successful 3 = Moderately Successful 4 = Quite Successful 5 = Extremely Successful DK = Don't Know				
<i>Question 10, Continued</i>											
<i>Note: The competency items listed below may contain two parts. The first part of the statement is <u>the skill set being assessed</u>. The second part highlights aspects considered essential for full performance.</i>											
MS	27. <u>Conduct oneself in a professional manner</u> , showing due respect and acting with integrity.	1	2	4.73	4	5	1	2	3.15	5	DK
	28. <u>Act with the interests of the larger community in mind</u> , promoting natural resource sustainability and human well-being.			4.22					3.81		
CC	29. <u>Understand audiences</u> , including how they process messages and what they view as meaningful and significant.	1	2	4.30	4	5	1	2	3.57	5	DK
	30. <u>Use oral communication effectively</u> , informing, instructing, motivating and persuading others.			4.55					3.65		
	31. <u>Use written communication effectively</u> , demonstrating proficiency in business or technical writing as well as writing for non-professional audiences.	1	2	4.59	4	5	1	2	3.89	5	DK
	32. <u>Use electronic media effectively</u> , harnessing the power of established and emerging technologies to communicate effectively with diverse audiences.			4.34					3.83		
	33. <u>Be able to speak two or more languages</u> .	1	2	3.01	4	5	1	2	2.67	5	DK
	34. <u>Be an effective listener</u> , knowing when to speak and when to listen.			4.46					3.67		
	35. <u>Be able to explain what environmentally responsible forest management is</u> , helping the public grasp its relevance to their lives.	1	2	4.31	4	5	1	2	3.86	5	DK
MP	36. <u>Engage audiences regarding complex and/or controversial science topics</u> , fostering understanding and stewardship.			3.99					3.57		
	37. <u>Work well in teams</u> , establishing positive relationships with team members who have diverse backgrounds and perspectives.	1	2	4.40	4	5	1	2	4.03	5	DK
	38. <u>Allocate people and resources to accomplish tasks</u> , planning, organizing and coordinating efforts in support of a shared goal.			4.33					3.70		
	39. <u>Build effective teams</u> , managing group dynamics and eliciting each team member's best effort and most essential contribution.	1	2	4.26	4	5	1	2	3.71	5	DK
	40. <u>Be decisive when necessary</u> , while also considering the long-term effects of decisions.			4.45					3.75		
	41. <u>Engage effectively in conflict management</u> .	1	2	4.21	4	5	1	2	3.33	5	DK
MEAN						MEAN					
↑ ↑ Results: Survey Mean Scores											

		Column A <i>How important is it that foresters demonstrate competence in this skill set?</i>					Column B <i>How successful is SFA in producing foresters who have the <u>knowledge, skills, abilities and behaviors</u> that make up this competency?</i>				
Question 10, Continued											
<i>Note: The competency items listed below may contain two parts. The first part of the statement is the skill set being assessed. The second part highlights aspects considered essential for full performance.</i>		1 = Extremely Unimportant 2 = Somewhat Unimportant 3 = Neither Important Nor Unimportant 4 = Somewhat Important 5 = Very Important					1 = Not at All Successful 2 = Somewhat Successful 3 = Moderately Successful 4 = Quite Successful 5 = Extremely Successful DK = Don't Know				
MP	42. Establish positive supervisory relationships, providing effective direction, guidance and employee coaching.	1	2	4.33	4	5	1	2	3.41	5	DK
	43. Create new and worthwhile ideas, communicating these ideas to others in ways they can understand.			4.14					3.54		
TL	44. Apply innovative approaches, to enhance workplace productivity, reach workable solutions, and launch needed initiatives.	1	2	4.16	4	5	1	2	3.56	5	DK
	45. Implement incremental and radical change, taking appropriate risks and successfully negotiating obstacles to success.			3.79					3.40		
	46. Be globally aware and responsive, respecting diverse cultures, religions and lifestyles while working with others to address global issues.	1	2	3.70	4	5	1	2	3.42	5	DK
	47. Reflect critically on past experiences, responding to failure as an opportunity to learn and improve.			4.22					3.60		
	48. Inspire others by being a role model, exhibiting selflessness, service and civic leadership.	1	2	4.25	4	5	1	2	3.66	5	DK
		MEAN					MEAN				

11. Please provide additional comments regarding the importance of competencies you view as essential for society-ready, society-engaged foresters. Add additional sheets as necessary.

12. Please provide additional comments regarding SFA's success in producing society-ready, society-engaged foresters. Add additional sheets as necessary.

PART 3 – Evaluation of Educational Issues, Procedures & Mastery

➡ *OMIT questions 13 and 14 if non-SFA forestry alumni.*

13. Indicate the extent to which SFA helped you master professional skills by providing you with opportunities to...

<i>Did SFA provide you with opportunities to....</i>	1= <i>Did Not Provide at All</i> 2= <i>Somewhat Provided</i> 3= <i>Moderately Provided</i> 4= <i>Provided Quite a Bit</i> 5= <i>Provided All the Time</i>				
Observe examples that illustrated what you were supposed to learn.	1	2	3	4	5
Practice new skills to the point of mastery.	1	2	3	4	5
Receive immediate and informative feedback while you were learning new skills.	1	2	3	4	5
Perform new skills in meaningful and diverse settings.	1	2	3	4	5
Reflect on your own learning and performance.	1	2	3	4	5

14. Please provide any additional comments you may have regarding your experience as a forestry student at SFA...

15. To what extent do you feel that you currently demonstrate the knowledge, skills, abilities and behaviors required to:

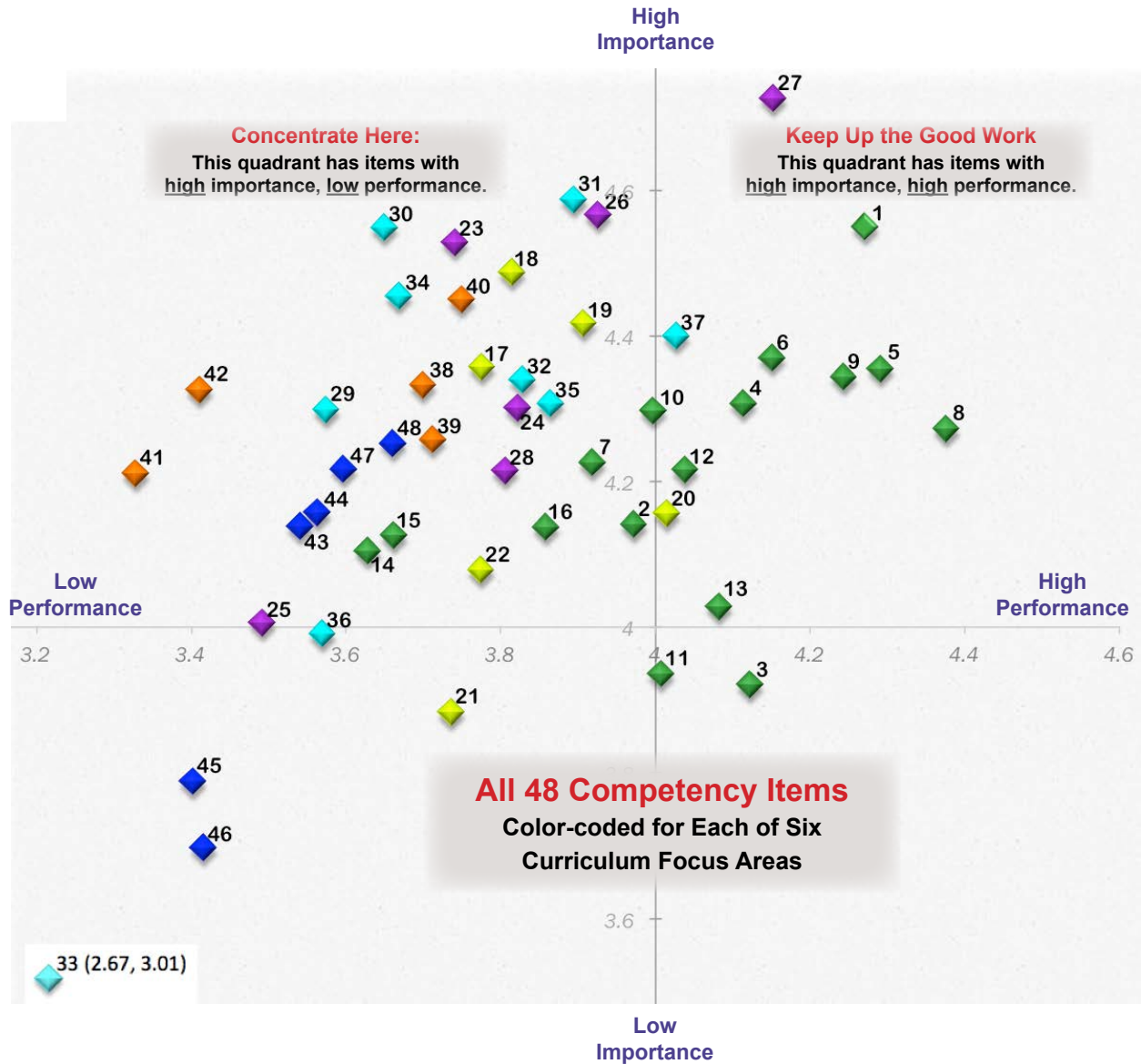
<i>Extent to which you currently demonstrate the knowledge, skills, abilities, and behaviors required to...</i>	1= <i>Do Not Demonstrate at All</i> 2= <i>Somewhat Demonstrate</i> 3= <i>Moderately Demonstrate</i> 4= <i>Demonstrate Quite a Bit</i> 5= <i>Fully Demonstrate</i>				
Manage forest resources.	1	2	3	4	5
Apply reasoning and critical thinking.	1	2	3	4	5
Manage self.	1	2	3	4	5
Communicate and collaborate.	1	2	3	4	5
Lead and manage people.	1	2	3	4	5
Engage in transformative learning and leadership.	1	2	3	4	5

16. Indicate your level of agreement with each of the following statements:

<i>Your level of agreement with the statement...</i>	1 = <i>Strongly Disagree</i>	2 = <i>Somewhat Disagree</i>	3 = <i>Neither Agree nor Disagree</i>	4 = <i>Somewhat Agree</i>	5 = <i>Strongly Agree</i>
Forestry is an interdisciplinary profession.	1	2	3	4	5
To meet the challenges of the future, foresters should have a single disciplinary focus.	1	2	3	4	5
If tension exists between maintaining a breadth of coursework in forestry and training in a single forestry discipline, I favor maintaining breadth.	1	2	3	4	5
To function as a forestry professional one should focus on gaining specialized knowledge.	1	2	3	4	5
As land-use conflicts and choices intensify, having a specialist's depth of knowledge will serve foresters best.	1	2	3	4	5
Foresters play an important role in meeting a wide variety of social, cultural, economic and environmental needs and values related to natural resources.	1	2	3	4	5
Forestry issues, concerns, and skills differ greatly from those of other disciplines like business, engineering, public administration and the social sciences.	1	2	3	4	5
As foresters face new situations and challenges, having a broad-based forestry education will serve foresters best.	1	2	3	4	5

17. Indicate how involved you think society-ready / society-engaged foresters should be in addressing each of the following issues:

