
PINCHOT INSTITUTE
FOR CONSERVATION

**The Evolution of Forestry Education
in the United States:
Adapting to the Changing Demands
of Professional Forestry**

by

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Leadership in Forest Conservation Thought, Policy and Action

PINCHOT INSTITUTE FOR CONSERVATION

About the Pinchot Institute

The Pinchot Institute for Conservation is an independent, non-profit organization dedicated to leadership in conservation thought, policy, and action. The Pinchot Institute was dedicated in 1963 by President John F. Kennedy at Grey Towers National Historic Landmark in Milford, Pennsylvania, historic home of conservation leader Gifford Pinchot, to facilitate communication and closer cooperation among resource managers, scientists, policymakers, and the American public. The Institute continues Pinchot's legacy of conservation leadership as a center for policy development in support of sustainable forest management.

Programs and activities

- **Policy research and analysis.** The Pinchot Institute serves as a bridge between the scientific and policymaking communities in forest resource management. The Institute provides independent policy research and timely, objective analysis targeted to the current information needs of policymakers and resource managers.
- **Convening and facilitation.** The Institute serves as a convenor and facilitator, fostering collaborative approaches to resolving key issues in forest policy. The Institute brings together leaders in forest management, research, and education from federal and state agencies, universities, industry, and conservation organizations to address new challenges and discover new solutions for advancing sustainable forest management.
- **Leadership development.** Through its program on leadership in natural resource conservation, the Institute conducts research and provides training for resource management professionals and community leaders in participatory decision making and conservation leadership.

Current programs

Institutional and policy changes to implement sustainable forest management. Much of the effort to date in sustainable forestry has focused on policy development, with far less attention devoted to the mechanisms by which these policies will be implemented, or potentially thwarted. Policies for integrated approaches to resource management will make little difference on the ground until the appropriate organizational structures and administrative processes are developed. These include the development of processes for conservation-oriented strategic goal setting and performance measurement, and integrated resource management planning, budgeting and fiscal accountability. These considerations are complex and intensely politicized, and the Pinchot Institute can play a critical, constructive role through both independent analysis and facilitation.

Forest stewardship and sustainable rural development. The restoration and maintenance of forest ecosystems for multiple objectives requires a variety of continuing land treatments that can be the basis of stable employment and income in rural communities. There is a need for policies aimed specifically at facilitating the development of local capacity to carry out such land treatments through the kind of small entrepreneurial firms that characterize rural communities. The Pinchot Institute is working with policymakers, federal and state land management agencies and with a network of community-based rural development practitioners to identify and address key policy issues such as contracting, bonding requirements, capital financing, and training in the development of specific strategies to advance both forest stewardship and sustainable rural development.

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EXECUTIVE SUMMARY

As a result of evolving practices in the forestry profession, employers are seeking a revised set of skills and competencies from recent graduates of professional forestry programs. The Pinchot Institute conducted surveys of forestry employers, recent forestry school graduates, and forestry educators in order to: (1) identify the skills and competencies that employers rate as being most important, and that new practicing professionals find they most need; (2) measure the perceptions of employers and recent graduates on how well forestry programs at U.S. colleges and universities are imparting these skills and competencies; and (3) discover the means by which forestry programs are addressing the changing needs of the profession.

In the views of both forestry employers and recent graduates now practicing forestry, a thorough grounding in the array of technical forestry skills is no less important today than in the past. However, the growing public visibility of forest management, and the importance of broader social, economic, and ecological considerations in forestry decision making, have greatly increased the need for competency in communication, ethics, collaborative problem solving, and managerial leadership.

On average, both employers and graduates indicated that the performance of forestry education in these areas was not commensurate with their importance. But while gaining these kinds of skills may have been optional in the past, it is now virtually required to be successful as a practicing professional forester, whether in government, industry, or private consulting.

How are universities responding to these changing needs? Leaders in forestry education are finding themselves in a difficult situation. On the one hand, the profession is asking them to expand the scope of forestry education to include new concepts in science as well as an increased emphasis on communications and teamwork. On the other hand, state legislatures and their own universities are pressuring them to downsize programs, reduce costs and credit hours, and demonstrate accountability. Forestry programs are responding in myriad ways – some have completely overhauled their curriculum, while others have found opportunities to integrate new skills into the existing curriculum.

While there are numerous opportunities for forestry education programs to become more sensitive and responsive to the changing market demand for professional forestry skills, there are also important opportunities for forestry employers to foster forestry schools' abilities to meet their needs. Schools are recognizing that they can call upon the resources of forestry employers and others who have a vested interest in educating forestry professionals who are technically competent, and who also can succeed in the complex social, economic, and ecological environment in which forestry is practiced today.

Foreword

Meeting the Challenges of Sustainable Forestry Education

In 1996, more than 4,000 people across North America came together as part of the Seventh American Forest Congress, to discuss their vision for the future of forests and forestry on this continent. A larger international effort over several years produced the "Montreal Process" criteria and indicators by which to measure nations' progress over time toward the goal of sustainable forest management. Just as important are numerous community efforts in which local participants have determined what is distinctive and valuable about their community, how these values might be protected and maintained, and what role the management of surrounding forest lands must play in fulfilling that vision for the future.

Forestry organizations, both public and private, are struggling to understand and meet these high expectations for forests and forestry. Part of the challenge is the always difficult transformation of existing organizations and institutions, and the relationships among individuals with differing values and perspectives. But these organizations have not been helped by the fact that many of the forestry programs at U.S. colleges and universities have themselves not kept up with the changes. Many are still oriented to training forestry professionals who, from the day they graduate and take their first job, are already behind.

At a 1996 Pinchot Institute conference, *Evolving Toward Sustainable Forestry: Assessing Change in U.S. Forestry Organizations*, forestry educators pointed out some of the reasons why universities often are not the cutting edge of innovation and creativity that is widely assumed. First, many schools are concerned about getting "too far out in front" of the perceived needs of potential employers of their graduates. Second, reduced public funding is making forestry school administrators all the more cautious about being seen as too trendy or "new age" and alienating more traditional sources of support.

Ironically, these are the very factors that should be driving innovation in forestry programs. Forestry employer needs are changing. With forestry now more than ever in the public eye, forestry organizations must be responsive to public expectations in order to, as one forest industry representative phrased it, "maintain our social license to practice forestry." Forestry organizations both public and private are seeking graduates already trained in the broader, interdisciplinary approaches to forest resource management. More importantly, they are seeking graduates who will someday have the skills and insights to lead the organizations to a successful future.

Reduced public funding for US colleges and universities -- forestry programs included -- has touched off a scramble for funding from private sources. And it has increased competition among forestry programs to attract the best students, not only from this country but from around the world. Prospective students are highly attuned to the changing marketplace demand for forestry professionals among traditional -- and an increasing number of not-so-traditional -- forestry employers. Prospective students also bring with them their own ideas about forests and forestry, many of them having worried about saving whales and rainforests ever since elementary school.

How will forestry programs at U.S. colleges and universities respond to these opportunities and challenges? The idea of market-responsiveness strikes many forestry educators as odd, or even inappropriate. The university is not in the business of following fads or the whims of fashion. Others see an opportunity to enhance their own relevance and contributions to the future of forest management and conservation, and perhaps to prosper along the way. Federal and state forestry agencies, forest products companies, and now charitable foundations have begun to make strategic investments in forestry programs in which forestry educators are eager to innovate and are willing to "think outside the box."

In one sense, forestry education today may not be breaking new ground so much as it is going back to its roots. The oldest continuously operating forestry school in the U.S. was founded a century ago by Gifford Pinchot at Yale to provide technical competency in the art and science of forest management, but also to give these first professional foresters the skills to understand and address local social and economic needs consistent with an over arching set of core values and conservation principles. What society seems to be asking of forestry -- and thus of forestry education -- is to not view technical competency so much as an end in itself, but as a means to advancing society's broader and longer-term need for forest conservation and stewardship.

The start of the second century of professional forestry practice in the United States could be a turning point in how forestry programs at our colleges and universities view their mission and role in educating tomorrow's resource management professionals. Through a variety of unmistakable signals, society is telling us that our forests are more valuable to us than ever before. Through a variety of mechanisms, society will invest in those people and organizations that can advance broadly-supported goals in forest conservation and stewardship. Therein lie the challenge and the opportunity in forestry education.

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This volume is dedicated to Lynn W. Day, who throughout her life demonstrated her enduring personal commitment to preserving both the history and the future of forests and forestry in America.

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INTRODUCTION

The practice of forestry and the public and private organizations that manage forests have undergone significant change in recent years. This evolution reflects not only changing public perceptions about what constitutes sustainable forestry and sound land stewardship, but also developments in scientific knowledge, technological communications, and global markets. Consequently, the skills and competencies sought by these organizations when hiring graduates of professional forestry programs have evolved as well (Cortner 1992; McKinney 1993; Baughman 1997).

In 1998, the Pinchot Institute surveyed forestry employers and recent graduates of forestry programs at U.S. colleges and universities, in order to assess how well these programs are preparing new forestry professionals to practice forestry consistent with today's needs. The study also gathered information from the leaders of every professional forestry degree-granting program in the country, in an effort to characterize the strengths and foci of each program, and their strategies for addressing the changing needs of the forestry profession.

The Institute embarked on this study of forestry education based on the findings of its earlier assessment of change in U.S. forestry organizations. During 1996 and 1997, the Pinchot Institute had conducted a strategic evaluation of efforts by organizations in forestry research, education, management and policy to respond to public expectations for more integrative approaches to forest management (Sample et al. 1997). Forestry educators participating in the assessment suggested that forestry schools are limited in their ability to innovate because of myriad institutional constraints; moreover, they did not want to get out of step with the current needs of the employers that hire their graduates. In response, several forestry employers voiced concerns that they frequently have to re-train graduates of forestry programs to understand and practice a style of forestry that is broader and more integrative than in the past.

This dichotomy suggested that the marketplace demand for skills and competencies of forestry graduates is evolving more quickly than programs for professional forestry education are responding. The Pinchot Institute determined that a systematic examination of both forestry employers and forestry education programs was therefore warranted to determine: (1) the extent to which this is in fact true, (2) possible reasons for this difference in employer needs and what forestry education programs are providing, and (3) potential opportunities for closing this gap.

A ranking of forestry programs, similar to the rankings of university MBA programs published annually by *Business Week*, was considered but rejected for several reasons. Periodic rankings are notoriously subject to biased responses by both graduates and recruiters, who have a vested interest in the particular school that they attended or from which they have hired graduates placing in the top ranks. More importantly, forestry programs are not as generic or comparable as MBA programs. Most forestry programs are geared to the needs of forestry practice in the particular state or region in which they are

located. Many others have chosen to differentiate themselves from other forestry programs by emphasizing a particular specialty, such as wood technology, forest economics, or wildlife management. Finally, despite the views of many forestry employers and recent graduates that more integrative approaches to forestry are needed, no definitive yardstick yet exists for how this should be reflected in course requirements or curriculum development.

Instead of ranking schools, therefore, the study sought to assess perceptions of forestry education in general, as well as individual efforts undertaken by the myriad institutions. This report explores the key results of the surveys of employers and recent graduates, the past and current challenges facing the academic institutions, and the ways that forestry programs have responded to these needs and pressures. The report also highlights the topics that were addressed at a Pinchot Institute symposium held in March 1999, in Washington, DC. The symposium, "Facilitating the Evolution in Forestry Education," explored several of the issues that had emerged during the course of the study, focusing on the shared responsibility that educators and employers have for maintaining communications between academia and the employment sector.

BACKGROUND

The recently published Dictionary of Forestry (1998) says that forestry is “the profession embracing the science, art, and practice of creating, managing, using, and conserving forests and associated resources for human benefit, and in a sustainable manner to meet desired goals, needs and values” (Helms 1998).

There has been considerable debate within the profession over the definition of what a forester is. There has been no overnight turn around in scientific thinking. But increasingly and by varying degrees, forest management is crossing paths with virtually every “-ology” in the natural science playbook.

The forestry profession sought to develop a common vision for the future of forests and forestry via the Seventh American Forest Congress in Washington, DC, in 1996. More than fifteen hundred people attended the four-day event, representing a wide spectrum of interests in American forests and forestry. In addition, nearly 6,000 people participated in preliminary conferences and workshops (Bentley and Langbein 1996).

The Congress was successful in developing a broadly supported vision for the future of the country’s forests, as well as principles to guide the achievement of that vision. Participants called for open and continuous dialogue among interested parties, voluntary coordination and cooperation to achieve shared ecosystem goals, and cohesive and stable programs, policies, and initiatives to facilitate sustainable management and restoration. (See **Appendix A for an overview of the visions and principles that emerged from the Seventh American Forest Congress.**)

In *Creating a Forestry for the 21st Century* (1997), co-editor Kathryn Kohm writes, “Advances in the natural sciences, particularly in ecology, have both stimulated and informed the paradigm shift that is occurring in the management of natural resources. The body of new knowledge generated by ecological scientists during the past 30 years has become, ultimately, so overwhelming in quantity, and so fundamental in quality, that it can no longer be discounted or denied. We can never look at forests and forest landscapes in the same simplified way, for the lesson ultimately has been complexity and its importance” (Kohm and Franklin 1997). Are colleges and universities buying into the “paradigm shift” toward a broader forest management policy?

The last decade has focused on questions such as these. The decade kicked off with a symposium in Denver in 1991 titled “Forest Resource Management in the 21st Century: Will Forestry Education Meet the Challenge?” (SAF 1992). This symposium forced the profession to critically examine whether educational curricula were adequately meeting the challenges of forest management.

Participants from academia, government, private organizations, and other institutions debated issues such as the factors driving forestry education, the future demands on forestry professionals, the features of an “appropriate” curriculum, and barriers to implementing

curricula change. Several of the speakers addressed flaws in current forestry education, and called for both basic and far-reaching changes (Cortner 1992). A key theme was the recognition that the profession has become a broader, more interdisciplinary field, and that educational institutions need to address this diversity.

Other symposia followed, notably "Education for Forest Resources: New Directions for the 21st Century" held in Syracuse in 1994 (Canham 1994), as well as two national biennial conferences on "University Education in Natural Resources" at Penn State in 1996 (Finley and Steiner 1996) and Utah State in 1998 (Heister 1998). Unlike the conferences in Denver and Syracuse, the Penn State and Utah State symposia were organized by and for teachers, rather than administrators. The goal was to provide an outlet for university forestry faculty to engage one another in the "scholarship of teaching" (Steiner, pers. comm.). A third conference in the series on "University Education in Natural Resources" is planned for the spring of 2000 in Missouri. Dr. Al Vogt, President of the National Association of Professional Forestry Schools and Colleges (NAPFSC), recently noted that "there has never been as intensive a sequence of conversations focused on forestry education in this country."

The past ten years has also produced several significant studies examining the demands of employers and the ability of forestry education to meet those demands (Brown and Lassoie 1998; Duncan et al. 1989). The study by Brown and Lassoie (1998) concluded that schools are adequately preparing forestry graduates, but that society and technology are changing so rapidly that schools need to frequently examine their programs in order to keep pace. Duncan et al.'s 1989 study raised some probing questions about whether the full cadre of necessary skills can be attained in four years, and how the blossoming of natural resources degree programs will affect forestry education. Recently, numerous case studies have been published that offer some creative solutions to address these challenges (Flick et al. 1995; Gillespie et al. 1998; Jensen et al. 1998).

In 1999, the Society of American Foresters (SAF) Council chartered a Task Force on Forestry Education Accreditation "(1) to involve forestry educators and employers in a dialogue to address how SAF can assist U.S. professional forestry education by preparing graduates for entry-level forestry employment, and (2) to recommend to SAF Council appropriate actions to maintain effective forestry accreditation." SAF is the professional society charged with evaluating and accrediting forestry education programs throughout the United States. Several educators and employers asserted that the accreditation requirements themselves were based on an outdated concept of forestry, and were impeding innovation at schools concerned about maintaining SAF accreditation. The Task Force undertook a comprehensive review and revision of the core curriculum requirements for forestry degree programs. These programs were also considered in light of the increasing level of specialization within forestry, and the growing importance of individual credentialing of forestry professionals. It is expected that the Task Force's report will be available from SAF in early 2000.

A CONTESTED PAST: FORESTRY EDUCATION IN THE UNITED STATES, 1898-1998¹

Westvaco Corporation's R. Scott Wallinger spoke for many at a 1991 symposium on "Forestry Education in the 21st Century," when he vented frustration with the profession's present state and future condition. "It is clear from professional and conservation literature that there is no clear definition of what forestry is today," a lack of clarity that had serious implications. "Until we agree on what the term means, until we agree what a forester is, we can't agree on what a forester must know, we can't agree on what a forestry school is, we can't agree on what a forestry curriculum must contain." Rhetorical slights-of-hand would not suffice. "We have symbolically broadened the notion of a forester and forestry by using increasingly the term 'forest resources management,'" Wallinger observed, "but this undefined extension doesn't resolve the issue." No, this confusion over first principles was systemic, a sign of "an antiquated professional structure that no longer serves the professions or the public" (Giltmier 1996)

Many among the 200 researchers, educators, and resource managers at that conference also worried about the broader political ramifications of a profession that seemed in disarray; if foresters did not know how to define themselves, then why should a skeptical public trust them or their forest management practices? The bruising battles over environmental issues during the previous decade — from clearcutting to old growth preservation — seemed to confirm a marked decline in respect, a sharp loss of authority (Giltmier 1996).

Much of this contemporary handwringing assumes a declensionist posture. The bleak present (and dreaded future) is set against a glorious past. Back then, the argument goes, foresters had a shared set of goals, had a precise fix on their social role, and earned a grateful nation's admiration. Although some of this shimmering vision may be true, it is important also to recall how often the profession has been at odds with itself, how old are the questions that trouble it today. There has never been a time when foresters were free from doubt about themselves, their education, or mission.

Opening Arguments

In the beginning there was conflict. The three men who were central to the early history of forestry education — Gifford Pinchot, Carl Schenck, and Bernhard Fernow — had decided views on how to establish professional schooling in America. Each believed his perspective was correct, and sought, through the establishment of competing schools — Yale, Biltmore, and Cornell, respectively — to institutionalize their convictions. That they staked their reputations on the success of these educational ventures only heightened the drama.

¹ This chapter was contributed by Char Miller and James G. Lewis. Reprinted from the *Journal of Forestry* (vol. 97, no. 9, p.38-43) published by the Society of American Foresters, 5400 Grosvenor Lane, Bethesda, MD 20814-2198. Not for further reproduction.

The first American-born forester, Gifford Pinchot, found himself in a unique position at a pivotal moment. He had taken up the profession at the urging of his father before there was even a demand for foresters. There were no forests under practical management, no forestry schools in North America, and the tiny forest preservation movement – if such it could be called – was divided over how to slow the industrial assault on the nation's forested estate. After graduating from Yale College in 1889, Pinchot studied at the French Forest School at Nancy, France, and then served a succession of supervised apprenticeships in Germany and Switzerland during which he learned some of the profession's scientific language and technical methodology. He also learned that European forestry could not be transplanted wholesale to his native country – it was “chiefly valuable as a sort of guide in the study of new conditions and the devising of new methods” better suited to New World conditions (G. Pinchot to JW Pinchot, 18 Feb. and 31 Aug., 1890).

In subsequent years he would apply another critical lesson gained overseas. A leading Swiss forester had advised the young man to “Go slow with [the] f[orest] org[anization] in America. First mark out state forest[s], then protect them, then [establish a] forest school” (Pinchot diary, 1 May 1890). This advice reads like a historical summary of the profession's first years. Though the first national forests were created in 1891, just after Pinchot's return from Europe, as secretary of the National Forest Commission in 1897 he helped establish new ones and worked for the passage of the Forest Management Act to bring these forests under scientific management. Three years later Pinchot and his family endowed the Yale School of Forestry.

Before Yale, Pinchot had informally taught the principles of forestry to employees at George Vanderbilt's massive home, Biltmore, in Asheville, North Carolina; he had been the estate forester since late 1891. Others interested in this new profession, including his friend, and fellow Yale graduate, Henry Graves, came to the estate to learn about American woodlands before heading to Germany for formal training (Pinchot 1998). When Pinchot left Biltmore in 1895, Dr. Carl A. Schenck, a young German forester educated at the University of Giessen, replaced him, and he taught his apprentices forestry on an informal basis. Two years later, in 1898, with Vanderbilt's permission and Pinchot's encouragement, he formally established the Biltmore Forest School, essentially but not always a one-man school patterned after the German master schools (Schenck 1955). Catering mostly to the sons of lumbermen or landowners who wanted a quick overview, the instruction in the one-year program was theoretical and practical, emphasizing the management of private forest properties.

It was on pedagogy that Schenck and Pinchot most sharply disagreed. Schenck's curriculum gave his students extensive, real world experience, and this meshed with his goals for their careers. “I had advised my graduates to seek employment with the large landowners of timberlands rather than with the Bureau of Forestry in Washington, because I wanted them to be foresters in the woods rather than foresters in office buildings,” he later wrote (Schenck 1955). Openly critical of Yale's more theoretical curriculum, which he believed left its students ill-prepared for practical forestry, Schenck also challenged what he perceived as Yale's anti-industry bias. Lumbering, the head of Biltmore affirmed, “was an essential part of forestry and an integral part of the studies and the lectures offered at any forest school.”

Any programs but Yale's, that is. When Pinchot learned that "in the school examinations at Biltmore a knowledge of logging and lumbering were weighed higher than that of silviculture or any other branch of 'scientific' forestry," he reportedly called Schenck "an antichrist" (Schenck 1955).

Pinchot bedeviled him further, urging George Vanderbilt to shut down the Biltmore School. When he did, more than a decade later, it was market forces, not personal animosities, which led to its demise. Schenck's nondegree-granting school, with slim resources and informal instructional methods, could not compete with the then-fourteen university-based undergraduate and graduate programs and the academic credentials they could bestow. Although these more powerful organizations had not resolved "the proper balance between academic and practical training" (Skok 1996) that Schenck thought so vital to successful professional forestry education, by every other standard they had superseded Biltmore.

Another German-born and German-trained forester – Bernhard Fernow – foresaw the benefits of making forestry and academic discipline and established the first university program in 1898, when he resigned as chief of the Division of Forestry to head the School of Forestry at Cornell. He had left Washington under something of a cloud. As the nation's chief forester and as the executive secretary of the American Forestry Association, Fernow had stood at the apex of power within the forestry movement. But his critics, among them an impatient Gifford Pinchot, claimed he had not pushed hard enough for forest management on public lands, and instead had focused too much on research (Pinchot 1998). For his part, Fernow resented Pinchot's involvement in the 1897 creation of the controversial national forest reserves that had undercut his long-term efforts to build congressional support for forestry, and argued that extensive research was necessary to intelligently implement any management policy. Caught between indifferent politicians on Capitol Hill and insurgents within the profession's small ranks, he saw in Cornell an opportunity to build forestry from the ground up (Miller 1992).

Such was not to be. Fernow believed the Cornell program would succeed because the 1897 Forest Management Act created a demand for trained civilian foresters, but his efforts were stymied by underfunding, poor facilities, and just plain bad luck (Miller 1992; Steen 1976). Pinchot, not coincidentally, hurt the school's growth by siphoning off its best students and faculty for work in the Bureau of Forestry. Worse, under political pressure from wealthy camp owners angered by clearcutting at Cornell's 30,000-acre demonstration forest at Tupper Lake, the state legislature closed the school in 1903 (Miller 1992; Rodgers 1951).

Cornell may have collapsed ignominiously after only five years, but it had considerable impact on the future of forestry education. Fernow and his students started *Forestry Quarterly*, the forerunner of the *Journal of Forestry*, a crucial mechanism for professional communication. Cornell's curriculum established a benchmark by which other forestry schools measured themselves, as did Fernow's *The Economics of Forestry* (1902), a text that marks the "real beginning of the standardized curriculum of American instruction in forestry" (Hosmer 1923).

Much of what Cornell had lacked in funding and facilities, Yale obtained at the outset: in February, 1900, the Pinchot family gave Yale University \$150,000 to establish the School of Forestry; its two-year master's program was the first of its kind in the country, and Graves agreed to serve as its dean. (Gifford Pinchot to Amos Pinchot, 19 Dec. 1899). Convinced the Bureau of Forestry "must have the trained foresters it needed," and certain that no school then existed to supply a sufficient number of them, Pinchot and Graves developed a curriculum that built off students' undergraduate work in the general sciences, preparing them for employment in governmental forestry or private industry.

These two "enthusiastic Yale men" (Pinchot 1998) clearly wanted their alma mater to supersede Fernow and Cornell. It would do so by reclaiming American forestry from foreign interlopers: "Fernow was bearing too close to the German pattern of a forest school and to teaching German methods of silviculture," Graves later wrote (Biographical Notes of Henry Graves, Graves Papers). Pinchot was just as blunt and dismissed Biltmore along with Cornell: "We had small confidence in the leadership of Dr. Fernow or Dr. Schenck. We distrusted them and their German lack of faith in American Forestry. What we wanted was American foresters trained by Americans in American ways for the work ahead in American forests" (Pinchot 1998). Yale's influence quickly spread throughout the emerging forestry profession. Most of its graduates entered government work, either on the state or federal level; the first five chief foresters of the United States Forest Service were either faculty members or graduates of Yale's School of Forestry. In short order, it had become dominant.

Yale's success, combined with the implementation of federal, state, and private forestry, bred competition and an increased demand for additional schools. Their subsequent proliferation created several problems, however. The varied quality of education and lack of standards became the most critical threat to the future of forestry education. In 1909, Pinchot organized the first conference "to consider the aim, scope, grade and length of [forestry] curriculum" (Hosmer 1923), and two years later their evaluation, entitled "Standardization of Instruction of Forestry," appeared in *Forestry Quarterly*. The report asserted that professional "training must include a substantial general education, as well as a well-rounded course in all branches of technical forestry, and that the standard must be high. Emphasis was placed on a training that would create a body of professional men who could formulate principles and do the constructive work required to put them into operation" (Hosmer 1923).

This vision dovetailed with the Forest Service's belief in giving rangers and forest supervisors greater autonomy in decision-making, suggesting how influential the agency's needs had been in curriculum planning (Hosmer 1923). That said, none of the schools of forestry was required to adopt the proposed curriculum, but their cordial response to it helped lay the foundation for a more consistent form of education over time.

Turf Wars

Yet consistency did not stop arguments over the nature and quality of the educational offerings. On the contrary, success bred discontent. Throughout the 1910s and 1920s

enrollments increased (except during First World War), new schools were created, and a wider range of specializations emerged to complicate the educational agenda of the professional programs. These changes generated a wave of critical commentary on the presumed deficiencies in forestry education. “In addition to concerns over curriculum content and sufficiency,” Richard Skok has observed, “writers were equally critical of the inadequate number of well qualified faculty at many schools, the emphasis schools were placing on research, and the inadequacies of facilities” (Skok 1996). As the drumbeat grew louder, forestry educators did what they have done ever since – they called for a comprehensive study. Henry Graves complied, offering in 1928 a close analysis of the social and scientific forces affecting the profession, providing insight into the increased need for both specialized training and natural science-based curricula, and recommending that an even more complete assessment was necessary (Graves, 1928).

Graves took his own advice, and with Cedric Hay Guise, produced the single most comprehensive assessment of the profession theretofore. Their book-length study, *Forest Education* (1932), revolved around the by-now standard question, What is a forester? There was no easy answer, and any response was complicated by employers’ sharp criticism of the educational attainments of entry-level foresters (Graves and Guise 1932). To meet the employers’ pressing needs, the authors proposed, and a series of follow-up studies concurred, that the Society of American Foresters accredit forestry programs. Controlling for quality and membership, SAF president H.H. Chapman later asserted, was the only way to distinguish “between a profession and a craft,” and it was as a profession that foresters had the best chance to control their destiny (Chapman 1934).

His argument assumed that there was a single definition of foresters and what they did. That is why he later opposed, for example, a broader interpretation of the term to encompass those who administered “wild land,” for this would have diluted the profession’s occupational homogeneity (Chapman 1943). But not all foresters agreed. Forest Service scientist H.T. Gisborne did “not believe that our Society [SAF] can continue to thrive or that commercial timber growing can even exist on any appreciable area without sharing *equitably* with other wildland uses both the responsibilities and costs of operation” (Gisborne 1943). Foresters, in other words, must secure the broadest possible training, and their professional society must embrace as wide a range of occupations as possible.

Chapman and Gisborne represent conservative and liberal arguments over accreditation issues and over the core of forestry education: Was forestry mainly timber management or was the forest a unit to be managed for multiple purposes? The debates continued for decades with the conservatives holding a comfortable majority. In the late 1930s, an SAF questionnaire to its members implied that “real foresters” practiced silviculture, prompting a threatened mass resignation of all foresters in the Department of Interior. In the 1940s many foresters with range responsibilities resigned from SAF to join the Society of Range Management. In 1949 the SAF membership voted 1,506 to 2,036 *against* broadening forestry curricula, favoring the existing focus on silviculture and timber management. Myron Krueger argued in the *Journal of Forestry* that silviculture was the field of study that made forestry unique, and to dilute it would be undesirable. We can “be experts in making forest lands yield timber crops up to the full potential of those lands to

produce, or we can make it a society of specialists covering a range so wide that the general public is confused as to what a forester really is" (Krueger 1952). Hewing to a narrow self-definition was the means to professional survival.

Doing so might also be a means to professional stagnation, or so worried Gifford Pinchot. The fourth and final edition of his primer, *The Training of a Forester* (1937), reflected his willingness to redefine forestry to remain socially relevant and scientifically advanced. Unlike earlier editions, the 1937 version revealed significant alterations in his thinking about forests and forestry; ecological insights began to replace utilitarian perceptions (Miller 1994). The book's original emphasis on silvics, forest economics, and lumbering, was modified through the insertion of material he labeled "forest ecology." Where once he addressed trees' "individual habits of growth and life," now there was considerable new material on them as "members of plant communities" rooted in diverse climates, physiography, and soils. Foresters should not be concerned solely with trees, either; they must also have a good understanding of entomology and wildlife. Such philosophy suggested that human needs were not always paramount, an argument having implications for forestry as traditionally defined. Foresters "must know about these elements of the forest and their behavior" because they "must work toward maintaining the balance of nature." Foresters would also have to adapt to competing human claims on the environment. To prepare their students for these many challenges, forestry educators needed to teach a more sophisticated form of land management (Pinchot 1937).

They did not take up Pinchot's challenge, however. Over the next twenty years new voices were raised in support of teaching a more multidisciplinary form of forestry. At the 1947 SAF annual meeting, for example, Walter Mulford from the School of Forestry at the University of California at Berkeley argued that the increasing demand to manage forests for their "many and varied uses" required educational curricula that more broadly trained professionals. Concurring was H. Dean Cochran, head of the Forest Service's Division of Personnel Management: "Phases of wildland management other than tree forestry should be recognized as full brothers to tree-forestry in a widely inclusive profession" (Hirt 1994); similar pleas could be heard through the 1970s. But those who advocated broadening the forestry curriculum found their arguments went for naught. During the succeeding decades, the Forest Service and private companies dedicated themselves to getting out the cut to meet the post-war urban housing boom, and therefore hired silviculturalists and road engineers (Hirt 1994). In response, most SAF members favored an accreditation process that insured the continued instruction of the five core fields – silviculture, forest protection, management, utilization, and economics – that Harry Graves had proscribed decades earlier; in this environment, courses on forest ecology and wildlife management were rare commodities (Miller 1994). Despite efforts to reform the profession, at the mid-twentieth century it remained a highly technical specialty.

Studies in Green

That began to change during the 1960s. Internal and external critics continued to demand the teaching of a more ecologically sensitive forestry, but now their criticisms dovetailed with a pronounced shift in student interest, which in turn was in reaction to the emergence of a powerful environment movement (Hays 1997). Educators responded, beginning to market “a variety of courses and curricula in environmental fields,” including forestry. The discipline was “sufficiently environmentally oriented to attract a large number of majors as well as masses of students from other majors who were seeking electives with an environmental flavour” (DeSteiguer and Marrifield 1979). Evident in a land-grant institution like the University of Minnesota, a private school like Yale, and the tiny undergraduate-only program at the University of the South, these new course offerings were designed to provide a more interdisciplinary forestry education that would result in enhanced employment opportunities. Although researchers concluded that the environmental impulse had left “a permanent mark on forestry education,” they also reported that by the late 1970s enrollment pressures had eased, and the “rapid expansion of environmental course offerings had ended.” This change was perhaps a result of an “‘environmental backlash’ on the part of students and faculty as they examine the social and economic trade-offs resulting from extreme environmental pressures,” (DeSteiguer and Marrifield 1979).

The green revolt proved more durable, however, than it may have appeared in the late 1970s. Undergraduate enrollment in forestry programs continued to grow rapidly through the mid-1980s and graduate enrollment climbed until just before 1990 (Skok 1996); by the early 1990s, those numbers were on the rise once more. Throughout this period of growth, the marketing of the discipline to a more ecologically conscious student body kept pace. The number of environmentally based courses increased to the point that many formerly straight “forestry” colleges, departments, or programs had begun to add “environmental” to their name in the early 1970s. Yale became the School of Forestry and Environmental Studies (1972); Duke’s underwent a similar alteration in 1974, emerging as the School of the Environment in 1991. The many schools of “Natural Resources” were another reflection of the symbolic and real changes in curricula and academic orientation.

The value of these changes remains hotly debated and continually reassessed. Every few years a new study has taken the profession’s pulse (Duncan 1975; Duncan et al. 1989; Brown and Lassoie 1998), examined the ever-more varied roles that foresters have filled, agonized over accreditation of forestry schools, and concluded that the term *forester* has lost much of its former meaning. Inevitably, this seeming loss of definition has led to the dire conclusion that the profession was (and is) in the midst of an “identity crisis” (Duncan et al. 1989).

But is crisis the apt term? The relentless self-questioning has been productive, after all, requiring professional educators to examine much more closely what their field is, how it operates within dynamic educational systems and political arenas, and how it responds to shifts in employment patterns. Surely this is a sign of the discipline’s ongoing health, one marker of which is its ability to help succeeding generations of foresters evolve so as to maintain what one industrial employer has argued is the “social license to practice forestry”

(Sample 1998). Renewing that license always has been a necessary part of the foresters' social compact, and not surprisingly has been central to the century-long struggle to define the character and purpose of American forestry education. It is no shock, either, that this past has been contentious, for the contests began the moment Gifford Pinchot, Carl Schenck, and Bernhard Fernow launched the profession's first schools.

AN ASSESSMENT OF FORESTRY EDUCATION BY EMPLOYERS AND RECENT GRADUATES

An independent survey research firm was retained to assist in developing and conducting surveys of forestry employers and recent forestry school graduates. The surveys were designed to: (1) identify the skills and competencies that employers rate as being most important, and that new practicing professionals find they most need, and (2) measure the perceptions of employers and recent graduates on how well forestry programs at U.S. colleges and universities are imparting these skills and competencies.

Comprehensive lists of both general skills and specific technical competencies were developed for use in both the employer and recent graduate surveys. These lists were based on forestry attributes identified in other recent studies of forestry education needs (Duncan et al. 1989; Brown and Lassoie 1998) and events such as the 1991 Denver Symposium on Forest Resource Management in the 21st Century (SAF 1992). Further input came from processes such as the Seventh American Forest Congress (Bentley and Langbein 1996), in which a broad cross-section of Americans articulated their vision for forest management and the future of the nation's forests.

Methods: Employer Survey

For the employer survey, a list of 500 forestry employers was developed from various sources, including all the member companies in the American Forest and Paper Association, every state forestry agency, every National Forest, and every member of the Association of Consulting Foresters employing at least three professional foresters. Furthermore, employers with small businesses and non-profit organizations were identified through directories including the Random Lengths Buyers and Sellers Directory of the Forest Products Industry, the National Network of Forest Practitioners, and the Forest Steward's Guild. The employers were predominantly high- or mid-level members of their organizations.

Attempts were made to contact the entire list and conduct a telephone interview. Employers were initially asked questions to ascertain whether their organization had hired any forestry school graduates in the last five years and whether they personally had participated in the hiring process or supervision of those graduates. Employers who fulfilled those qualifications were asked to rate the importance of each of seven general skills on a scale of one to ten. These seven skills were designed to correlate with the visions and principles overwhelmingly supported by the broad cross-section of participants in the Seventh American Forest Congress. In the interest of aiming the study at employers who would support the views regarding forests and forestry reflected at the Congress, those employers who rated those skills higher than a pre-determined baseline were then asked a more detailed set of questions. This step was not designed to discriminate against any particular sector; in fact, the interviewees that fell below the baseline were divided fairly evenly among the various sectors. Furthermore, all responses to the question regarding the importance of the seven skills were included in the results.

The employers were then asked to rate each of 29 technical competencies on a scale of one to ten, and were also asked to indicate the level of education (baccalaureate, graduate, or continuing education) at which they expected each of these skills and competencies to be gained. Finally, the employers were asked to provide the names of up to three forestry schools from which they recruit most often and, for each of these schools, to provide their assessment of graduates' performance relative to each of the skills and competencies. (See **Appendix B for the complete employer questionnaire**).

Methods: Graduate Survey

To reach recent forestry graduates, all employers who participated in the telephone interviews were asked to distribute standardized questionnaires to their employees who had received a bachelor's or higher degree in forestry within the past five years. Rather than surveying students in their final semester before graduation, the Pinchot Institute focused on recent graduates because, as practicing professionals, it was expected that they would be better able than current students to accurately assess how well their education has prepared them for the actual demands of the workplace. The disadvantage of this approach is that recent graduates are far more difficult to locate than students that are still on campus, since many schools find it difficult to maintain current alumni contact information.

Graduate survey respondents were asked to complete an individual questionnaire for each degree received. These surveys asked graduates to evaluate their forestry program's performance in each of the listed skills and competencies, as well as to provide their views on how well the program prepared them for their career. (See **Appendix C for the complete recent graduate questionnaire**).

Results: Employer Survey

Successful contact was made with 333 (67%) of the 500 employers on the list. Of the 333, 26 (8%) were screened out because they did not have hiring or supervising responsibility and 50 (15%) were screened out because they had not hired a forestry school graduate in the past five years. The 257 participating forestry employers represented federal agencies (29%), forest industry (24%), forestry consultants (23%), state agencies (17%), non-profit organizations (5%) and small businesses (3%). While employers from the latter two groups were included in the total employer analyses, the sample sizes of those groups were too small to draw conclusions about their sectors. Geographically, the respondents were unevenly distributed. The majority were from the West (51%) or South (31%), with a small proportion from the Midwest (11%) or Northeast (7%).

State foresters were most likely to have hired forestry school graduates in the last five years (90%), and they hired more graduates on average (17.6) than did employers in other sectors. By contrast, consulting foresters were least likely to report hiring during the past five years (81%), and they hired the fewest graduates on average (4.7).

Of the forestry graduates hired by employers during the past five years, 70 percent had a bachelor's degree, 23 percent had a master's degree, and seven percent had a doctorate. Employers from forest industry (39%) and federal agencies (37%) are more than twice as likely as consulting foresters (15%) or state government (18%) to hire graduates at either the master's or doctoral level.

Public sector employers are considerably more likely than private sector employers to view foresters as generalists. The great majority of employers from both state government (81%) and federal government (65%) define a forester as a *generalist* who works with a team of specialists to manage the entire forest ecosystem rather than as a *specialist* in some area of forest management. In contrast, only 52% of industry employers and 40% of consulting foresters hold that view (**Figure 1**).

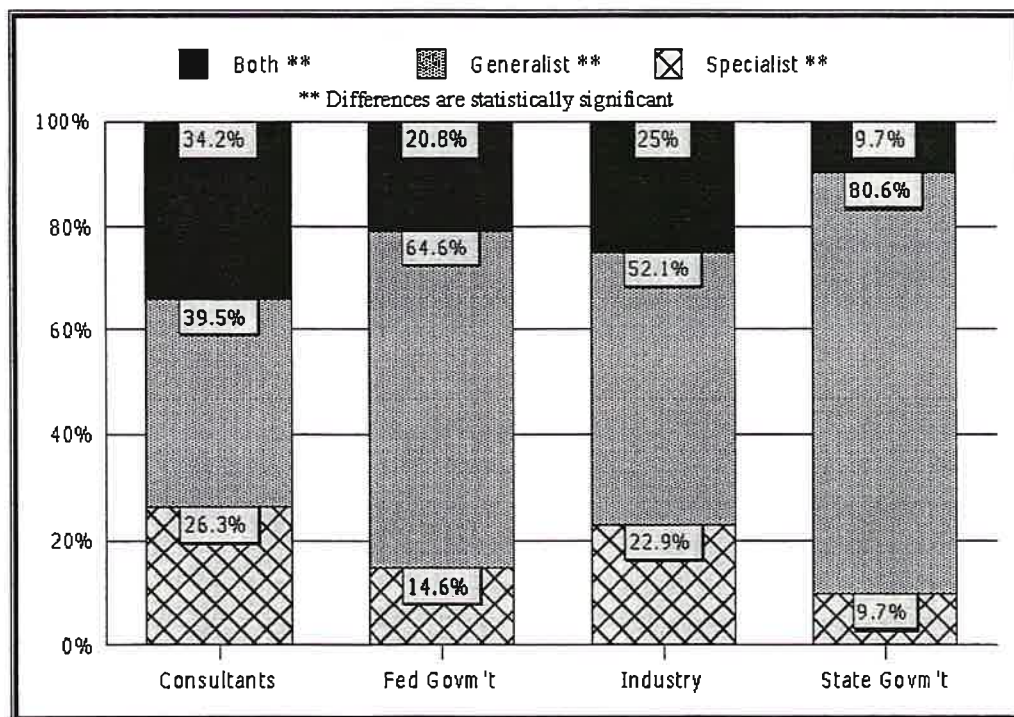


Figure 1: View of foresters as specialists or generalists by employer type.

Of the seven skills employers were asked to rate on a scale of one to ten, the ability to work in teams was the highest rated skills among employers in every sector (**Table 1**). The ability to address public concerns was rated second- or third- highest by every sector.

Table 1: Employer's Importance Ratings of Skills
(Numbers in parentheses represent the ratings on a scale from one to ten.)

- **Ability to work in teams (9.0)** -- Ability to work well in teams that include individuals with a variety of perspectives, both within and outside the organization.
- **Ability to address public concerns (8.2)** -- Ability to listen to and address public questions and concerns and to explain the principles of environmentally responsible forest management practices to the public.
- **Understanding of sustainable ecosystem management (8.0)** -- Understanding of the requirements of a healthy forest ecosystem, and the full variety of silvicultural and other tools available to manage that system sustainably.
- **Innovative approaches to forest management (8.0)** -- Innovation - critical thinking and willingness to test new and non-traditional approaches to forest management.
- **Innovative approaches to working with the public (7.7)** -- Ability to utilize innovative approaches to working with the public to address forest management problems.
- **Ability to evaluate and synthesize information (7.5)** -- Ability to evaluate and synthesize input from a variety of specialists when developing resource management plans.
- **Landscape-level understanding (7.3)** -- A landscape-level understanding of forest ecosystems and how to manage them to meet ecological, economic, and social needs.

Forestry employers in all sectors continue to rate the importance of traditional field forestry competencies such as silvicultural systems (8.4), forest ecology (8.0), forest inventory/biometry (7.8), and tree/plant species identification (7.7) relatively high (**Table 2**). However, the competencies given the top three ratings by employers in all sectors were ethics (9.3), written communications (9.2), and oral communications (9.1). Also highly rated were managerial leadership (8.2), collaborative problem solving (8.2), and resource management planning (8.0).

Although there was general agreement among the sectors as to which competencies rated highest, some sectors favored certain competencies more than other sectors did. Consulting foresters, for example, ranked forest science/management competencies (such as tree/plant species identification, forest inventory/biometry, forest pathology, and others) comparatively higher than the other three sectors did. Federal government employers, on the other hand, gave relatively higher ratings than the other sectors did to organizational management competencies (such as alternative dispute resolution and human resource management).

Table 2: Employers Ratings of the Importance of Technical Competencies
Numbers in parentheses represent the ratings on a scale from one to ten.

Ethics (9.3)	Alternative Dispute Resolution (7.3)
Written Communication (9.2)	Fire Dynamics (7.3)
Oral Communication (9.1)	Organizational Development (7.2)
Silvicultural Systems (8.4)	Forest Soils (7.2)
Managerial Leadership (8.2)	Resource Policy/Law (7.0)
Collaborative Problem Solving (8.2)	Wildlife Biology (7.0)
Resource Management (8.0)	Government Relations (7.0)
Forest Ecology (8.0)	Forest Pathology (6.8)
Forest Inventory/Biometry (7.8)	Conservation Biology (6.8)
Landscape Analysis/GIS (7.7)	Forest Engineering/Transportation Systems (6.3)
Tree/Plant Species Identification (7.7)	Rural Community Development (5.9)
Human Resource Management (7.6)	Wildland/Protected Areas Management (5.8)
Watershed Management (7.6)	Range Management (4.3)
Resource Economics (7.5)	Foreign Languages (3.6)
Financial Management (7.5)	

The employers' ratings of forestry programs reveal that employers are moderately pleased (7.8) with the overall performance of the graduates that they have recruited, with industry giving the highest rating (8.3) of all the sectors. However, for several of the seven skills, there are gaps between employers' importance ratings and their ratings of graduates' performance (**Figure 2**). The largest skill gaps, from the employers' perspectives, lie in the ability to work in teams and the ability to address public concerns.

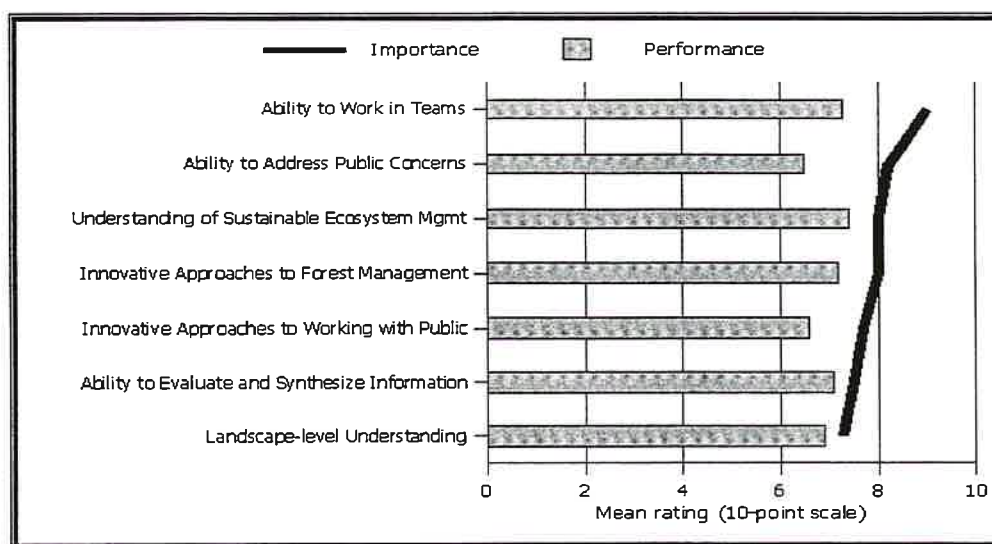


Figure 2: Employer's ratings of the importance of skills needed for long-term success in forestry versus the performance of graduates

The employers' performance ratings of graduates in many of the 29 technical competencies also fall short of the employers' importance ratings. Other than tree/plant species identification, all of the competencies for which gaps exist involve communicating with and managing people. These competencies include written and oral communication, managerial leadership, collaborative problem solving, organizational development, alternative dispute resolution, and government relations (Figure 3).

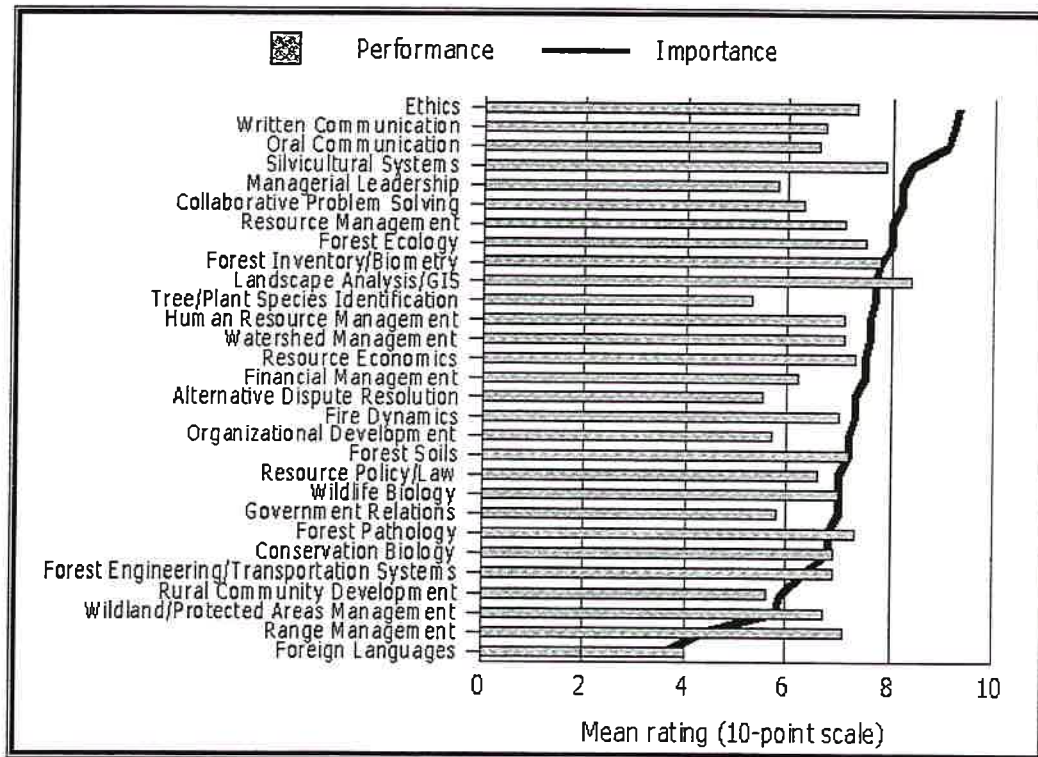


Figure 3: Employer's ratings of the importance of technical competencies needed for long-term success in forestry versus the performance of graduates

Employers are much more likely to expect employees to have acquired the majority of the 29 technical competencies at the undergraduate level than at the graduate level (Figure 4). At least three-quarters of employers expected undergraduates to acquire the following eight competencies: tree/plant species identification (93%); written communication (86%); forest inventory/biometry (86%); silvicultural systems (85%); forest soils (80%); ethics (79%); oral communication (78%); and wildlife biology (78%).

However, employers do not expect that all of the skills they consider to be most important, such as managerial leadership and collaborative problem solving, will be acquired at the undergraduate level. Although employers look to graduate education to provide many of these competencies, many are increasingly looking to extension and adult continuing education to help practicing professionals to build these skills throughout their careers.

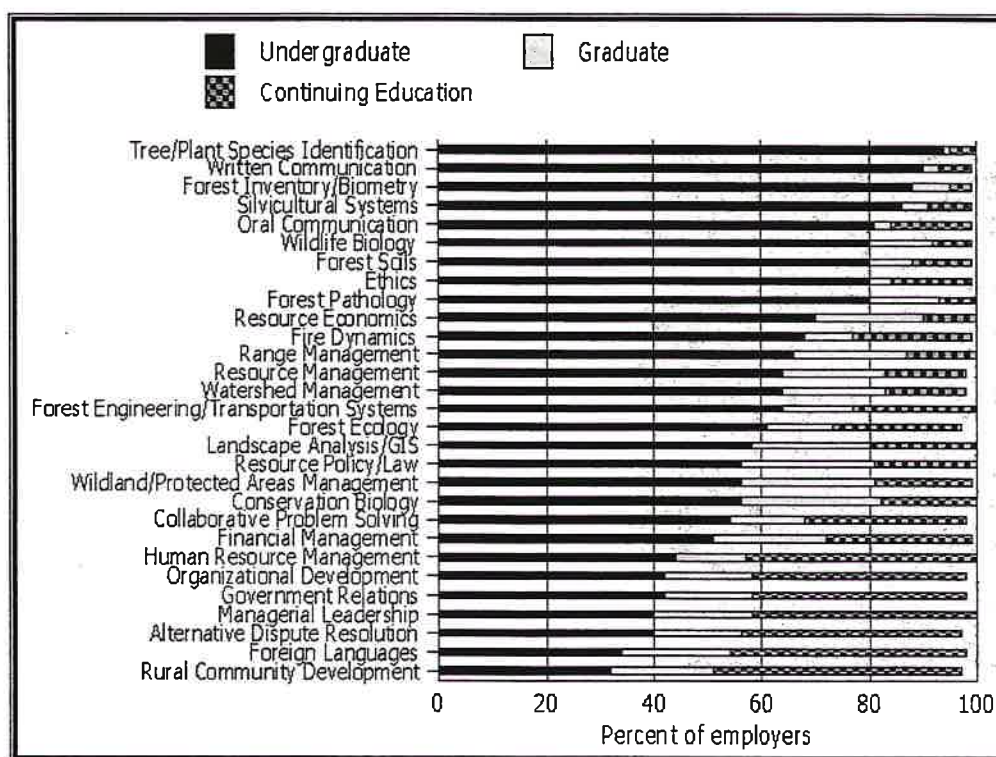


Figure 4: Educational level at which employers expect technical competency to be gained

Employers' recruiting preferences indicate that two-thirds of western employers recruited new hires from at least one school in their region, compared to 37 percent of southern employers, 24 percent of mid-western employers, and eleven percent of northeastern employers. Furthermore, southern employers (49%) are most likely to recruit from schools in the West, while northeastern (61%) and mid-western (55%) employers are most likely to recruit from schools in the South.

Results: Graduate survey

A total of 265 forestry graduates participated in the survey. Eighty-five percent of the survey respondents have bachelor's degrees, while 14% have master's and only 1% have doctoral degrees. Although 41 different programs were evaluated by recent graduates of those institutions, the sample sizes for individual programs were too small to provide a school by school analysis.

On average, graduates gave their schools a moderately positive overall rating (7.5), similar to the 7.8 rating that employers gave to schools from which they recruit. Graduates rated their programs highest on imparting an ability to work in teams (8.1) and understanding of sustainable ecosystem management (8.0), and lowest on teaching innovative ways of working with the public (6.5).

There were significant gaps between employers' ratings of the importance of certain competencies and the proportion of graduates educated in those subjects, particularly management and problem solving competencies. The greatest gaps are in managerial leadership, collaborative problem solving, human resources management, alternative dispute resolution, organizational development, government relations, ethics, and rural community development (Figure 5)

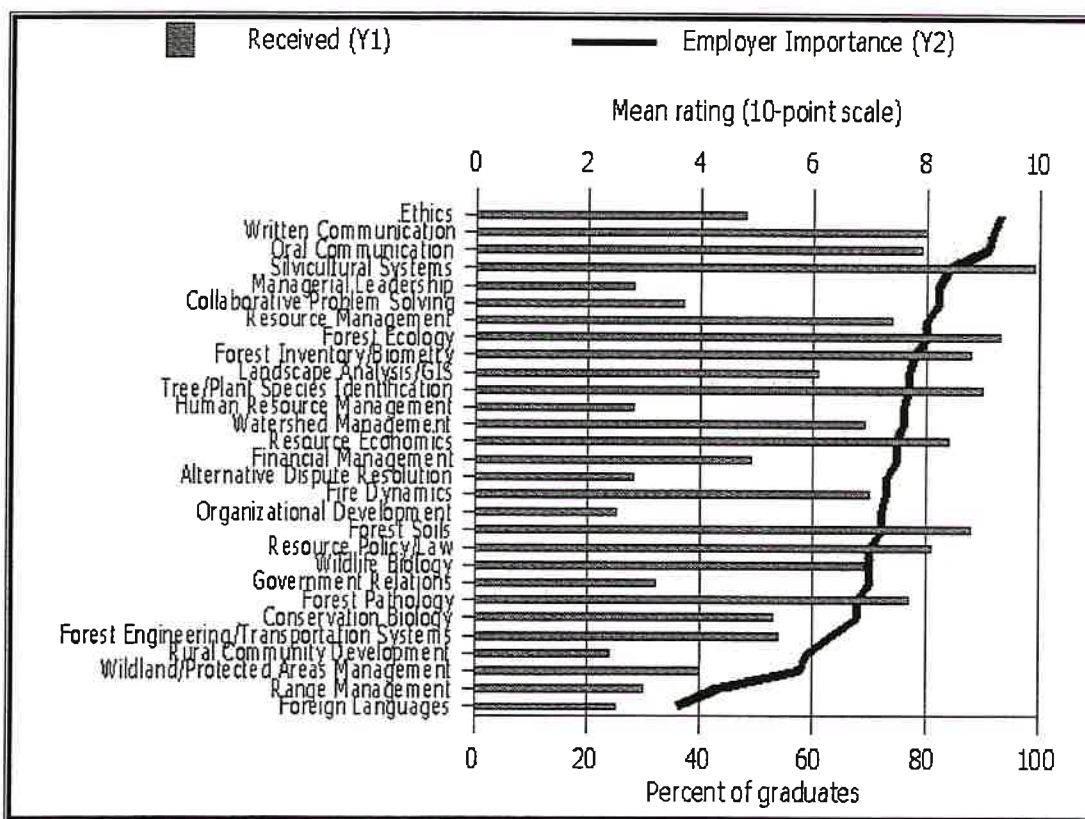


Figure 5: Comparison of employers' ratings of the importance of technical competencies with the percentage of graduates educated in those areas

The survey also revealed which competencies were generally available in the forestry school, and which competencies were gained through other departments. Nine out of ten graduates indicated that courses in technical areas such as silvicultural systems, forest inventory/biometry, tree/plant species identification, and forest ecology were available within their forestry school. However, more than three-quarters indicated that courses that covered oral and written communications could only be found by going outside the forestry school to other departments on campus. In rating the education that they received in the 29 competencies, graduates rated competencies higher when they received that education in the forestry school than in other departments (Figure 6).

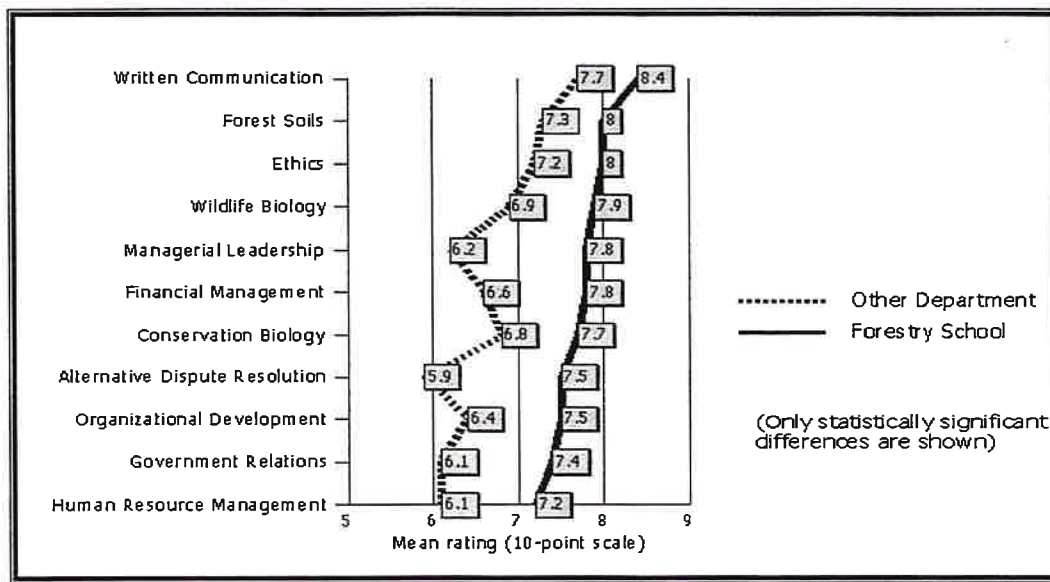


Figure 6: Graduates' ratings of the competencies gained in forestry school versus those acquired in other departments.

Analysis

In the views of both forestry employers and recent graduates now practicing forestry, a thorough grounding in the array of technical forestry skills is no less important today than in the past. However, the growing public visibility of forest management, and the importance of broader social, economic, and ecological considerations in forestry decision making, have greatly increased the need for competency in communication, ethics, collaborative problem solving, and managerial leadership.

On average, both employers and graduates rate the performance of forestry education programs in these areas low relative to the importance with which they are judged. But while gaining these kinds of skills may have been optional in the past, it is now virtually required to be successful as a practicing professional forester, whether in government, industry, or private consulting.

There are several interesting contrasts between the private sector and the public sector. Employers from state and federal agencies perceive foresters to be generalists, more so than employers from industry or the consulting field. Furthermore, federal government employers place higher emphasis on the importance of organizational and management competencies than do employers from the private sector. Although these differences may result in divergent hiring practices, the study certainly found more commonality among sectors than differences.

Geographically, the majority of employers surveyed were located either in the western or southern regions of the United States. It is likely that those regions of the country

include the majority of large forestry employers, whereas the northeastern and midwestern regions consist of numerous small employers. Due to the survey requirement that employers needed to have hired a forestry school graduate in the last five years, the study may have unintentionally discriminated against small organizations in the northeastern and midwestern regions.

Nonetheless, the geographical data on recruiting patterns raises some provocative questions. Why are forestry employers so often seeking forestry school graduates outside of their region? The survey sample size is insufficient to make valid interpretations regarding employers' specific recruiting preferences. It is possible that employers seek students outside of the region in order to gain foresters with outside perspective. It may simply be that employers seek the best graduates, regardless of the region of the country in which they completed their education.

Forestry educators may not be surprised at the importance that employers place on skills like communication and problem-solving. Previous studies (Brown and Lassoie 1998; APA 1987) and symposia have articulated the need for schools to emphasize these skills to a greater degree. Furthermore, the importance placed on communication skills and other cognitive/interpersonal skills resonates not only with other studies on forestry education, but also with studies on general education (Hersh 1997). But as the forestry profession prepares to enter a new century of forestry education, these results suggest that forestry programs should continue to explore and evaluate the skills and competencies that they are imparting to future forestry professionals.

THE EXTERNAL CHALLENGES FACING FORESTRY SCHOOLS

Forestry school program heads are under colossal pressures that are coming from multiple directions to change the way they do business. Many of these pressures are helpful, assisting schools to react to the changing job marketplace for their students. Others create tension, as when states attempt to rein in university costs, and demand more accountability that student success is assured. These things are happening in the face of a growing body of scientific knowledge about forest land use that makes educators wonder whether students should be graduated with a knowledge base that is a mile wide and an inch deep, or whether traditional forestry skills should dominate a four-year forestry program.

Program heads have a duty to their students to prepare them to fulfill their calling as accomplished practitioners of the arts and crafts of forest management. Unlike many other college alumni, forestry school graduates are expected to have a quiver full of practical skills for immediate use upon graduation.

To add to the problem, employers and alumni of forestry schools have been thinking up new qualities that they would like forestry graduates to bring to the job. At the 1991 Forestry Education Summit in Denver, many school officials complained that it was becoming increasingly difficult to give students adequate preparation for their profession in four years. It was not possible, they said, to give students an education of core subjects in the liberal arts; to teach forestry fundamentals; and to provide the broad range of integrative skills increasingly demanded – all in four years.

At a time when forestry programs are urged to offer students even more than in the past, schools are faced with enormous external challenges, such as reduced state funding, outcomes-based education, diversification, and distance-learning, that are increasingly making forestry education that much more difficult.

The Crisis in Funding for Higher Education

Traditionally, states have funded public higher education based on anticipated enrollments, current costs, and inflation. State-funded flagship universities were a guarantee of the future, and an assurance that college graduates would stay home to become productive, patriotic citizens who would help to make their state societies and economies greater every year.

That original premise seemed a good one, but over time graduates in the upper Great Plains and some Intermountain and Southern states began to learn that there were no comparable jobs in their home states to match the skills they had learned in school. Off they went to places like Chicago, Denver, and California to seek their fortunes. The taxpayers that had subsidized their learning soon began to figure out what was happening to their investment.

By 1976 the bubble had burst. Inflation was rampant, and government spending at all levels seemed out of control. Then in 1981 the country was in a deep recession and the federal government was plunging into trillions of dollars of public debt to finance greater defense capabilities to overwhelm the Soviet Union. State spending priorities were driven by new citizen demands. In-state public university tuition doubled in many places.

Since 1976 there has been a crisis in the funding of public post-secondary education (CAE 1997). In 1994, the Council for Aid to Education, a subsidiary of the RAND Corporation, created a Commission on National Investment in Higher Education. The new commission's report was dire. "What we found was a bomb ticking under the nation's social and economic foundations," the report said. "At a time when the level of education needed for productive employment is increasing, the opportunity to go to college will be denied to millions of Americans unless sweeping changes are made to control costs, halt sharp increases in tuition, and increase other sources of revenue." It added that the deficits facing higher education in the near future "are more critical than the much publicized crisis in the Social Security System" (CAE 1997).

The situation was recently documented by Timothy Eagan in the *New York Times* (Eagan 1999). Eagan reported that since 1985, the nation's jail and prison population has grown 130% and will soon surpass two million people, even as crime rates continue a six-year decline. Every week, on average, a new jail or prison is built to lock up more people in "the world's largest penal system." California alone is spending nearly \$4 billion a year to operate the nation's largest prison system, and the state added 212 prisons since 1984. Eagan wrote, "Spending on prisons has grown 60% over a decade, and pay for prison guards has more than doubled. For higher education (in California) there was virtually no growth, and salaries in the state university system stagnated, falling behind other states. A prison guard now makes about \$51,000 a year, while a first-year professor in California's once-vaunted university system is paid \$41,000. As the prison population swelled, California raised tuition to make up the university-financing gap. Over the last ten years, as the state's population grew by five million people, state university enrollment fell by 20,000."

For many decades, the publicly supported colleges and universities in Alabama have been cared for as state treasures by governors and members of the legislature. Auburn University has been treated as the school that turns out people who get the work of Alabama done. Auburn has produced a statement of "Measures of Quality" in the university catalogue to explain itself to its clients in Alabama, and outside of the state. Its statement attempts to show that the university turns out people of "accomplishment and personal merit."

However, despite the apparent equilibrium at Auburn, there has been considerable turmoil in Alabama higher education for the past several years, an unrest that goes far beyond the control of the university administration at Auburn. Some of the state's politicians have descended upon the university system of the state like avenging angels, treating it like a cash cow ready for slaughter. Former Governor Fob James called the system "over built and over funded." In 1995 the Alabama Commission on Higher Education's Academic Program Inventory listed a series of redundancies in the Alabama system, even though the state is

geographically strung out over hundreds of miles, from Huntsville in the north to Mobile in the south, with Birmingham, Montgomery and dozens of smaller communities in between.

Alabama public colleges and universities were kept on less than maintenance budgets for four years during the administration of Governor James, with no one in the system receiving raises in pay. Finally, the universities, their students, alumni, and friends developed an unprecedented, in-state political action committee to identify and organize proponents of higher education in Alabama; to advocate the importance of higher education to the state; and to "promote new leadership partnerships." Rallies were held at the state capitol, organized by this new Higher Education Partnership. Finally, in 1998 the 15 colleges and universities of the system received a small budget increase.

On its own, Auburn University resorted to a television advertising campaign to sell the school to Alabama residents (Zack 1998). A commercial showed a close-up of clear water running from a shiny kitchen faucet. Then the water slows down to a brown trickle. An announcer says, "Considering that Auburn University is responsible for the design, construction and management of water supply systems that provide clean drinking water to 85 percent of the people in our state, it seems only fair to pose this question: Where would Alabama be without Auburn?" Governor James was defeated for reelection in November of 1998.

Alabama presents an extreme case. However, throughout this decade even progressive state governors and legislators all over the nation are doing major studies and overhauls of the administration of state university systems (Stukel 1998). Far from being an anti-intellectual movement, many progressive state politicians have been trying to impose some fiscal controls on institutions that seemingly never had enough money.

Most universities are now required to be more accountable for their handling and use of money, and also for the capabilities of their graduates. The academic world, which has traditionally operated in almost a national subculture, is now being told that the product must be identifiable in terms of well-taught students, and that the schools must learn how to operate in a businesslike manner in a new world of work.

Outcomes-Based Education

Outcome-based education² is a new wave of educational theory that swept through the state school systems, grades K-12, in the late 1980s, and now it has come to forestry education at the university level. It is a collectively endorsed mission by school systems that

² See "OBE Resources," outcome-based education and curriculum change, practice and critique at www.vista.ac.za/vista/resource/obe/index.htm/. Also see "Developing Learning Outcomes and Performance Standards" at www.n-s-s.com/dlops.htm. The site is replete with essays on all sides of measuring educational performance. Most of the essays are based on experiences with outcomes-based education in grades K-12. An annotated list of educational standards by state and subject area is published by Charles Hill of the Putnam Valley Central Schools, New York, entitled, "Developing Educational Standards" at <http://putwest.boces.org/standards.html/>.

says all students will succeed by attaining specific "exit outcomes" before they are permitted to leave school. It is a complicated strategy that expects that nearly all students can succeed in school if they are held accountable for what they do through testing, and that through the repetitive nature of teaching the same things in different contexts, all students can eventually "get it" and then move on. Ultimately applied, the two possible grades are "pass" and "incomplete." The expectation is that those with "incomplete" grades will eventually "pass."

Even though this system cannot possibly operate *verbatim* in the present highly structured college curriculum and calendar -- even those with curriculum flexibility -- outcomes-based education has found its way to university campuses in many states. Many of the educators at public institutions that were contacted for this study have been directed to begin using outcomes-based education tools, or to find some other mechanisms to demonstrate what proven student benefits the states are deriving from their investments in higher education. These requirements are not casual cautions. In many states, such as Alabama and Tennessee, appropriations for higher education will be based on demonstrated outcomes, usually through some sort of student testing. Politically, performance-based educational funding is a logical evolution of outcomes-based education, which has captured the hearts of those demanding proven values derived from taxpayer dollars paid for education. The states that have adopted performance-based funding besides Tennessee and Alabama are Colorado, Connecticut, Florida, Kentucky, Minnesota, Missouri, Ohio, South Carolina and Washington. Twelve additional states and the District of Columbia are likely to adopt it soon³.

Measuring the outcomes of higher education amounts to putting all of the responsibility for quality on the universities and not the students. In the minds of some progressive critics, like Governor John Kitzhaber of Oregon, the time has come for the universities to demonstrate their worth. In a 1997 speech introducing a Higher Education and Economy Task Force, he said, "...I believe we can do a better job of making our state (university) system independent, entrepreneurial and able to respond to the changing market for education. My recommendations are to accomplish that while maintaining Oregonians' access to a higher education, and preserving our university's mission to deliver a strong liberal arts education."

As much good will as there is towards public education in nearly every state, the creation of formulas that are linked to measures of assessment lead some to wonder whether educators or politicians will shape the process of education in the long run. Critics of outcomes-based education argue that tangible, countable things often matter least in the process of education. The key to a lifetime of learning comes in different sizes for different people, and its secrets cannot necessarily be found in the answers to a pop quiz.

³ In 1995 the General Assembly of North Carolina directed the Board of Governors of the University of North Carolina to study various methods to provide "funding incentives for the campuses when they accomplish specifically stated performance goals in the improvement of the quality of undergraduate education." The idea was to find a positive element, "incentive funding" and distinguish it from "performance budgeting and accountability reporting." The Board's report is helpful because there was an extensive study of what public university systems in other states were doing. Elements of the report are available under the heading "General Administration" at the University of North Carolina website (<http://www.unc.org>).

Among the elements that establish the criteria for performance indicators are surveys of employers and alumni, retention and graduation rates, job placement, state licensure examination scores, administrative costs, and time required to attain a degree. Selection of performance indicators and success standards are seen as the major difficulties in establishing performance-funding measures.

Performance standards that drive state budgeting are emerging virtually everywhere. There has not yet been time to determine whether they are in any way workable. But the education industry is trying to give the policymakers what they want, whether or not, as some suspect, it is all a scheme to produce data for its own sake. Educational thinkers of all political stripes are doing serious studies on ways to enhance the quality and use of students' outcomes data. The National Postsecondary Education Cooperative is working on processes for identifying useful outcome measures for policymaking. Special attention will be given to cognitive development and occupational preparation, and of developing new ways to assess job-related skills, student transitions, and work-based experiences.

Much of this work to evaluate the quality of output from state-supported higher education, and then potentially translating that data into financial rewards and penalties, has the potential to strike at a number of levels of the existing forestry education system. Forestry education may be compelled to become even more competitive with other courses of study in terms of employer and graduate satisfaction, the cost of the course of study versus funding available, and the number of students taking classes each year. Such things as declining student populations in degree programs will not bode well for some schools in this atmosphere, perhaps even in those schools where natural resources students are successfully replacing the declining number of enrollees in forestry.

How well will state standards for forestry education mesh with Society of American Foresters accreditation standards or state licensing and registration of foresters? It is possible that SAF accreditation will set the standard for each state, making accreditation all the more important. What collisions can be expected between state standards and tenured professors who believe that what and how they teach is largely their own call? Will state political enthusiasm for the creation of primarily on-the-ground foresters conflict with the education careers of students who wish to go into research and teaching?

Cultural Diversity and Student Access

The apparent difficulties that forestry schools are having in attracting minorities will surely have considerable impact on the future of forestry education. While the size of the student population of the nation's public colleges and universities has hardly changed over the past six years, its racial/ethnic composition has shifted substantially. According to the American Association of State Colleges and Universities (AASCU), the enrollment of racial and ethnic minorities increased 24 percent at all public four-year institutions between the fall of 1990 to the fall of 1996, while the enrollment of white, non-Hispanic students declined over the same period (AASCU 1999). In California, minorities are already the majorities in

primary and secondary schools. Women are already the majority among all undergraduate college students.

According to AASCU, the change can be traced to demographic and policy developments, including the expansion of institutional efforts to recruit and retain minority students, significant growth in the number of high school graduates from racial/ethnic minority groups, and changing immigration patterns. Minority groups posting the largest percentage gains over the period were Asian Americans, followed closely by Hispanic Americans and native Americans. Projections for the future, based on expected high school graduates, suggest that the pool of enrollees will become even more diverse in the years ahead.

A 1995 study by the American Council on Education, however, indicated that only 34 percent of public university administrators ranked their schools high in the ability to attract African American students, and only 21 percent ranked themselves high in attracting Hispanic students.

While there has been a sizeable increase in the number of women attending forestry schools, at many institutions they are less than a significant minority. Even though there is a growing trend in America to eliminate equal access rules for enrollment of minority students, the people who run the forestry schools are thinking hard about their future enrollments. The AASCU regional enrollment trends suggest that while in some areas overall enrollments will explode, in others, already small forestry departments will have a difficult time keeping all of their present degree options available if current ratios of white to minority students remain the same.

The National Association of Professional Forestry Schools and Colleges (NAPFSC) Strategic Plan, cites a 1997 report of the Food and Agriculture Education System (FAEIS) that says only seven percent of the nations forestry students are minority persons. The report states, "The prospect for increasing minorities in professional forest resource careers will not improve until more of them pursue forest resource degrees at NAPFSC institutions. Informing minorities about the array of careers in forest resources is a challenge to be addressed by NAPFSC in cooperation with the agencies and private sector who employ forest resource professionals" (NAPFSC 1998).

Several forestry education administrators surveyed indicate that they have spent a disproportionate amount of their time unsuccessfully trying to recruit minority students. Critics, however, say that unless there are women and minority members of the faculty, minority students will not show up. The same critics say that even when women and minority faculty are hired, they sometimes do not last long because of unfriendly environments.

A report by the National Association of State Universities and Land Grant Colleges (NASULGC) says, "Access to our institutions will become one of the defining domestic policy issues in coming years... Some of our flagship institutions are trapped in a zero-sum game in which they are unable to offer admission to all qualified students... Americans need

to know that access must be broadened because the practical economic need for diversity on our campuses is too compelling to ignore.” (NASULGC 1997)

Virtual Universities and Distance Learning

A study by the U.S. Commerce Department says that traffic on the Internet is doubling every 100 days, and predicts that electronics commerce will grow to \$300 billion a year by 2002 (USA Today 1998). *Business Week* reported that “The nation's top business schools have long scoffed at the idea that they could teach capitalism's secrets without a live, pipe-smoking professor in front of the class. No longer. Instead of denigrating companies that offer Internet-based courses, elite institutions, such as Harvard business school, are investing in them” (Business Week 1998)

According to the article in *Business Week*, Harvard Business School is working with a two-year-old start up company, Pensare, Inc., of Los Altos, California, to develop on-line courses with the school's publishing arm. Pensare is also working with the Wharton School of the University of Pennsylvania on executive education courses.

“Educators and policy leaders envision a new approach to instruction based on communications and computer technology, using On-Demand Learning and learner-centered instruction,” according to an IBM promotional piece. New technologies will allow the states to get control of the two most expensive cost factors in higher education: new and critical scientific applications like Geographic Information Systems that necessitate the addition of new faculty, and the expected cost of increasing productivity by learning outcomes.

“The combined effects of new technology and a changing economy directly challenge many of the assumptions and foundation upon which states...have built their regulatory, organizational and financial policies governing higher education,” according to Sandra Ruppert, a research associate with the State Higher Education Executive Officers (Rupert 1997). She says that bold leadership will be called for to harness market forces and come to terms with emerging social, technological and financial issues.

Many of the larger states are responding by creating virtual universities using the Internet. The Western State Governors University was recently joined by the State of Indiana, and others are seeking entry. The Southern Regional Education Board in 1997 created a virtual university for the South that now offers more than 1,000 courses and 25 degree programs. More than 50 colleges and universities in 15 states are participating. One of the goals of these virtual schools is to regionalize certain courses so that teaching staff can be reduced. Even the smallest schools will be able to offer course material taught by big names at the flagship universities. As yet there are only a few forestry courses being offered.

IBM estimates that the shelf life of a technical degree today is only five years, and the pace of knowledge advancement will require constant updating. On-demand learning will provide many opportunities for “re-skilling” workers through distance learning on the

Internet, but not a large number of forestry schools appear to be preparing for these eventualities.

Forestry schools are generally tied to places, either individual states or landforms. Faculty administrators may, however, be required to distinguish between those courses that can be delivered through the Internet, and those that can only be taught on the ground. Undoubtedly, there will be those who argue that regular interaction between teachers and students, that is so important to a good education, cannot be duplicated on computer terminals. They will say that distance learning is a two-dimensional exercise that processes information but does not transfer wisdom and judgement.

That may be true. But assuredly, forestry schools are going to have a difficult time trying to fit into the new design of higher education that is emerging. As the pressure to process students in and out in four years "or else" comes from the legislature while at the same time new science and technologies continue to surface, "lifetime learning" may provide a major long-term solution for schools of forestry. Yet too few schools are thinking ahead to consider this potentially large market for supplemental in-career training for foresters, and what role distance learning can play in making this happen.

ADAPTING TO CHANGE AND SOLVING PROBLEMS: HOW FORESTRY SCHOOLS ARE HANDLING THE CHALLENGES

As a part of its study on forestry education, the Pinchot Institute for Conservation engaged in an examination of the 48 forestry schools accredited by the Society of American Foresters (SAF). The Institute also looked at several additional schools where forestry studies are offered, but the programs are not SAF accredited. Since the study did not allow for campus visits and other criteria by which to make meaningful value judgements about each school, the Institute relied heavily on assessments by the schools of their own strengths and specialties.

The information on schools came from questionnaires that the Institute sent to each dean, from college catalogues, brochures, and websites, and from strategic plans and external reviews provided by the schools. The Institute sought information about what made each school unique and what each school hoped to impart to its students. More than anything else, the focus was on delving into the curriculum changes that have been instituted at each school in the last decade, in response to developments in the forestry profession and external challenges.

Not every school is written about in this narrative, and some are covered in more detail than others are. **(See Appendix D for short profiles on each school.)** Some of the schools are unique in the ways they have focused on making changes. Some provide interesting contrasts in how different institutions have dealt with the same problems.

Two messages came through during this survey: 1) Change is rampant throughout virtually every undergraduate forestry program. Change has either occurred within the past five years, or it is just getting underway. 2) The fundamental struggles that were addressed at the Education Summit in Denver in 1991 are still being engaged in because of additional pressures from the states to limit bachelor's degree programs to fewer credit hours. At the same time faculties see the need for additional education to adapt the curriculum to changes in science and technical knowledge; to adapt to the changing world of employment in forestry; and to cope with formidable external demands.

Most programs are attempting to assess their performance through feedback from alumni and employers. Sixty percent of the forestry program heads that responded indicated that they have conducted alumni surveys in the past, and several more are in the process of developing surveys. More than half indicated that they also utilize an advisory committee, often consisting of forestry employers, to assist in program and curricula planning.

The Pinchot Institute for Conservation has been cautioned many times that measuring the performance of forestry schools from one end of the country to the other is impossible, and it is. With a half dozen or so exceptions, the large majority of all the forestry departments, schools and colleges attract undergraduate students from the states and regions where the schools are located (although not necessarily their graduate students), and, as such,

are intricately tied to their respective regions. For instance, the University of Massachusetts (UMass) Department of Forestry and Wildlife Management (now the Department of Natural Resources Conservation) states that they “provide a well-balanced curriculum of technical training in resource management, forest biology, and exposure to the social and behavioral sciences and the humanities. What distinguishes this program from other forestry schools is the emphasis on forest problems unique to the Northeast, and specifically to Massachusetts, where forest issues are entwined with those of a large human population.” Furthermore, forestry is splitting up into specialties, just as medicine has evolved over the course of decades, and comparing a school that is strong in silvicultural techniques to one that emphasizes watershed management is a futile task.

Forestry education in America has changed a great deal in the past decade, and it is changing still. More than ever, forestry programs are recognizing the need for a focused vision. The introduction to the 1998 UMass Strategic Plan, for instance, describes the way things used to be at that school:

“The Department of Forestry and Wildlife Management lacks a current strategic plan which will identify what the department will be in the year 2003. Although two programs within the Department have drafted strategic plans over the past 10 years, there has not been a comprehensive plan developed for over 10 years. Changes in university and college missions...economies, and levels of environmental awareness (that) have occurred over the past 10 years are likely to continue to occur over the next few years at UMass, in the region and in the country. To be effective in this changing environment we must have a clear and collective vision of our future.”

Part of the Strategic Plan involved changing the name of the Department of Forestry and Wildlife Management to the Department of Natural Resources Conservation, which at least superficially spells “integration.” In January of 1998, the faculty got together for a day-long retreat to identify the current strengths of the Department, and to catalog profitable areas for investment over the next five to ten years. They began by identifying areas of emphasis that in combination characterize the department now and in the future. Within each area of emphasis, there are issue-driven target areas where the department would like to invest in future faculty to fill in some of the bare places that showed up as the integration process was being formulated.

The story of the change that occurred at UMass is very similar to what has occurred around the nation as school after school has become involved in strategic planning. The differences between the schools are the processes used to affect change, and the emphases that are placed on various subjects, as faculty committees across the country struggle to balance a core liberal arts curriculum with a technical curriculum.

Change Comes to Auburn

In recent years, change has been a way of life at Auburn University. According to Associate Forestry School Dean George W. Bengtson, the faculty of the School of Forestry

undertook a substantial revision of the undergraduate curriculum in 1995 to meet internally identified needs, as well as those seen by the employers of Auburn graduates. The school is currently involved in another revision to accommodate for the university's shift from a quarters system to semesters in 2001. As before, input from the school's Advisory Council will be sought in making curriculum changes. The Advisory Council is made up mostly of employers who confer frequently with the faculty. Although students are not directly involved in curricula development, they will be surveyed five years after graduation.

Writing about the 1995 reorganization, several faculty members noted "If forestry is confused about its identity, and we think it is, that confusion will be reflected in forestry education and curricula. The confusion is an outgrowth of the intense conflict over which ideals and demands -- commercial and utilitarian or esthetic and ethical -- should guide forest use and forestry education. For forestry education and thus forestry to succeed, they must build opportunities for reconciliation and accommodation" (Flick et al., 1995).

As part of their research that led to reorganization, the authors found four types of programs at other forestry schools: 1) Forestry in a context of a larger whole, wherein forestry becomes a part of something more comprehensive such as natural resources, ecology or natural resources focus; 2) Multiple curricula (e.g., timber management, recreation, and wildlife), allowing students to make their own choices, frequently with an advisor's approval; 3) A totally integrated curriculum, abandoning traditional forestry subdivisions and disciplines to create new ones suitable to their visions of today's forestry applications; 4) The addition of new required courses to a traditional forestry program, nearly eliminating electives in the process.

Auburn chose none of those routes. The authors wrote, "The forestry profession needs a better approach. First, forestry education needs to embrace simultaneously the modern emphasis on non-timber forestry and the profession's traditions. Timber is and will be important. It will continue to pay many bills. Yet it is impossible to deny the explosion of interest in preservation, ecology and related concerns." Secondly, they wrote, the doors of forestry must be opened wide to women and minorities who will bring with them different kinds of perspectives. "Third, and perhaps most difficult to articulate, forestry educators and professional foresters should restrain their tendency to control the ideology of others involved with forestry. This point is difficult to accept... In education, relinquishing control means empowering student choice."

At Auburn the decision was made that curriculum reform could both open up the profession and at the same time maintain a link to its traditions. They compressed most of the required forestry courses into one academic year, creating a professional core of work common to all forestry students. The faculty then created 14 concentrations with 80 different courses. Students must select two concentrations, one of which has to be either "forest resources" or "forest operations." The professional core is referred to as the "Theory of Forestry," which centers around biology, economics and measurements. The Theory of Forestry is an integration of core scientific principles into a unique whole that explains and predicts forest behavior. The authors wrote, "When integrated, these disciplines can serve commercial or esthetic ideals -- neither has a monopoly over the minds of young foresters.

Compressing the Theory of Forestry into one year gives opportunities for coordination and integration.”

In addition to developing internal responses to changes in the forestry profession, Auburn found itself one of many state universities where “outcome-based education” was imposed as part of a strategic planning exercise. Several goals were listed for the school, and under each of the goals is a set of measurable objectives that are supposed to make the forestry program relevant unto itself, as well as an integral part of Auburn University. The strategy contains four protocols:

1. To secure from the Board of Registration of Foresters in Alabama the success rate of Auburn graduates on the board's annual certification examination;
2. To secure from the Student Services Office data on success in initial professional forestry employment, or acceptance into graduate programs within six months of graduation;
3. To secure via survey to be conducted in 1999, and at five-year intervals thereafter, information from alumni on their employment history, and their assessment of strengths and weaknesses of the curriculum;
4. To secure via survey to be conducted in 2000, and at succeeding five-year intervals, assessment information from employers that coincides with the alumni survey.

A New York State of Mind

While forestry programs understandably differ from one part of the country to another, there are even examples where myriad approaches to forestry education are witnessed within one state.

Forests and forestry have always been important in the State of New York. Forests cover 65% of the land area in the state. Its government was the first to organize itself to deal with the problems of forestry, and it has the longest continually operating state forestry program in the nation. It had the first forest reserves set aside by law in the Adirondacks, and it had the first forestry school, founded in 1898 at Cornell University by Bernard Fernow. Fernow was active in every aspect of forestry in New York, even before he left the Bureau of Forestry to become Dean at Cornell.

Despite his efforts, his attempts to accomplish scientific forest manipulation in the Adirondacks angered many of the wealthy residents of the protected forest preserve. His attempts to pay for the costs of the forestry school through the sale of timber were stifled, and finally he was fired and the school was closed. Some have called this incident the first battle over clearcutting in America, but the neighbors of Fernow's experimental forestry plots could not abide anything about forestry, not its sights, sounds nor smells. The New York legislature decreed that there would never be another forestry school at Cornell.

What Cornell offers today is the Department of Natural Resources (DNR), headed by Dr. James Lassoie. The mission of the Department of Natural Resources is “to improve society's stewardship of natural environments and their enduring resources for human use.

We address this mission by providing leadership for four programs areas identified in the Strategic Plan for Cornell's College of Agriculture and Life Sciences (Fish and Wildlife Biology and Management; Forest Biology and Management; Human Impacted Ecological Change; and Resources Policy, Management and Human Dimensions), and by supporting many others." Although not SAF-accredited, the Department receives periodic reviews from teams sent by the Cooperative State Research, Education and Extension Service (CSREES) of the U.S. Department of Agriculture.

Lassoie says his is a strong department in "a strong college in a strong university." There is little doubt about the truth of that. For decades the Cornell College of Agriculture was a major trend-setter for American farm policy, and in some respects it still is. Lassoie says he is able to call on resources from across the campus, and "we are well known for our interdisciplinary applied scholarship, and the department's involvement in a wide and diverse number of college-wide programs supports such a reputation."

In the late 1980s Cornell's DNR revamped its undergraduate curriculum and formed a "core curriculum" which required a set of courses for all students, and opportunities for specialization in fish, forest, and wildlife science and/or management. Before the restructuring, "our curriculum better resembled what is typical of most graduate schools -- almost total flexibility, which depended on a student's interests, and advice from a faculty advisor. We still have the most flexible curriculum in the college, offering opportunities for many electives, which allows students to specialize in more traditional areas of natural resources, as well as areas such as environmental sciences/studies, environmental toxicology, policy and human dimension, ethics, international conservation, etc."

Lassoie says that DNR is teaching more "ecosystem management," and trying to integrate the disciplines. They have a major program in "conservation and sustainable development," stimulated by a National Science Foundation-funded graduate training grant, that has filtered into the undergraduate program. He added that there is a lot more emphasis on policy and human dimensions aspects of resource management.

Graduating seniors from Cornell's DNR (50-60 per year) are employed in a wide variety of environmental and natural resources professions. Lassoie explained, "(W)e do not graduate students like those from forestry schools. Linked with our flexible curriculum this means that students interested in forests can specialize in various aspects of forestry.... They seem very successful finding jobs or slots in graduate programs elsewhere. DNR's undergraduate population has grown from 155 in 1988 to 230 today. About 25% of these students are committed to forest science and management, but very few end up with traditional kinds of forestry positions."

How much freedom students will have to move between courses of study in the future is unclear. The conservatively oriented Board of Trustees of the State University of New York has adopted a new core curriculum for all of its students. Ten individual courses will be required, consisting of not only the standards like mathematics, natural science, foreign language, Western civilization, humanities, the arts, social sciences and American history,

but also less traditional requirements like basic communications and reasoning, information technology, and other world civilizations.

Fifty miles and change down the highway from Cornell is the College of Environmental Science and Forestry (ESF), State University of New York at Syracuse. William R. Bentley, Chair of the Faculty of Forestry, said that people never compare the offerings of DNR at Cornell with those of ESF. Bentley added that the focus at ESF is much like that at Auburn, teaching people to apply science for the solution of human problems; to gather facts and values and test them in real world situations.

In addition to being responsible for professional and scientific forestry education at Syracuse, Bentley and the Faculty of Forestry are accountable for the Ranger School at Wanakena. The Ranger School is the largest and oldest forestry technician program in North America. ESF is one of the largest colleges in the world focused on forests, with three engineering facilities, and faculties in landscape architecture, chemistry, applied biology and environmental studies. The undergraduate programs in forest resource management and forest technology are accredited by the Society of American Foresters.

Bentley says the public may not care much for forestry, but they care deeply for forests. He says the lessons learned at ESF after nearly 100 years are that forestry must be science based and value driven; that integration of values and scientific facts characterize successful professions in democracies; and that the next generation of foresters will be successful if they integrate these two threads. ESF's education and research goals are to understand forests -- how they function and their dynamics; to be skilled in manipulating forests and predicting the consequences; to monitor and respect citizen and landowner values of forests; and to integrate values with scientific facts and understand the limits of knowledge.

ESF has stopped trying to be "all things to all people" and cover all specialties. "We are now focusing on fewer, more broadly conceived areas of study. The five areas include Resource Policy and Management; Forest Ecosystem Science and Applications; Watershed Management and Forest Hydrology; Forest Recreation and Tourism; and Quantitative Methods in Resource Science and Management. At the undergraduate level, we are focusing on forest resource management (which involves a year at the Ranger School at Wanakena) with seven options, ranging from traditional management to urban forestry, to forest-based business, to forest ecosystem science."

Of the recent changes, Bentley notes, "We refined our strategy to concentrate on five areas of research and graduate study. These areas are at once broader and more focused than the much larger number a few years ago. More critically, they are each linked to the strengths in the college and in (the adjoining) Syracuse University. Resource Policy and Management, for example, is tightly linked to the Maxwell School for Policy and Public Administration and the School of Management. Forest Ecosystems Science and Applications is an obvious way to integrate our traditional strengths in silviculture and soils with a large and increasingly excellent faculty of organismic biology and ecology. Watershed Management and Forest Hydrology is part of a campus-wide hydrological sciences group

that also includes some Syracuse departments. Similar linkages are developing in quantitative methods and forest recreation and tourism. In simple terms we are focusing on our comparative advantages, and dropping areas where we cannot clearly be among the very best. Everyone of any size is growing much faster in areas adjacent to forestry, but not forestry itself. Thus we see ESF's environmental engineering, chemistry, applied biology and environmental studies as the growth (areas)."

Dr. Don Floyd and a small ad hoc committee led the Faculty of Forestry at ESF through a major strategic planning effort in 1996-1997 and created a more vivid vision and purpose in the process, setting forth 15 goals. But planning and strategic thinking are in constant flux at the school because of changes occurring in state spending emphasis over the past several years. New criteria are more performance oriented and more market driven.

"(Student) assessment is much more difficult than the faculty thought at the end of the strategic planning exercise. We are still looking for some instruments tied to our surveys for marketing purposes, but we gave up early on the notion of some sort of results-oriented examinations (outcome-based education). They would lead us to focus on the concrete and move away from more philosophical and abstract. Interestingly enough, the capstone integrative management courses are providing good, albeit qualitative, indicators of whether we are making progress in overall skills and ability to think critically, and integrate across wide ranges of knowledge and values. We still have a way to go."

Cornell and ESF are not the only schools in New York thinking strategically about changes in the forestry profession. Known as the College of the Adirondacks, Paul Smiths College of Arts and Sciences is located on 170 acres, 12 miles from the nearest town (Saranac Lakes, pop. 7,000). The school has about 35 classrooms, students' residences and administrative buildings. Surrounding the site are about 13,000 acres of college owned forests and lakes. The college has had Society of American Foresters accreditation of its forestry technician program for some time.

Recently, the New York Board of Regents granted approval for the school to offer baccalaureate degrees in environmental science and in natural resource management. The purpose of the degree in natural resources is to study the interaction between human society and nature in regions, like the Adirondacks, that are in protected status. The program is centered in Adirondack Park, an area that is comprised of six million acres of public and private lands. Forestry Division Head Mike Rechlin explained that "Students will gain from their studies an understanding of sustainable development and the national and global attempts to maintain ecosystem viability, along with economic activity. The regional model provides many case studies of resource management for student observation and study. Students will use scientific exploration to better understand human impact on the environment, and provide the scientific base for rational decision-making. Both the environmental science and natural resource study tracks will address the philosophical ethical issues associated with the management of natural resources." Rechlin noted that the 1991 Education Symposium in Denver was a stimulus for the development of the Natural Resources program.

Accountability at Purdue

Several states created outcomes-based curriculum measuring systems in the 1990s to quantify how colleges serve students' learning needs. Several schools are having trouble dealing with outcomes testing because it is difficult to test for qualitative learning, such as deductive reasoning and personal adaptability to new situations. At Purdue University's Department of Forestry and Natural Resources, the measurements are primarily based on internal examinations and measurements against a number of criteria.

Even though Purdue is located on the flat lands of the Corn Belt, the Department of Forestry and Natural Resources celebrates its 85th year in 1999. The mission of the department is to develop and disseminate knowledge in the natural resource sciences associated with the protection, management, and sustainable use of forests and related ecosystems. The department offers two undergraduate degrees: a Bachelor of Science in Forestry (BSF) and a Bachelor of Science (BS). The BSF is a professional degree. Enrollment in departmental undergraduate programs increased in the 1980s until FY 1991/92 and has remained constant since then. Enrollment over the past five years averaged 319 students.

Most undergraduate students in the department are interested in wildlife. For example, 54.6% of the declared majors during the past five years were in wildlife. In comparison 21.3% were in forestry and 12.1 percent were in fisheries.

While Purdue's department must face occasional scrutiny from CSREES review committees, and SAF accreditation committees, the most frequent examination of university operations comes from the university administration and from state government. Numbers of faculty are carefully counted in relation to the number of students. The balance between teaching, research and extension services is carefully measured.

Dr. Dennis C. LeMaster, head of the Department of Forestry and Natural Resources at Purdue, reported that "We do quite a bit of counting...in terms of both productivity and diversity. Productivity is measured in terms of: (1) undergraduate enrollment, (2) graduate enrollment, (3) student credit hours generated, (4) outside support, (5) research publications, (6) number of extension events prepared."

LeMaster hangs out his wash for public scrutiny every two years in a published biennial report. The report covers changes and reorganizational developments in the program; departmental budgets; the names of graduates; graduate and undergraduate enrollment; student credit hours; percentages of female, foreign and nonwhite students; titles of publications and extension events; sources of income and use of funds; faculty biographies; and lists of outside grants and support.

The Department at Purdue began the decade of the 1990s with the anticipation of growth including new programs, more dollars for research, and more jobs for students trained in the natural resource and environmental sciences. Opportunities for adult and continuing

education were also expected to increase. The 1994 elections, however, produced a major upsurge in attitudes toward less government, tempered only slightly by a surging economy.

In 1995 the department decided to reorganize following a faculty curriculum review. The number of majors was reduced from nine to five, and a new model was established for departmental curricula, featuring a common core of courses. The model also included a summer practicum for all majors, a required core of courses for each major, and an area of specialization in course work to be developed by each student with a faculty advisor.

Major objectives of the curriculum changes were: (1) to integrate the curricula by providing students with a common core of instruction in the basic sciences as they relate to forests and related ecosystems; (2) to increase the amount of field work, as students and faculty alike agreed that hands-on learning is the most enduring; (3) to enhance learning and working in an interdisciplinary environment; and (4) to improve the problem-solving skills of students.

It was determined that faculty staffing should correspond to and promote attainment of this desired future of the undergraduate teaching program, and it should be conducted in a timely way to minimize program discontinuity. Similar criteria were set for the graduate instruction program. Measuring what graduates take with them from the university against these criteria is an important assessment tool at Purdue.

Montana: Using Retirements as a Tool to Affect Change

Reorganization of the School of Forestry at the University of Montana was occasioned by three factors: a new dean, the simultaneous retirement of several faculty members, and the requirement by the university that the curriculum be reduced from 130 to 120 credit hours for graduation. Because Montana is not a wealthy state, adjunct professors, such as former Forest Service Chief Jack Ward Thomas, are used extensively.

Dean Perry Brown says that advance planning for retirements is needed to prevent lag-time between retirement and the new direction that the school wants to take. He says that when corresponding curriculum planning has not occurred, one reaction to a faculty opening is to cover existing courses. When this is the response, he says, opportunities for substantive change can be lost for a long time. "The fundamental question is, for the future, what curriculum and research needs do we have?" The next question is, how might an open position be used to meet those needs?

"Responses to such questions might or might not imply radical change in programs. In some cases the direction might be a change in emphasis within an existing topic, such as hiring a silviculturalist with an emphasis on uneven-aged management, in contrast to even-aged management. One might still be hiring a silviculturalist who will be expected to provide instruction across the range of silvicultural principles and tools, but with a research emphasis on uneven management regimes. Other changes might be more radical, such as hiring a remote sensing rather than a forest protection professor. Such a move clearly would

mark a radical change in direction, and require not only consideration of what the new professor will do, but also, how many residual needs for the former direction will be met," Brown said.

He pointed out that forestry professors often have split appointments between teaching and research (sometimes extension and research). As such, hiring for new directions becomes a complicated process. "The needs in instruction and research might be somewhat different, and thus, the need for clearly articulating the characteristics needed is really important. Planning in response to upcoming retirements helps provide the time necessary to carry out discussions that can lead to clear articulation of needs."

One-third of the Montana faculty has been hired since 1994, and Brown says the change has allowed the school to reshape the faculty expertise so that complex natural resource issues can be responded to in a timely manner. He concluded, "Over the next five years there are more retirements likely, and we are already visualizing how we might use the opportunities these retirements present to shape our future."

Changes in the Pacific Northwest

The University of Washington's College of Forest Resources initiated a formal strategic planning process in 1995. Reflecting on this process, Dean David Thorud wrote, "National trends in higher education planning, including emphasis on interdisciplinary research and teaching, increasing demographic and cultural diversity, global interdependence, fiscal constraints coupled with a public demand for more accountability, greater interest on the part of stakeholders and increasing use of advanced technology and information systems, made the planning effort both timely and urgent.... A primary challenge facing resource managers, ecologists and engineers is how to satisfy the growing demand for natural resource products, while at the same time protecting soil, water, fish, wildlife, and amenity resources. The complexity of these issues will intensify in the years ahead as the population of the Pacific Northwest grows and continues to urbanize."

Dean Thorud promises that the planning process will be institutionalized in the day-to-day management of the college. While some schools exclude forestry majors from their classes, Washington improves its student/teacher ratios by offering 14 courses to students campus-wide. These include Ecology of Urban Environments, Forest Ecosystems, Global Changes and Forest Biology, Restoration Ecology, and Social Functions of Forest Ecosystems.

In 1997 the College initiated an Environmental Studies Major with core courses that are interdisciplinary, team taught, independent of each other, and reliant on case studies. The intellectual world of environmental studies at the University of Washington is divided into four domains of inquiry: natural sciences; social sciences; law, policy and management; and ethics, values and cultural framework. The undergraduate program includes a capstone experience, most often in a group setting. Plans are being formulated for advanced degree programs in the Program on the Environment.

It is not uncommon for forestry schools to set up natural resource courses of study that parallel forestry courses. In many universities there are more students enrolled in natural resources studies than are studying forestry. But because the University of Washington is so large, it is going into this endeavor in a major way.

At Washington, both the graduate and undergraduate curricula have changed recently to meet recent trends and developments in the field. The Forest Management undergraduate curriculum underwent a complete revision in response to the rapid changes in the way state, national and international forest resources are managed. The Forest Management curriculum redesign included:

- Creation of specific and attainable goals and objectives.
- Specification of a set of lower division courses in the natural and social sciences, plus the humanities to provide building blocks for later intellectual development.
- Introduction of professional forestry courses into the lower-division courses in the natural and social sciences to build on the basic sciences, while also educating students in aspects of the biological and physical components of the forest system.
- Recommendations for a set of upper-division elective courses related to communication, human resource management, conflict resolution, leadership, organizational development, group dynamics, decision-making models, and management information systems to educate students into the fundamentals of management and human relations.
- Identification of a set of core professional forestry courses at the upper division which integrate the biological and physical sciences within an ecosystem management framework, explore social and political dimensions of forestland management, foster understanding of the paradigms operating in the public and private sectors, and consider managerial impacts of actions.
- Inclusion of a capstone study course where students are exposed to real life experiences and problem solving.

The university says the evidence of the effectiveness of the changes can be seen in the more than doubling of its enrollment over the past two years, and the increased placement of graduates.

High Country News in 1995 said that Oregon State University's College of Forestry was once known as the "Vatican of sawlog forestry." Wendell Wood of the *News* wrote, "But things change even in the Vatican. The listing of the northern spotted owl as a threatened species in 1990 ushered in a new age for forestry in the Northwest. And Oregon State, whose faculty forms the nucleus of a community (Corvallis, Oregon) of nearly 500 forest scientists, has become entwined with new forest policy. Its faculty has supported, and sometimes designed, much of the clearcutting and overcutting of the past, but the college, more recently has become home to some of the nation's foremost educators in forest restoration ecosystem management." Wood quoted Professor Steve Radosevich as saying, "Ecological issues facing the Northwest are really centered here. We have the highest per capita number of ecologists in the nation; plus we're surrounded by forest."

Knowledgeable outsiders credit Dean George Brown and several key faculty members. New Forestry inventor Jerry Franklin of the University of Washington said, "They've been leaders, healers in integrating traditional and environmental forestry." Students majoring in forest science now explore forest ecosystems, not just the science of making trees grow faster. Engineering students must learn how to remove fish-killing culverts, as well as how to build logging roads.

Oregon State's College of Forestry recently began offering a series of extension courses on key topics relating forestry practices to more sensitive social, ecological, and community-level economic concerns. The demand for these courses was unexpectedly high, not only among the mid-career professionals to which they were oriented, but to a growing number of graduate students. Subsequently, a new graduate program was developed, better utilizing the people and resources brought in originally to develop the continuing education program.

Oregon State is now exploring ways of incorporating basic elements of these programs into its undergraduate forestry curriculum. This effort has attracted substantial interest outside Oregon State, including that of a major national foundation that provided a seed grant to help start up a continuing education program in sustainable forestry. This attention has, in turn, caught the interest of the university's top leaders, who are affording the School of Forestry additional flexibility and support to make the program a success. Oregon State has now expanded this effort into a "Sustainable Forestry Partnership" aimed at helping forestry programs at other universities discover their own innovative ways of addressing the challenges of professional forestry education.

Oregon State was one of the early innovators in using team teaching. Insofar as developments in sustainable forestry initiative are concerned, Professor Steve Daniels says, "We aren't telling people what they ought to think, but we are creating some environments where they have the opportunity to work through the challenges and wickedness of late 20th century land management." Daniels says the Sustainable Forestry Partnership is a portal through which the university can look out at the world. He noted that universities are not usually change agents, but they are demand driven.

However, despite the positive changes that are occurring at the school, Dean Brown admits that Oregon State is struggling with the same problems that other institutions have reported. He said that he was having difficulty finding room in the four-year program for students to take electives, and he indicated that he sometimes has trouble maintaining what the state believes is a cost effective program.

Challenging the Undergraduates at Missouri

Construction was completed in 1998 on the Anheuser-Busch Natural Resources Building for the School of Natural Resources (SNR) at the University of Missouri. It represented a capping off of what has been a progressive forestry education program for many years. Forest resource management ethics and professionalism are now taught as an

integral part of the required curriculum. Most of the faculty is committed to and are heavily involved in team and multidisciplinary teaching.

Many faculty are using innovative approaches to challenge their students to think critically about the basic biology and management of complex wildland ecosystems. A number of professional courses are taught as "Writing Intensive (WI)." Courses labeled WI are a part of the university's General Education Architecture Strategy to improve writing competency by all students, as well as mathematics proficiency, computer and information literacy.

As is the case with many universities where outcomes-based education prevails, the campus requires that graduating seniors in each program be assessed to determine how well they have retained, and can integrate and apply, the knowledge acquired throughout their undergraduate careers.

The leadership of the School of Natural Resources is planning to carve out three specialized niches where it is expected that the School can excel. These are urban forestry, agroforestry and ecosystem management. All will require new personnel and funding support.

One of the interesting things about the relatively small program at Missouri is the way the school tries to reinforce the idea that what is learned in the classroom must be applied in the field. For example:

- Early in three of the four forestry curricula, students attend a six-week field camp at the school forest. They are put through a five-week series of courses covering various aspects of forestry. During the sixth week, teams of students are asked to develop a management plan for several hundred acres of forestland, utilizing data that they collected during the previous weeks. The student plans are reviewed critically by the whole class and visiting local professionals. The plan serves as an integrating capstone for this summer field experience.
- The upper level Forest Resources Management course takes this strategy several steps further. The students are taught in greater detail how to organize and prepare a land management plan. They are asked to collect data and develop a plan for a local, typically private, ownership, which considers current uses and landowner objectives. The final plan, developed by the class, is critiqued and presented to the landowner.
- The Natural Resource Practicum course, the forestry curriculum's capstone course, is used as an assessment vehicle. Senior forestry students are combined with majors from Fisheries and Wildlife, Parks, Recreation and Tourism to develop a management plan for a local wildland area. The students are taught the intricacies of operational and strategic planning. The various majors are intermixed and placed into teams so that the students can benefit from the interaction with students who have training in other disciplines.

Forestry on "The Domain"

Sewanee, also known as the University of the South, runs the only undergraduate forestry department located at a private, liberal-arts university. Located on a 10,000-acre campus known as "The Domain" on the Cumberland Plateau in Tennessee, Sewanee calls itself "an ideal place to prepare for a lifetime." In the European tradition of education, Sewanee seniors take comprehensive examinations in their majors as a part of graduation requirements. A major goal of the university is to prepare students for graduate school.

The Department of Forestry and Geology offers three majors: forestry, geology, and natural resources. Students may select either B.A. or B.S. degrees from each of these. The faculty of six offers a wide variety of field-oriented courses for all Sewanee students. There are about 70 students majoring in the Department. Three-fourths of the students major in natural resources, and the remainder are about equally divided between geology and forestry.

The main goal of the department is to teach students to analyze, interpret and predict natural phenomena in forested and geological systems, with an emphasis on interdisciplinary approaches. To accomplish this goal the department emphasizes study within and outside the classroom, linking the classroom to the rest of the world by synthesizing (1) theoretical and conceptual aspects of the sciences of forestry and geology with (2) extensive field work emphasizing detailed observations and careful data collection. All three majors integrate field work, laboratory work and classroom theory in the analysis of "real world" problems involving forested and geological systems.

Sewanee graduates frequently go on to graduate schools in geology, forestry, hydrology, environmental studies, geography, water resource management, architecture, environmental education, medicine and environmental law. Some work as foresters, or in environmental consulting firms and governmental agencies before going on to graduate school. Others go on to become writers, farmers, physicians and architects. Although Sewanee is not currently accredited by the Society of American Foresters, it once was. However, no plans are being made to seek reaccreditation. Sewanee is a member of the Associated Colleges of the South, a 14-member consortium of outstanding liberal arts colleges and universities dedicated to program excellence, continuation of the liberal arts tradition, and student growth and development.

Going Back to Square One: Radical Surgery

In a special 1995 forestry education issue, the weekly environmental newspaper, *High Country News*, selected Northern Arizona University as having the top forestry program in the West. Lisa Jones wrote, "If we had to pick a leader among the schools profiled here, it would be Northern Arizona University, not only because it has plotted the cleanest, straightest path toward a new kind of forestry, but also because for years it has encouraged the interdisciplinary thinking needed for scientists to solve real problems."

Northern Arizona University's (NAU) School of Forestry was one of the first forestry schools to adopt an integrated resource approach. Since 1972, the School's undergraduate curriculum has featured a professional program that is divided into three integrated 16-credit courses, known as Semesters A, B, and C (Fox et al. 1997). NAU conducted a major reorganization of its forestry school in 1995-1996; unlike most similar efforts, however, the revamp started from square one. Prior to that time, the school had relied on university-mandated program reviews, SAF accreditation, and program evaluation required by the addition of a master's degree program in 1984 and a Ph.D. program in the early nineties.

The faculty instituted an "adaptive curricular design" approach, which eventually led to a comprehensive review of the entire undergraduate program, including delivery methods, prerequisites, academic content areas, and the appropriate relative emphasis of the sub-disciplines within the profession. The three integrated semesters within the professional program are now continually reviewed. While each of these three semesters is under the coordination of a single faculty member, there is strong emphasis on team teaching. All of the faculty members that are involved each semester are expected to meet frequently to discuss and review curriculum and make adjustments as warranted (School of Forestry 1996). The School is currently considering further readjustments that would allow for integration not just within semesters but between semesters

The University of Vermont's School of Natural Resources also recently conducted a major overhaul of its curriculum. As with NAU, the changes were a function of extensive faculty deliberation, as well as outreach to external sources of information and expertise. Rather than adding courses to its existing curriculum, the School developed an integrated core curriculum for its six baccalaureate programs (one of which is an SAF-accredited forestry program). The School took a retrospective approach – first developing a set of goals for student achievement, then completely re-designing the core curriculum to create a structure that fosters the attainment of those goals (Association of American Colleges 1991).

This process was driven by a series of faculty workshops, which first defined appropriate outputs of an integrated core curriculum, and then developed a set of necessary inputs. These inputs and outputs were then validated through a process of identifying those competencies necessary to address real-world natural resource issues. The result was a seven-course core that provides an understanding of how to synthesize and apply knowledge from a variety of disciplines to solve contemporary problems (Manning 1998). The success of this project may be attributed, in part, to the fact that the School has avoided the trend toward increased departmental fragmentation, thus facilitating interdisciplinary exchange

Dr. Robert Manning, a professor with the School of Natural Resources, notes, "This curriculum reflects our commitment to a holistic approach to natural resources education, which requires integration across the traditional natural resources fields of study and the synthesis of the natural and social sciences. It is built on a foundation of knowledge, skills and values that define competence, literacy, and fluency in natural resources. Combined with distribution and major requirements, we are confident that our core curriculum will provide

our graduates with the ability to contribute to the resolution of complex natural resource and environmental issues.” (Manning 1998).

A Little Fine-Tuning

The majority of forestry schools surveyed have not conducted a major overhaul of their curricula in the last few years, but instead have focused on steadily making improvements. In response to societal or technical developments, some programs have added new courses. At Louisiana Tech, for example, the adoption by the American Forest and Paper Association of the “Sustainable Forestry Initiative” has prompted two new courses in watershed management and ecosystem management. Michigan Tech University in Northern Michigan has added formal course work in recent years on resource/environmental assessments, landscape ecology, geographic information systems, remote sensing and conservation biology in response to the demands of employers and students.

For many schools, however, there simply is little or no room to add new classes. As noted in the previous chapter, forestry educators are increasingly finding themselves squeezed between pressures from within the forestry profession to expand the scope of forestry education, and external pressures from their universities and even state legislators to downsize, reduce costs, and place tighter limits on the time and resources invested in each student (Hammonds and Jackson 1997). A number of forestry schools around the country are exploring innovative ways of dealing with this dilemma.

One strategy has been to better integrate competencies, such as communications, within the existing curriculum, rather than through additional courses or credit requirements (Daniels and Reed 1992). The usefulness of such an approach is supported by the findings of the recent graduate survey, which suggest that students gain a better understanding of these skills and competencies when they are taught within the context of forestry. Humboldt State’s Department of Forestry is applying this approach through the use of a matrix that assesses the extent to which existing courses expose students to a set of desired professional skills and qualities. These include: writing competence, group cooperation, leadership, conflict resolution, integrity, open-mindedness, public speaking, debate and persuasion, critical thinking, and adaptability. Gerald Allen, Chair of the Department of Forestry at Humboldt State, describes the matrix as a tool for faculty and administration to use in evaluating the role that individual forestry courses play in providing such skills across the curriculum.

Schools are constantly struggling with whether a breadth of cross-disciplinary understanding is most important, or whether a depth of technical skills is of most value. In trying to resolve this dilemma, UMass suggests that “Solutions to complex land and water management problems face managers today and will continue to become more complex as the balance among competing values for multiple natural resources is debated. Resolution to these social debates must be sought by managers and decision-makers. Students completing degree programs in the areas of natural resources management must have adequate depth in an area of specialization as well as adequate breadth among disciplines to ensure

communication with other members of interdisciplinary teams assigned a management problem. Further, the team approach to solving management and research problems will require students to have experience in interdisciplinary problem solving if they are to compete successfully in an ever restrictive employment market in most areas.”

“Our Forest Ecosystem Science and Management curriculum differs from other accredited undergraduate forestry programs,” says David M. Hix, associate professor and coordinator of the Forestry Program in the School of Natural Resources at Ohio State University. According to Hix, they take a holistic approach to the study of forest ecosystems, rather than the traditional view of forest resources management. Emphasis is placed on application of basic ecological principles in the management of forest ecosystem components for a wide variety of products, benefits and values. Hix says the emphasis at Ohio State is on educating future professional foresters, not merely training students to meet present needs. Like Montana, the change instituted at Ohio State were the result of some critical retirements.

“We (started making) adjustments in our curriculum to accommodate ecosystem management in the mid-1970s, and (we) have continued to refine the implementation,” says Wayne H. Smith, director and professor of the School of Forest Resources at the University of Florida. “Our biggest changes in recent years have been to strengthen the communications elements, including critical thinking skills, advanced information technology skills, and integrated resource management,” he said. Curriculum change at Florida is undertaken by an Undergraduate Programs Committee that Smith says is continually fine tuning the curriculum as the need arises. Major changes are brought before the faculty in a “retreat type” setting.

At Colorado State University's Department of Forest Sciences, a core natural resources program is built into the forestry curriculum. A series of courses designated with an “NR” prefix are required by nearly all of the students in the College of Natural Resources, within which the Department of Forest Sciences is contained. Among these courses are: Natural Resource Ecology and Measurements (offered at the university's mountain campus at Pingree Park); Natural Resource Policy; and Integrated Ecosystem Management. All of these courses are centered on natural resources management and watershed management.

Like many programs, the College of Forest Resources at Mississippi State University has struggled with ways to fit it all into four years. The university has discovered a clever way of working in another year of study through the creation of a forestry/business double-degree program. Successful graduates wind up with two bachelor's degrees, one in Forest Management from the College of Forest Resources and another in Business from the College of Business and Industry.

Not all stories were success stories. Pennsylvania State University's School of Forest Resources attempted to make several curriculum changes as a result of the 1991 Education Symposium in Denver, including the development of a new major. However, after years of intense discussion, and the unwillingness of the university to fund new teaching positions, the effort was dropped. Since then, however, the School of Forest Resources has been successful in institutionalizing several things, including courses in forest ecosystem

management and natural resource decisions, a quasi-capstone course taken by forestry, wildlife and fisheries majors.

Conclusions

These highlights of how various forestry schools have adapted and changed – often under circumstances where red tape and excessive academic bureaucracy is rampant – is in no way an effort to select out certain schools as the best or worst of anything. It is hoped that by presenting these case studies, other academics will identify actions that were tried and that succeeded to solve problems and adapt to the changes occurring in their own institutions. Because of the differences in the size of the bureaucracy at the various schools, each institution has had to find its own ways to effect change. Even though there is a similarity in what faculty curriculum committees were trying to accomplish, there were great differences between campuses as to how they achieved it.

The Pinchot Institute survey of forestry schools revealed that those campuses that foster interaction and discussion among faculty of the various natural resources and social sciences disciplines experience an easier transition when making curriculum changes and introducing interdisciplinary, team-taught courses.

The survey also suggested that a number of forestry schools are focused primarily on granting undergraduate degrees. Some schools do not even allow students to minor in forestry course work. This raises questions about why foresters complain that the public at large does not understand the essential tradeoffs between garnering the benefits of forests and protecting ecosystem values, when interested students are not permitted in the door for just a little glimpse. Yet some schools have learned that by allowing interested students in to take survey courses, they are better able to bolster student-teacher ratios that score points with university administrators.

Furthermore, while there is a lot of conversation about the need for life-long education and learning in forestry, continuing education falls off the plate of many schools because of a lack of funds, and the need to concentrate scarce resources in the degree programs. There are schools like North Carolina State, Virginia Tech, the University of Washington, and Oregon State that provide extraordinary examples of what can be done. Auburn once did so with help from the state forestry commission and federal funds; however, the eventual lack of funds led to the privatization of its program.

The American Forest and Paper Association's Sustainable Forestry Initiative is a paragon of self-regulation for American industry. It is a promise to the public that the industry will practice sustainable forest management that is more in tune with the wishes of its stockholders, its customers and the general public. Such a sea change in operating major businesses that affect the economy to the tune of billions of dollars each year would seem to beg the question, "What does this change mean in terms of how beginning foresters are educated for a world of work?" This question is just beginning to be asked in the right places. Some answers can be found at many of the schools that shared their stories.

GRADUATE EDUCATION: CONFLICTS AND CONTROVERSIES

The Pinchot Institute's study on forestry education was designed to study "professional forestry education," including both undergraduate degrees in forestry as well as graduate degrees. Of the employers interviewed, however, 70% of the forestry school graduates that they had hired within the last five years had only a bachelor's degree. The employers' responses, therefore, are more a reflection of undergraduate education than of graduate education.

In the course of this study, however, the Institute had the opportunity to gain insight into employers' perceptions about graduate study as well as information about available graduate programs. This knowledge was gained through interviews with employers and academics, communications with program heads, and discussions at a symposium on forestry education held in Washington, DC, in March of 1999. The challenges facing graduate programs, and the issues surrounding graduate forestry education, are considerably different than those of undergraduate education.

Graduate Education: A Need or a Luxury?

There is general agreement within the forestry profession that a graduate degree is necessary if the student wants to conduct specialized forestry research or enter academia. There is considerable debate, however, about whether a graduate degree is necessary for management positions in industry, government, or other organizations. The debate centers on questions related to how the profession defines a "forestry professional" and whether one is considering short-term vs. long-term success.

Those employers and academics that believe a graduate degree is necessary often stress that there is increasing complexity in the forestry profession, and a four-year degree cannot cover all of the skills necessary to be a professional forester. Scott Wallinger, Senior Vice President of Westvaco, has asked, "The legal profession requires seven years of education, medicine requires eight, and MBAs require six. Why does forestry think it can do it in four?" Other employers have indicated that a graduate degree is certainly not necessary in gaining employment following college, but may become more essential as a forester's career progresses. Charlie Bingham, a retired Vice President of Weyerhaeuser, noted, "A graduate degree is not necessary in today's market, but the leadership is going to come from people who have graduate degrees because of those skills learned in graduate school."

Several employers and educators have remarked that the market will determine the need for graduate education. John Helms, former Dean of the School of Forestry at the University of California at Berkeley, remarked, "The situation could be largely resolved in the market place if employers provided significantly higher salaries for holders of MF degrees. Because they currently do not, it seems to me that the market has indicated that a graduate degree is not necessary." Some companies, however, are willing to back up their expectations. Westvaco, according to Wallinger, strongly encourages their promising

bachelor degree-holding employees to pursue graduate degrees, even offering financial compensation for tuition.

The role of continuing education must be considered as well, either in addition to graduate education or as an alternative. As the Pinchot Institute survey of employers suggests, it is expected that many of the highly rated competencies be delivered through continuing education. Furthermore, several employers made the case that practical, on-the-job experience is the best education. Nevertheless, the debate over the role of graduate education has been central to the profession and warrants further examination.

But What Kind of Graduate Degree?

Even among those employers and educators who consider a graduate degree necessary for professional forestry, there is debate about what that degree should be. Of course, the answer depends on the type of employment desired. A career in forest management or policy might require further broad training in forestry, as might be gained with a Master of Forestry (MF). Specialized research in a particular area of forestry, such as silviculture or watershed management, would necessitate a Master of Science (MS) degree. A forester with an undergraduate degree in forestry who is considering a career in industrial forestry, consulting, or timberland investment might opt to seek graduate education outside the direct realm of forestry and pursue a Master of Business Administration (MBA).

Of the 55 programs that were examined in the Pinchot Institute study, 48 offer graduate degree programs in forestry. That education varies both in scope and by degree. Graduate education in forestry generally falls into two categories: professional education or research. Almost every school that offers graduate education offers a Master of Science (MS), traditionally a research-focused degree. Only twenty schools offer a Master of Forestry (MF) or similar degree (such as Master of Forest Resources or Master of Professional Studies) that is geared towards professional training. In the majority of cases, the professional degree is designed for students who received an undergraduate degree in a field other than forestry. The Society of American Foresters (SAF) accredits six MF programs, all of which are designed to be "First Professional Degrees" (FPDs).

These statistics raise several questions. If most professional forestry degrees are designed for students without a previous forestry degree, then what is available for students who received an undergraduate degree in forestry and want to go on to gain a professional forestry degree? Are MS degree programs offering something for foresters who want who want to pursue professional careers outside of research?

Responding to Graduate Needs

There are several schools that offer both an MF (or equivalent) degree and an MS degree. Many schools noted, however, that their MF program has struggled during the last decade. Alan Ek, Head of the Department of Forest Resources at the University of

Minnesota, indicated that there have been only 7 or 8 students opting for the MF program during the last ten years. During that same period, 60-70 students have completed the MS program. Dr. Ek suggested that the MF has fallen out of favor lately, as students have recognized that it is less marketable and less recognizable than the MS degree. Richard Skok, Professor Emeritus at the University of Minnesota, added that there is often more funding available for MS students than for MF students.

The University of Michigan's School of Natural Resources and Environment has witnessed a similar trend. According to the School's SAF Accreditation Self-Evaluation Report, during the past 12 years, 122 students in forest-resource related programs earned the MS degree, whereas only 9 earned the MF degree (SNRE, 1998). The report noted that most of the School's graduate students perceive the MF degree to represent a field of training too broad to meet their professional interests, and would prefer to specialize in one area of forestry. In response, the School eliminated its MF program and sought SAF accreditation for its MS degree in Terrestrial Ecosystems, with an emphasis in forestry, which was recently approved.

One of the major criticisms raised against the "necessity" for forestry education is that the time and money invested in graduate education is not universally rewarded. Most undergraduate forestry programs claim that students are not having trouble finding jobs in forestry upon graduation. Students therefore have difficulty justifying another two years of school to gain a graduate degree. The University of Georgia's School of Forest Resources has proposed a compromise to that dilemma, according to Dean Arnett Mace. A recent proposal recognizes that "the demands now placed on forest resource professionals have increased to the point where many positions require proficiencies that cannot be acquired in the time permitted for a bachelor's degree. As a result, the master's degree has become a necessary qualification for certain positions." Pending final approval, the School will offer a joint degree program between the BS in Forest Resources and the Master of Forest Resources. The joint program will enable students to receive both a bachelor's degree and a master's degree in five years, as opposed to six.

The results of the Pinchot Institute's survey of employers suggests that many of the skills employers consider important, particularly management and problem-solving skills, should be gained through graduate education or continuing education. Many foresters are not opting for graduate education, however, because of the perceived lack of necessity or the lack of reward for advanced training. When students do pursue graduate education, it is usually through MS programs, which traditionally focus on specialized research as opposed to problem solving and management skills. Unless or until the profession promotes graduate professional education that provides those necessary skills, forestry schools need to make an effort to better integrate such competencies into undergraduate programs.

FACILITATING THE EVOLUTION IN FORESTRY EDUCATION

As part of this study, the Pinchot Institute for Conservation convened a symposium entitled "Facilitating the Evolution in Forestry Education," in Washington, DC, in March, 1999. The objectives were to: 1) achieve a broader understanding of factors influencing forestry education in the United States, and 2) identify specific actions that can be taken by both forestry educators and employers to assist educational institutions in addressing the challenges of sustainable forest management. Participants included top leaders from forest industry, government non-profit conservation organizations, and forestry schools.

Forestry employers from several sectors offered their perspectives on the results of the study and described their current and future expectations of forestry graduates. Phil Janik, Chief Operating Officer of the USDA Forest Service, emphasized that foresters increasingly are called upon to adopt a big picture approach to forest management, in order to comprehend concepts such as sustainability and watershed integrity. Richard Donovan, Director of SmartWood, noted that an understanding of the role of forests in communities, businesses, and the environment is crucial for today's foresters. There was general consensus among the employers that, in addition to a foundation in technical skills, new hires must have strong interpersonal and communication skills, vision and creativity, and the capacity for collaboration. Several employers, including Janik and Scott Wallinger, Senior Vice President of Westvaco, stressed that their organizations are increasingly looking to hire foresters with graduate degrees.

Innovative university approaches

Al Vogt, President of the National Association of Professional Forestry Schools and Colleges (NAPFSC), highlighted the recommendations that emerged from the 1991 Denver Symposium, "Forest Resource Management in the 21st Century: Will Forestry Education Meet the Challenge?" He noted that the symposium provided impetus for many of the changes that have occurred in forestry education in the 1990s.

Representatives from a number of forestry programs presented a glimpse of the developments taking place at their universities. An overriding theme was the increasing emphasis on outcomes, instead of inputs. Winifred Kessler, Chair of Forestry at the University of Northern British Columbia (UNBC), shared her experience of starting a forestry program from scratch. In developing their new program, the faculty decided that they would create courses that could accommodate a mix of disciplines. Kessler noted, "What really mattered, in our view, was not the amount of exposure the students had to certain topics. The important thing is what the students come away with – the competencies developed – as a result of having completed certain courses or experiences." The School of Natural Resources at the University of Vermont (UVM) recently underwent a similar evolution, according to Associate Dean Don DeHayes. In the course of revising the curriculum, the faculty identified and developed inputs, process, and outputs, allowing the desired outputs to drive the planning.

Forestry programs have also directed significant attention recently towards integration. During its initial years in the 1970s, the School of Natural Resources at UVM was fragmented into different departments, including forestry, fisheries, etc. DeHayes noted that the attempts at integration during the 1980s involved encouraging students to take courses from multiple departments, but the students were expected to build the bridges themselves. The recent curriculum revision, however, took a different approach, and the outcome was a single core curriculum for all of the majors within the School of Natural Resources. Similarly, the faculty of the School of Forestry at Northern Arizona University (NAU) have made integration a key goal of their curriculum development, emphasizing collaborative learning, team teaching, and capstone courses that bring together students from multiple disciplines. Oregon State University has responded to the increasing demand for integration by adding two new programs, one in Natural Resources at the baccalaureate level and one in Sustainable Forestry and Agroforestry at the master's level.

Several educators highlighted the challenge of striking a balance between training students in technical skills and educating them in areas such as communications and the liberal arts. Mike Wagner of the School of Forestry at NAU commented that the emphasis at NAU has been on education instead of technical training, noting that "it is easier to technically train an educated person than it is to educate a technically trained person." Kim Steiner of the School of Forest Resources at Pennsylvania State University echoed that sentiment, noting that forestry educators have increasingly recognized that their role is not just to prepare students for their first job, but also to provide them with the skills for a successful career. He encouraged educators to consider the possibility that "we are overeducating students in the technical areas and undereducating them in career skills." Kessler emphasized that the qualities of the "target graduate" at UNBC reached beyond technical forestry competencies to include concepts like ethics and citizenship. