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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

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ABSTRACT

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“Society-ready” foresters are capable of dealing effectively with the complex economic, ecological, and social issues involving forestry in the 21st century. To assess the knowledge areas, skill sets, abilities, and behaviors needed by society-ready, entry-level foresters today, we surveyed 800 forestry employers and forestry alumni from Stephen F. Austin State University (SFASU), and we also conducted focus group sessions with a total of 58 forestry employers. Important areas of knowledge on emerging issues for society-ready Bachelor of Science in Forestry (BSF) graduates included climate change, water availability and quality, and dealing with invasive plants, pathogens, and insects. However, the skill sets and abilities that involve dealing effectively with people were ranked highest in terms of areas in which the BSF curriculum at SFASU should be strengthened. This basic message—the need to improve people skills while maintaining strength and relevance in technical skills—is consistent with reports, studies, and conferences on forestry education in the United States since the early 1900s. At SFASU, we are revising the BSF curriculum to address the results of our research-based process, and we are also targeting research and outreach to address the century-old, chronic issue of how to measurably improve the knowledge, skills, abilities, and behaviors needed for foresters to work most effectively with people. In our research and application of results, we learned that the *process* of curriculum revision is just as important as the *product*: learning from our process will help guide other program leaders in forestry and natural resources to evaluate and revise undergraduate curricula. When done well, we believe work of this type will strengthen both the *rigor* and *relevance* in a curriculum, and the process will also strengthen *relationships* with alumni, employers, and other key constituents.

Keywords

curriculum, research-based, revision, education template

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Today, major forces of change at the 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 human 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 ([USDA Forest Service 2012](#), [Wear and Greis 2013](#)).

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.

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](#), p. 10). According to the National Association of University Forest Resources Programs (NAUFRP), 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](#), p. 10).

The 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.

To produce society-ready foresters, we know that BSF curricula must continue to be rigorous, but we also know that rigor is not 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 review and revise the BSF curriculum at SFASU in 2012–2013. This article, with the companion monograph, shares our curriculum revision and research processes, our research results, and broad curriculum revisions we are implementing at the university ([Bullard et al. 2014](#)). Our process, findings, and results may help other institutions as they begin to revise and update their own undergraduate curricula in forestry and natural resources.

LITERATURE REVIEW

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There is a strong, consistent theme in BSF curricula studies, symposia, and reports over the last century in the United States. The two-pronged theme requires that BSF programs must do the following: continue to emphasize current, well-focused technical forestry knowledge and skills; and achieve much higher levels of competence in areas such as oral and written communication, management, leadership, and other general and personal competencies needed to work effectively with people.

The second point (above) has been stressed by forestry educators and other leaders for discussions on forestry education in the United States began in the early 1900s, with anecdotal comments as well as survey results through the years showing a consistent, continuing need for improvement in the area of human dimensions. This key point, the continuing need to enhance people skills, was made in every major forestry education study (see [Graves and Guise 1932](#), [Chapman 1935](#), [Dana and Johnson 1963](#)), yet is still a basic issue decades later, after many studies and national symposia on forestry education (also see [Barrett 1953](#), [Burns 1969](#), [Brown and Lassoie 1998](#), [Sample et al. 1999](#)). It is

significant that this finding is still true despite decades of emphasis on general competencies in SAF accreditation guidelines ([SAF 2011](#)). See [Davidson \(2013, p. 7\)](#), for example, for a very recent statement that foresters today have little or no preparation in “people skills, political savvy, and problem solving agility.”

The two basic points listed above are true for BSF curricula in the United States, 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](#)).

In the United States, inherent biases against making major changes in the BSF curricula have been reported, 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 last ten years,” [Burns \(1969, p. 11\)](#) 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.”

Management and Policy Implications

To develop society-ready foresters, Bachelor of Science in Forestry (BSF) programs must involve knowledge, skills, abilities, and behaviors that span personal and general competencies as well as technical competencies. In the past, Stephen F. Austin State University and other universities have generally done well at preparing BSF graduates in technical knowledge and skills, but improvement is needed to strengthen general and personal competencies, particularly those that involve working effectively with people. These competencies include oral and written communication skills, and behaviors such as conducting oneself in a professional manner. To cultivate technical, general, and personal competencies in BSF programs in the future will require specific actions that involve forestry educators as well as employers and other practicing professionals to address systemic biases favoring the status quo. Together we must do the following: (1) stress all important competencies in the BSF curriculum, not just the technical disciplines; (2) through research, develop methods to measure progress and results in developing all competencies; (3) share best practices to enhance specific competencies; (4) increase the scholarship of teaching and learning applied to forestry education; (5) continue to work with employers and other practicing professionals to enhance opportunities for internships, service learning projects, professional engagement, and other experiences for BSF students that are cocurricular and extracurricular in nature; and (6) continue to encourage lifelong learning and professional development in forestry, particularly to cultivate and promote means of working effectively with people.

Although major curricular changes are relatively rare in BSF programs, forestry educators have generally done well in 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 skills and knowledge (see, e.g., [Brown and Lassoie 1998](#), [Sample et al. 1999](#)), which reflects decades of close attention to technical content in SAF accreditation standards. In addition, forestry faculty are, in most cases, PhD scientists, well versed in and prepared to emphasize specific technical subjects in their instruction, but often leaving general competencies to other courses or to other aspects of the educational experiences of undergraduate students.

In May 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 was formed with 13 members representing all aspects of the program. A six-person subcommittee led the research phases of the work, including analyzing and summarizing research results. The research subcommittee included the dean, two faculty members with expertise in human dimensions, two faculty members who specialize in data analysis, and an education specialist. The education research specialist worked full time from May 2012 through May 2013 to help guide the research process and ensure high-quality, timely results.

The BSF revision process involved both quantitative and qualitative research in a concurrent triangulation design (Creswell 2009). The design uses both approaches with the same objectives in mind and compares the results for their consistency and enhancement. 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 (derived from sources such as the Pinchot Institute, NAUFRP, SAF, and Institute of Museum and Library Services), and also to evaluate our success at SFASU in producing foresters with those skills and abilities. The survey's 48 skill sets ("competency items") were placed into six focus areas (Figure 1) which, ultimately, resulted in three broad areas of competence—technical, general, and personal (Figure 2). The survey also asked respondents to assess the relative importance of major forces, challenges, and issues affecting US forests in the 21st century.

-
- I. Managing Forest Resources (Technical Competency)
 1. Understand the ecological functioning 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 monitor and predict.
 6. Manage forest resources at the stand, forest, and landscape levels.
 7. Restore forest health and productivity.
 8. Know how to identify trees, non-trees, and wildlife species.
 9. Sustainably manage forest systems.
 10. Be able to develop management plans.
 11. Use forest management practices to achieve habitat management goals.
 12. Use geomorphic techniques.
 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 sustainable forest products for society.
 - II. Applying Reasoning and Critical Thinking (General Competency)
 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.
 21. Understand how historical events and ideas influence environmental experiences, beliefs, and values today.
 22. Address relevant moral and ethical questions.
 - III. Managing Self (Personal Competency)
 23. Manage work schedule and workload efficiently.
 24. Demonstrate a commitment to life-long learning.
 25. Maintain physical, mental, and spiritual health.
 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.
 - IV. Communicating and Collaborating (General Competency)
 29. Understand audiences.
 30. Use oral communication effectively.
 31. Use written communication effectively.
 32. Use electronic media effectively.
 33. Be able to speak two or more languages.
 34. Be an effective listener.
 35. Be able to explain what environmentally responsible forest management is.
 36. Engage audiences regarding complex and/or controversial science topics.
 37. Work well in teams.
 - V. Leading and Managing People (General Competency)
 38. Allocate people and resources to accomplish tasks.
 39. Build effective teams.
 40. Be decisive when necessary.
 41. Engage effectively in conflict management.
 42. Establish positive supervisory relationships.
 - VI. Engaging in Transformative Leadership and Learning (General Competency)
 43. Understand and work with ideas.
 44. Apply innovative approaches.
 45. Implement incremental and radical change.
 46. Be globally aware and responsive.
 47. Reflect critically on past experiences.
 48. Inspire others by being a role model.

Figure 1.

The 48 competency items in the survey, numbered and grouped in six focus areas (as presented in the survey instrument).

Figure 1.
Click to view

Figure 2.

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

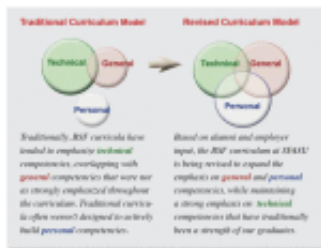


Figure 2.
[Click to view](#)

The survey was distributed in paper and electronic formats in November 2012 to all 3,279 possible participants. Eight hundred responses were obtained through the closing date in February 2013, a response rate of about 24%. Demographic characteristics of the respondents were consistent with the known alumni characteristics of the population, and we believe nonresponse to be a matter of interest and not a bias that would affect generalizing from the responses. Just over 600 (75%) of our survey respondents were BSF alumni from SFASU. Survey data were analyzed using importance-performance analysis (IPA) which compares how participants identify the importance of certain facets with how well they are being met ([Martilla and James 1977](#)) and also by examining the mean weighted discrepancy score (MWDS), which examines what respondents identify “is” compared with what “should be” ([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 were selected through a modified Delphi process (systematic multiple reviews and additions based on those reviews) and extensive graduate employer records. The final groups represented major categories of employers of BSF graduates, including the 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. The focus groups allowed more in-depth discussion of competencies, with an opportunity to compare results for employer categories and subject areas of employment. Sessions were held at several locations across Texas to accommodate the participants. The sessions were facilitated by the education specialist and supported by the attendance of a content expert and forestry education expert. All focus group sessions were recorded (audio only) and transcribed, and qualitative data analysis software and research methods were used to determine themes relating to general and specific competencies.

Survey and focus group data were analyzed according to [Kreuger and Casey \(2009\)](#), using thematic coding and Atlas.ti qualitative analysis software, which helped produce quantitative results from qualitative data. Themes identified here were consistent with those identified through the survey results. Results were summarized and presented to the faculty and professional staff, as well as to external groups. Word clouds were used to enhance visual representation of the qualitative data. Through these presentations and discussions, we obtained additional insight on interpreting and using both survey and focus group results.

RESULTS AND DISCUSSION

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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 ([Figure 3](#)). Technical competencies include subjects such as 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.

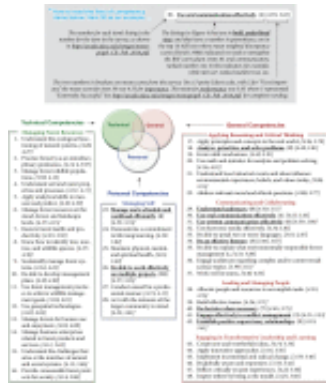


Figure 3.

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

Figure 3.
[Click to view](#)

Of the 48 competencies in our survey, the top 5 identified for importance were from the Personal and General competencies. The highest mean score for importance was “Conduct oneself in a professional manner,” with a mean score of 4.73 on a 5-point rating scale (item 27 in [Figure 3](#)). This was followed by “Use written communication effectively,” mean score of 4.59, “Be able to work effectively on multiple projects,” mean score of 4.57, “Use oral communication effectively,” mean score of 4.55, and “Manage one’s schedule and workload efficiently,” with a mean score of 4.53.

The quantitative results from the survey were also summarized using IPA ([Martilla and James 1977](#)) and are presented in seven charts in Appendix B of the companion monograph (data not shown; for details, see [Bullard et al. 2014](#)). The IPA, the qualitative research summaries of themes, and word clouds of focus group sessions (shown in Appendix C of [Bullard et al. 2014](#)) are in full accord with the findings broadly summarized in [Figure 3](#). The primary competency items needed to be strengthened in the curriculum based on Borich’s mean weighted discrepancy score are presented in [Figure 4](#).



Figure 4.

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 proposed by Borich (1990). More detail is provided in the monograph.

Figure 4.
[Click to view](#)

The biggest need for improvement was indicated in competencies that are people related. In fact, 8 of the top 10 competency items ([Figure 4](#)) are in the general competency area, including 4 in Communicating and Collaborating and 3 in Leading and Managing People. Specifically, survey and focus group results both indicated that BSF graduates needed greater preparation in general competencies such as oral and written communication and personal competencies such as managing one’s schedule, taking initiative, and being able to work effectively on multiple projects.

Research results, findings, and recommendations from stakeholders were considered in detail by SFASU's forestry faculty in a series of six 3-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.

Proposed Curriculum Revision

[Figure 2](#) illustrates technical, general, and personal competencies in a traditional curriculum model and in the revised curriculum model at SFASU. In general, the new curriculum we have submitted for university and state records enhances opportunities for internships and other employment before graduation and 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.

Survey and focus group results provided insight on critical emerging issues to emphasize throughout courses in our BSF curriculum. In our faculty discussions we referred to “weaving” these topics in the curriculum because they would be emphasized in entry-level courses as well as in sophomore-, junior-, and senior-level courses to help address society needs and challenges. Faculty worked to determine where these critical topics are addressed in courses and where they need to be incorporated in future course content. In addition to skills and abilities that are people-related, these knowledge areas include the following:

- 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
- 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 ([USDA Forest Service 2012](#), [Wear and Greis 2013](#)). They are critical to the ability of entry-level forestry professionals to be society-ready and therefore are being threaded throughout the BSF curriculum at SFASU.

Revisions

Some of the proposed curriculum revisions at SFASU are course-related, so they are direct revisions to the BSF curriculum. Other changes, however, are *extracurricular*, because they relate to student employment, student organizations, and other opportunities and activities that may not be course related.

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

- Weaving people-related and human dimensions skills, such as leadership development, interorganizational skills, conflict management, outreach, and appropriate and effective written and oral communications, in existing courses throughout the curriculum
- Creating an advising process with extracurricular tracks to build leadership and people-related skills and abilities identified as essential by employers
- 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
- Updating the focus of both entry-level and capstone courses to enhance the general and personal competencies highlighted in [Figure 4](#)
- Changing the timing of our 6-week summer field station from after the junior year to after the sophomore year to allow students to participate in internships the summer before graduation

- Building a student-led mentoring program to establish and cultivate connections among beginning-core students and advanced-core students, as well as between students and forestry professionals at the direct request of past and current employers.

In addition to those changes made for student-centered purposes (theory placing the student at the core of academic decisionmaking world), we will be making changes to our assessment process as well. Currently based on SAF accreditation and the SFA model, our assessment plan will be revised to better reflect the recursive process of assessment coupled with the assessment of student success in mastering the components woven throughout the curriculum.

LESSONS LEARNED

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In this article, we present background information on why curriculum revision is critical today, and in the accompanying monograph ([Bullard et al. 2014](#)), we include a brief review of the 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.

Our intent in presenting the research process and analysis techniques, 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 to assist other university programs that may be considering assessing and revising 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. Our research-based process involved 2 years and expenses of about \$50,000, not counting faculty time. By considering our process, the results we obtained, and the revisions we are implementing, other university program leaders may be able to avoid steps or actions that are not appropriate or relevant to their programs.

When we, the Arthur Temple College of Forestry and Agriculture, 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 and consistently communicated these messages with our faculty using what we called a *Summary Document* from the beginning of the revision process to final stages. Faculty were, and remain, engaged in the curriculum revision process from design to implementation to evaluation and assessment.

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 United States for 100 years (see [Graves and Guise 1932](#), [Chapman 1935](#), [Barrett 1953](#), [Dana and Johnson 1963](#), [Brown and Lassoie 1998](#), [Sample et al. 1999](#)). We also learned that despite national surveys, conferences, and symposia of forestry leaders that have consistently focused on the need to address these skills, they are still the highest priority competencies to strengthen in BSF programs. We believe this finding may reflect a systemic problem in forestry educational programs of focus on technical over personal and general skills based on long-standing traditions and personal characteristics ([Stephens Williams 2014](#)). 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.

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