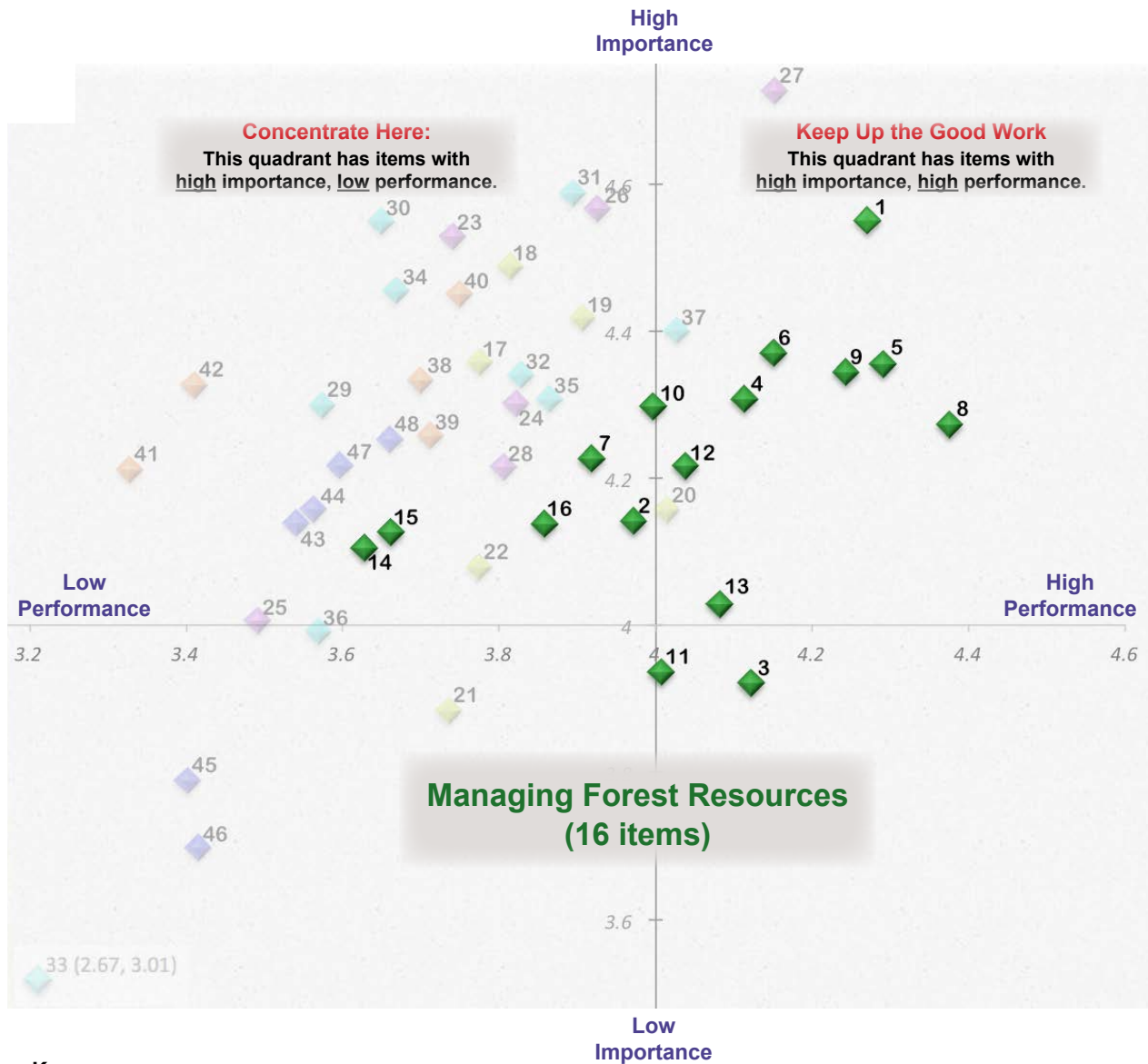
<i>Your opinion about how involved foresters should be in each issue...</i>	1 = <i>Not Involved at All</i>	2 = <i>Somewhat Involved</i>	3 = <i>Moderately Involved</i>	4 = <i>Quite Involved</i>	5 = <i>Extremely Involved</i>
<u>Population growth and redistribution</u> , urban expansion, and increased demand for ecosystem services.	1	2	3	4	5
<u>Climate change and its effects</u> , including changes in temperature, precipitation, sea level, flooding, drought, wildfire, and species distribution and survival rates.	1	2	3	4	5
<u>Bioenergy development</u> and resulting changes in forest product and fiber markets.	1	2	3	4	5
<u>Invasive plants, insects, and diseases</u> and their impact on forest diversity, productivity, health and regeneration.	1	2	3	4	5
<u>Changes in water availability, water quality, and instances of water stress.</u>	1	2	3	4	5
<u>Controversy surrounding land management decision making</u> , inadequate public engagement processes, public pressure to implement policies at odds with scientific findings, or a failure of consensus-building approaches.	1	2	3	4	5
<u>Forest fragmentation and ownership parcelization</u> , including associated impacts to sensitive plant and animal communities, outdoor recreation, and other non-timber values.	1	2	3	4	5
<u>Changes in wildfire regimes</u> , including the amount, intensity, aerial extent, and seasonality of wildfire.	1	2	3	4	5



The number for each item above is the competency number in question 10 of the survey instrument in Appendix A. The colors correspond to the colors used for each of the six curriculum focus areas in the survey instrument:

- ◆ Managing Forest Resources (n = 16 items)
- ◆ Applying Reasoning & Critical Thinking (n = 6 items)
- ◆ Managing Self (n = 6 items)
- ◆ Communicating & Collaborating (n = 9 items)
- ◆ Leading & Managing People (n = 5 items)
- ◆ Transformative Learning & Leadership (n = 6 items)

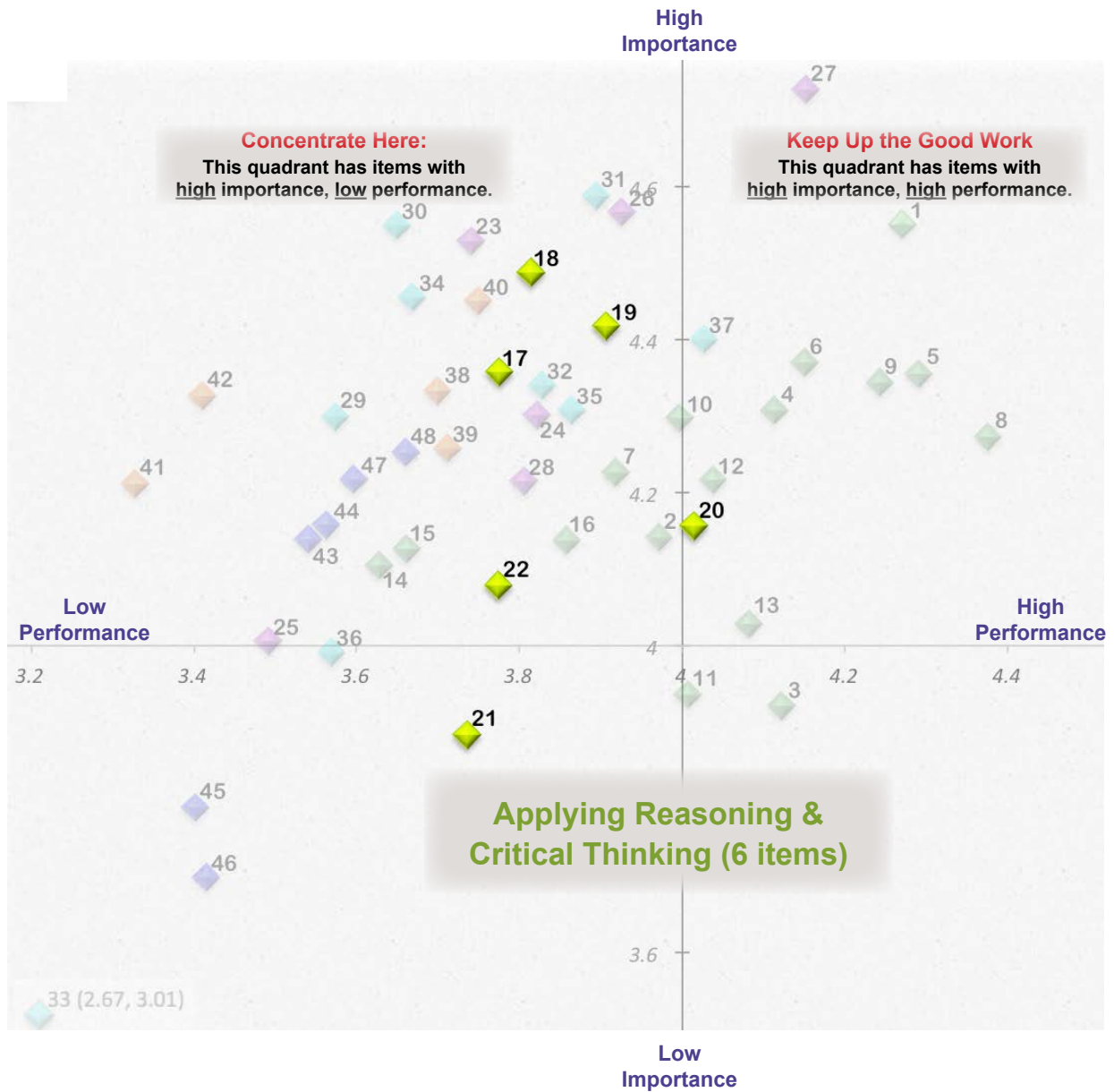
Appendix Figure B1. Importance-Performance Analysis chart for all 48 competency items in survey question 10.



Key:

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Understand the ecological function of natural systems. 2. Practice forestry as an interdisciplinary profession. 3. Manage forest wildlife populations. 4. Understand soil and water properties and processes. 5. Apply analytical skills to measure and predict. 6. Manage forest resources at the stand, forest, and landscape levels. 7. Restore forest health and productivity. 8. Know how to identify tree, non-tree, and wildlife species. | <ol style="list-style-type: none"> 9. Sustainably manage working forest systems. 10. Be able to develop management plans. 11. Use forest management practices to achieve wildlife management goals. 12. Use geospatial technologies. 13. Manage forests for human use and enjoyment. 14. Manage business enterprises related to forest products and services. 15. Understand the challenges that arise at the interface of natural and social systems. 16. Provide consumable forest products for society. |
|--|--|

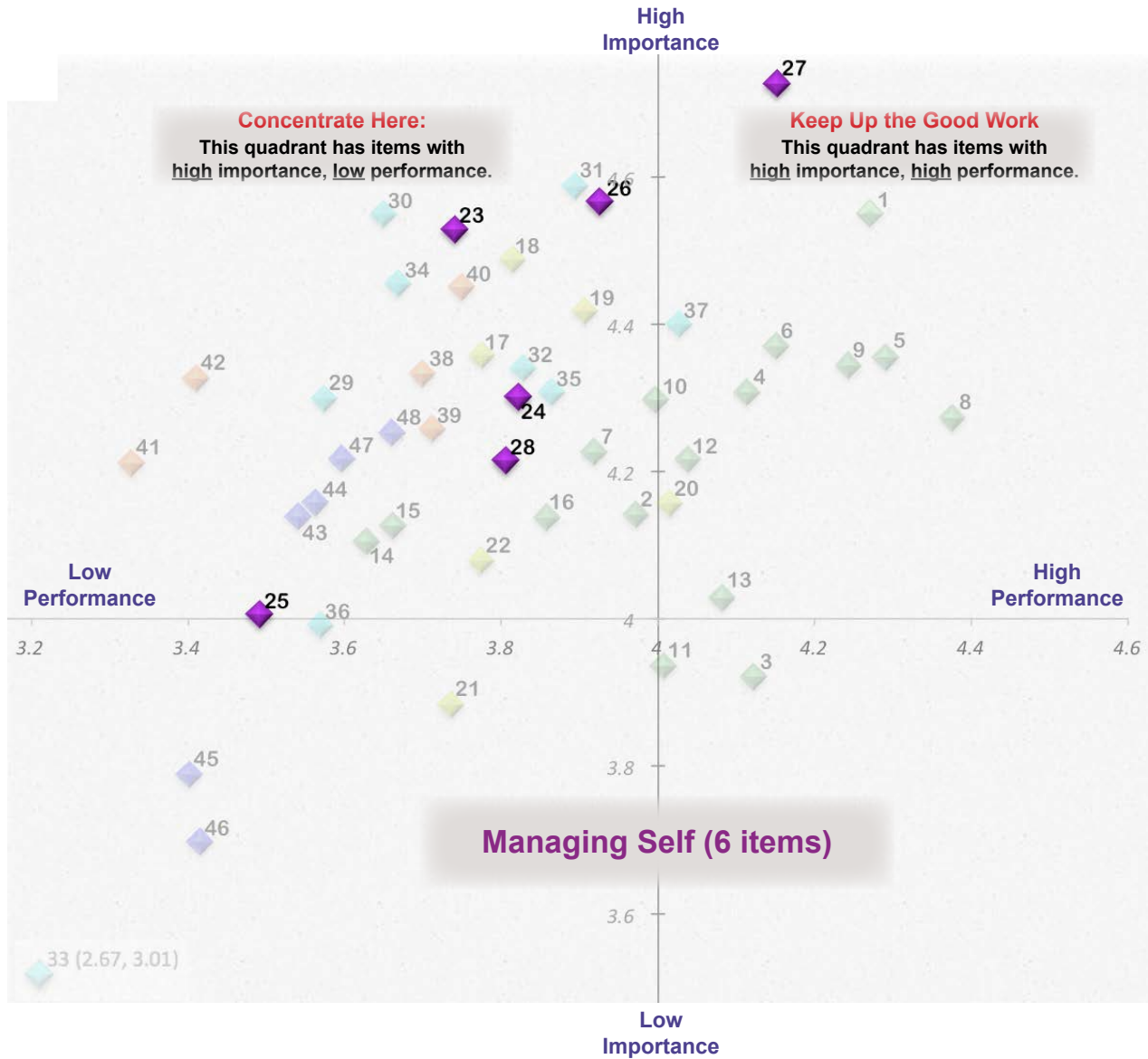
Appendix Figure B2. Importance-Performance Analysis chart for 16 competency items in the “Managing Forest Resources” curriculum focus area.



Key:

- | | |
|---|---|
| <ul style="list-style-type: none"> 17. Apply principles and concepts to the real world. 18. Analyze, prioritize and solve problems. 19. Form valid conclusions. 20. Use math and statistics for analysis and problem-solving. | <ul style="list-style-type: none"> 21. Understand how historical events and ideas influence environmental experiences, beliefs, and values today. 22. Address relevant moral and ethical questions. |
|---|---|

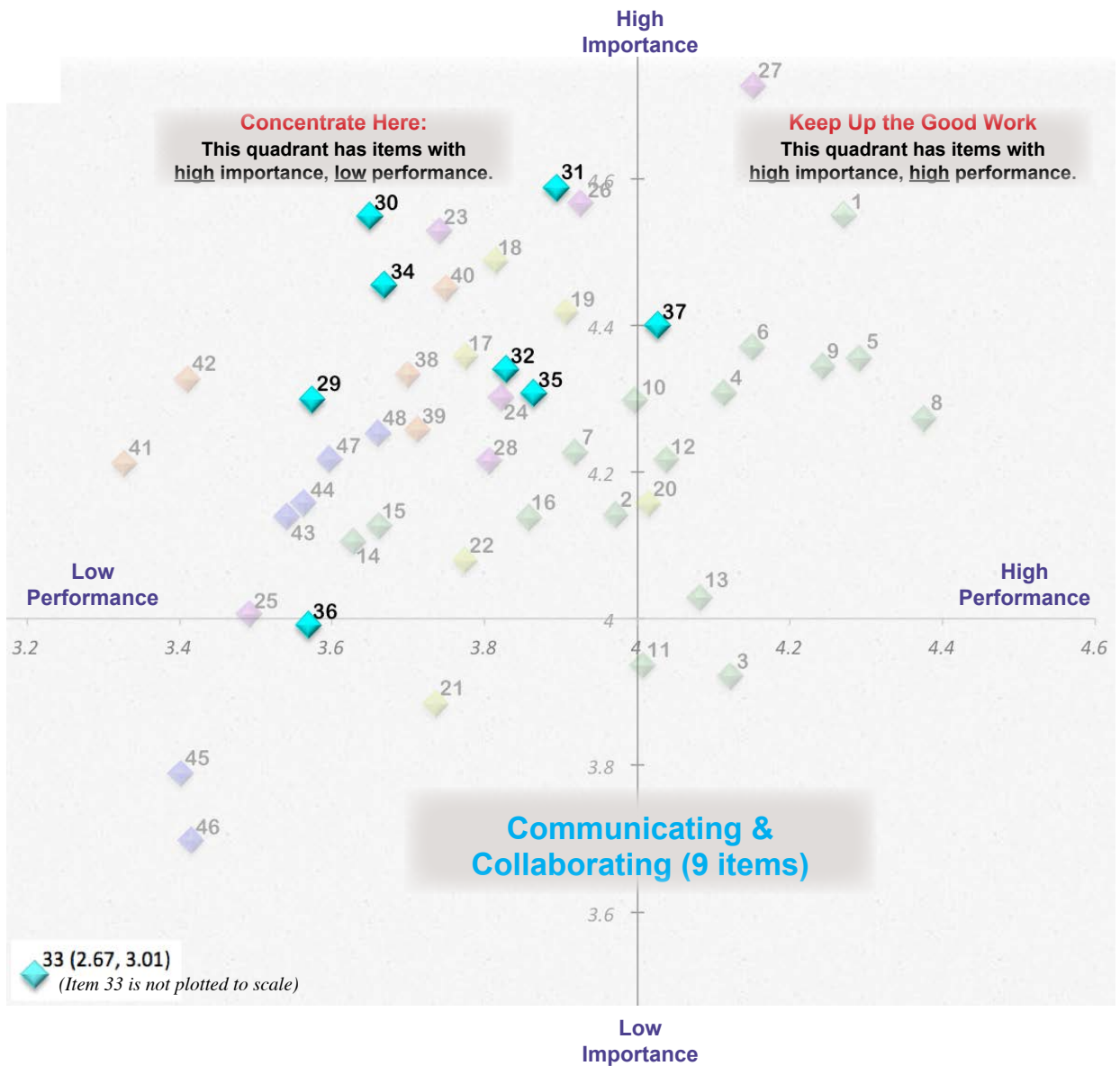
Appendix Figure B3. Importance-Performance Analysis chart for 6 competency items in the “Applying Reasoning and Critical Thinking” curriculum focus area.



Key:

- | | |
|---|---|
| <ul style="list-style-type: none"> 23. Manage one’s schedule and workload efficiently. 24. Demonstrate a commitment to lifelong learning. 25. Maintain physical, mental, and spiritual health. | <ul style="list-style-type: none"> 26. Be able to work effectively on multiple projects. 27. Conduct oneself in a professional manner. 28. Act with the interests of the larger community in mind. |
|---|---|

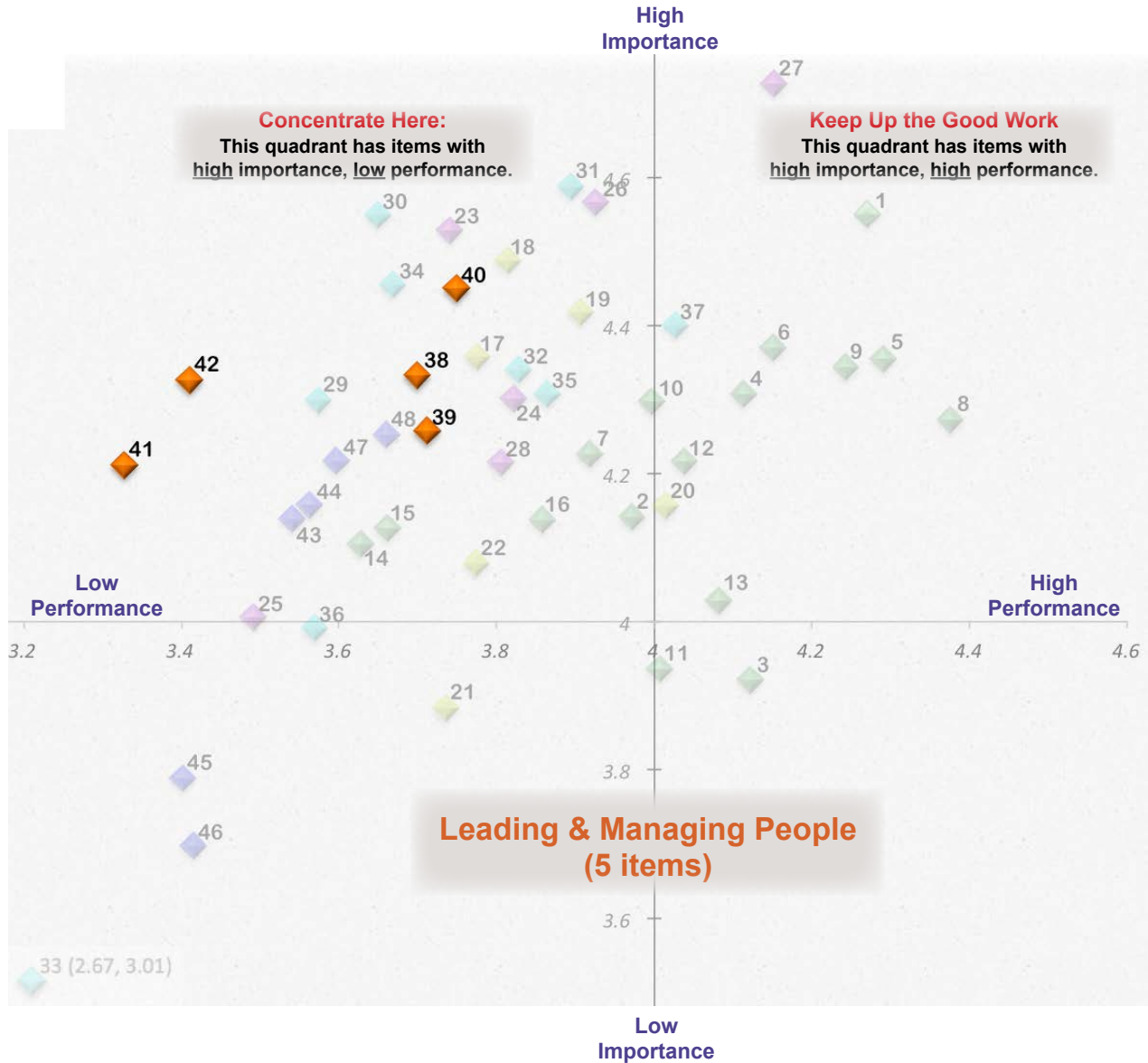
Appendix Figure B4. Importance-Performance Analysis chart for 6 competency items in the “Managing Self” curriculum focus area.



Key:

- | | |
|---|---|
| 29. Understand audiences. | 35. Be able to explain what environmentally responsible forest management is. |
| 30. Use oral communication effectively. | 36. Engage audiences regarding complex and/or controversial science topics. |
| 31. Use written communication effectively. | 37. Work well in teams. |
| 32. Use electronic media effectively. | |
| 33. Be able to speak two or more languages. | |
| 34. Be an effective listener. | |

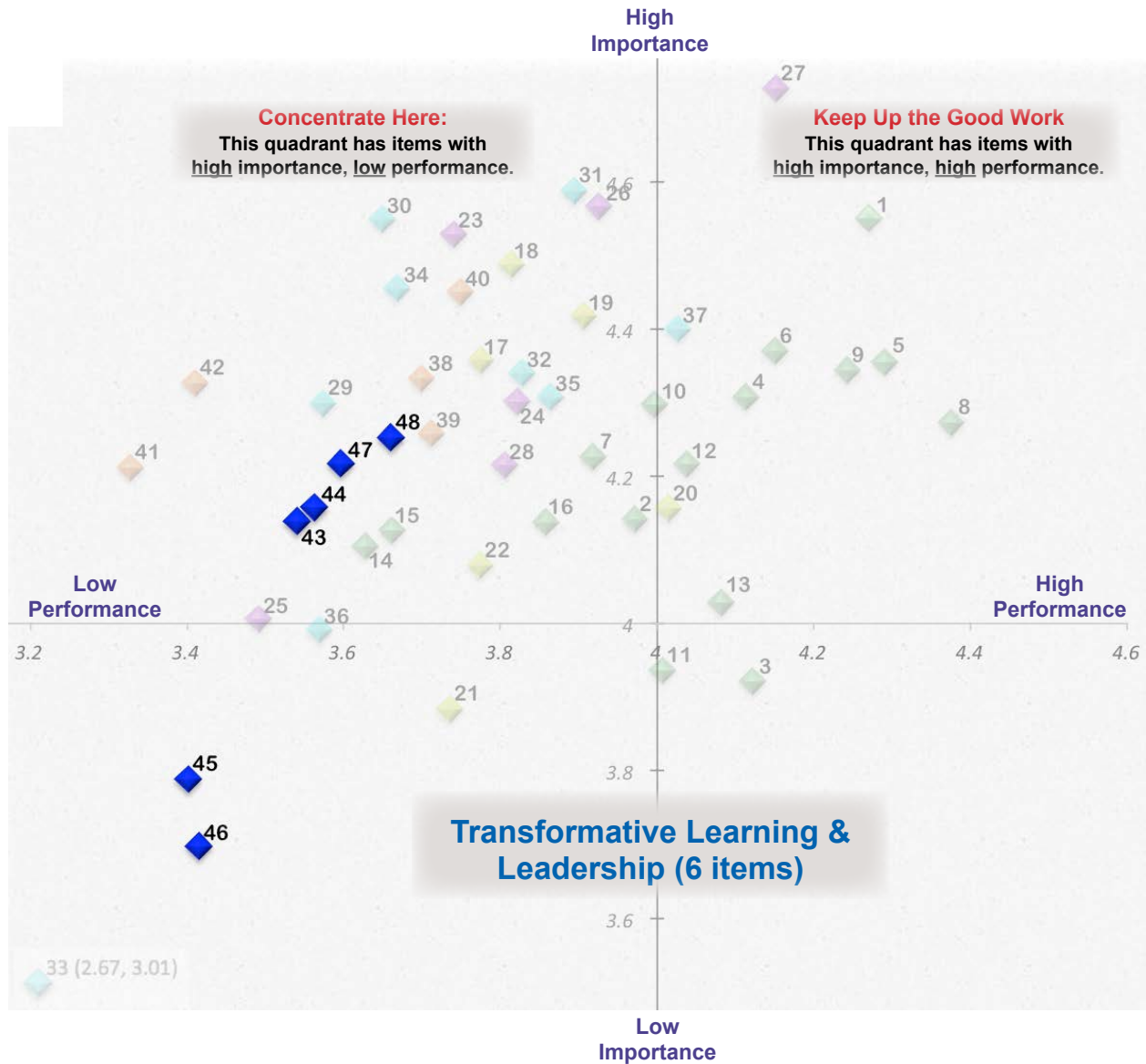
Appendix Figure B5. Importance-Performance Analysis chart for 9 competency items in the “Communicating and Collaborating” curriculum focus area.



Key:

- | | |
|--|---|
| 38. Allocate people and resources to accomplish tasks. | 41. Engage effectively in conflict management. |
| 39. Build effective teams. | 42. Establish positive supervisory relationships. |
| 40. Be decisive when necessary. | |

Appendix Figure B6. Importance-Performance Analysis chart for 9 competency items in the “Leading and Managing People” curriculum focus area.



Key:

- | | |
|---|---|
| 43. Create new and worthwhile ideas. | 47. Reflect critically on past experiences. |
| 44. Apply innovative approaches. | 48. Inspire others by being a role model. |
| 45. Implement incremental and radical change. | |
| 46. Be globally aware and responsive. | |

Appendix Figure B7. Importance-Performance Analysis chart for 6 competency items in the “Transformative Learning and Leadership” curriculum focus area.

Focus Group Order of Information and Questions for Participants

1. Briefly introduce SFASU's BSF curriculum revision project and processes.
2. What characteristics do you think define a good forester today?
3. What do you see as your current hiring needs right now? What about within the next 10 years?
4. What knowledge areas, skill sets, abilities, and behaviors do you think are most important for BSF graduates?
5. What additional qualities are you looking for in new hires?
6. Is there *specialized* knowledge that is essential to include in education today that is different from what you received?
7. Is there *general* knowledge that is essential to include in education today?
8. How do you think the Arthur Temple College of Forestry and Agriculture is doing in meeting the needs we have discussed for BSF graduates?
9. Ask for details ...
 - What kinds of communication skills are most needed? Examples?
 - If applicable, what components do you provide in forest management plans? Examples?
 - Other details relating to specific knowledge areas, skill sets, abilities, or behaviors?
10. Display the eight issues from the survey (question 17 in the survey). Project them on a screen or have them on a flip chart. Have participants rank them. Ask about additional issues that should be included in the list.
11. We are approaching the end of our time. What have we missed? If there were one or two things you would like to add to this conversation, what are they?
12. Although we can assure that all of what you said today will go forward, if you have one or two items that you want to make sure that we have heard, that we carry forward in each conversation and that we act upon, what would you list?
13. Follow through with the necessity of and appreciation for any examples they can provide (of management plans, for example). Ask if we may contact them in the future for examples, and ask if they are willing for us to follow up if we have any questions from the conversation in the session.

BSF Forest Management

	Fall Semester	FOR/GIS Courses Offered in both Fall and Spring Semesters	Spring Semester
Senior Year	<p><u>FOR 411 Timber Mgt (w/Lab)</u> (even years)</p> <p><u>FOR 427 Regional Silviculture</u></p> <p><u>FOR 435 Resource Economics</u> (also offered Summer II)</p> <p>Humanities Course</p>	<p><u>FOR 409 Forest Hydrology (w/Lab)</u></p> <p><u>FOR 458 Forest Resource Mgt⁴ (w/Lab)</u></p> <p><u>FOR 460 Forestry Internship or</u> <u>FOR 463 Independent Study</u></p>	<p><u>FOR 428 Intensive Silviculture (w/Lab)</u></p> <p><u>FOR 470 Forestry Consulting Business Course</u></p> <p><u>Approved Elective</u></p>
Junior Year	<p><u>FOR 317 Forest Biometrics II (w/Lab)</u> (odd years)</p> <p>MTH 144 Elements of Calculus with Applications for Business or</p> <p>MTH 220 Intro to Probability & Statistics</p> <p>PSC 141 Intro to Am Govt: Theory</p>	<p><u>FOR 313 Forest Insects & Diseases (w/Lab)</u></p> <p><u>FOR 337 Intro to Fire Management²</u></p> <p><u>FOR 347 Silviculture (w/Lab)</u></p> <p><u>FOR 349 Prin of Forest Soils (w/Lab)</u></p> <p><u>GIS 390 GIS in Natural Resources (w/Lab)</u></p>	<p><u>FOR 348 Natural Resource Policy</u></p> <p><u>PSC 142 Intro to Am Govt: Structure Business Course</u></p>
Field Station	<p><u>FOR 310 Field Silviculture¹</u></p> <p><u>FOR 325 Timber Cruising¹</u></p>	<p><u>FOR 336 Field Wildlife Techniques¹</u></p> <p><u>FOR 323 Land Measurement¹</u></p>	<p><u>FOR 329 Harvesting/Processing¹</u></p> <p><u>FOR 335 Non-timber Resource Management¹</u></p>
Sophomore Year	<p>ENG 273 Technical & Sci. Writing or</p> <p>BCM 247 Business Communication</p> <p>CHE 133 General Chemistry I⁴ (w/Lab)</p> <p>HIS 133 U.S. History I</p>	<p><u>FOR 205 Forest Biometrics I (w/Lab)</u></p> <p><u>FOR 209 Forest Ecol & Physiol (w/Lab)</u></p> <p><u>GIS 224 Intro to Spatial Science (w/Lab)</u></p>	<p><u>FOR 223 Surveying & Map. (w/Lab)</u></p> <p><u>FOR 240 Wood Science² (w/Lab)</u></p> <p>HIS 134 U.S. History II</p> <p>Humanities Course</p>
Freshman Year	<p>ENG 131 Rhetoric & Composition</p> <p>BIO 131 Principles of Botany⁴ (w/Lab)</p> <p>SFA 101¹ (Optional 1-hr Course)</p>	<p><u>FOR 111 Intro to Forestry (w/Lab)</u></p> <p><u>FOR 152 Intro to Wildlife Mgt (w/Lab)</u></p> <p><u>FOR 219 Dendrology (w/Lab)</u></p> <p><u>FOR 251 Intro to Rec & Human Dimens</u></p>	<p>ENG 132 Research & Argument</p> <p>COM 111 Public Speaking or</p> <p>COM 170 Interpersonal Communication</p> <p>MTH 138 College Algebra or</p> <p>MTH 143 Finite Mathematics</p>

► Course titles that are underlined are required in the Forest Management degree; they may not be required in other BSF degree plans.

► Courses in green or red that are not underlined are part of the Forestry Core.

► Courses in red are prerequisites to Field Station.

^{1,2,4} Superscript numbers represent the number of credit hours for a course. All courses without superscripts are three credit-hours.

BSF Forest Wildlife Management

	Fall Semester	FOR/GIS Courses Offered in both Fall and Spring Semesters	Spring Semester
Senior Year	<p>FOR 435 Resource Economics (also offered Summer II)</p> <p>FOR 450 WL Habitat Mgt (w/Lab)</p> <p>FOR 486 Mammalogy⁴ (w/Lab)</p> <p><u>Humanities Course</u></p>	<p>FOR 409 Forest Hydrology (w/Lab)</p> <p>FOR 458 Forest Resource Mgt⁴ (w/Lab)</p> <p><u>Wildlife Management Elective</u></p>	<p>FOR 406 WL Population Ecology</p> <p>BIO 433 Ornithology⁴ (w/Lab)</p> <p><u>Humanities Course</u></p>
Junior Year	<p>FOR 305 Wildlife Techniques (w/Lab)</p> <p>MTH 144 Elements of Calculus with Applications for Business or</p> <p>MTH 220 Intro to Probability & Statistics</p> <p>PSC 142 Intro to Am Govt: Structure</p>	<p><u>Wildlife Biology Elective</u></p> <p>FOR 313 Forest Insects & Diseases (w/Lab)</p> <p>FOR 337 Intro to Fire Management²</p> <p>FOR 347 Silviculture (w/Lab)</p> <p>FOR 349 Prin of Forest Soils (w/Lab)</p> <p>FOR 475 GIS Apps in Wildlife Mgt</p>	<p>FOR 348 Natural Resource Policy</p>
Field Station	<p>FOR 310 Field Silviculture¹</p> <p>FOR 325 Timber Cruising¹</p>	<p>FOR 336 Field Wildlife Techniques¹</p> <p>FOR 323 Land Measurement¹</p>	<p>FOR 329 Harvesting/Processing¹</p> <p>FOR 335 Non-timber Resource Management¹</p>
Sophomore Year	<p>CHE 133 General Chemistry I⁴ (w/Lab)</p> <p>HIS 134 U.S. History II</p> <p>ENG 273 Technical & Sci. Writing or</p> <p>BCM 247 Business Communication</p>	<p>FOR 205 Forest Biometrics I (w/Lab)</p> <p>FOR 209 Forest Ecol & Physiol (w/Lab)</p> <p>GIS 224 Intro to Spatial Science (w/Lab)</p>	<p>FOR 240 Wood Science² (w/Lab)</p> <p>PSC 141 Intro to Am Govt: Theory</p> <p>BIO 133 Zoology⁴ (w/Lab)</p>
Freshman Year	<p>COM 111 Public Speaking or</p> <p>COM 170 Interpersonal Communication</p> <p>ENG 131 Rhetoric & Composition</p> <p>BIO 131 Principles of Botany (w/Lab)</p> <p>SFA 101¹ (Optional 1-hr Course)</p>	<p>FOR 111 Intro to Forestry (w/Lab)</p> <p>FOR 152 Intro to Wildlife Mgt (w/Lab)</p> <p>FOR 219 Dendrology (w/Lab)</p> <p>FOR 251 Intro to Rec & Human Dimens</p> <p>FOR 255 Vertebrate Nat History (w/Lab)</p>	<p>ENG 132 Research & Argument</p> <p>HIS 133 U.S. History I</p> <p>MTH 138 College Algebra or</p> <p>MTH 143 Finite Mathematics</p>

▶ Course titles that are underlined are required in the Forest Wildlife Management degree; they may not be required in other BSF degree plans.

▶ Courses in green or red that are not underlined are part of the Forestry Core.

▶ Courses in red are prerequisites to Field Station.

^{1,2,4} Superscript numbers represent the number of credit hours. Courses without superscripts are three credit-hour courses.

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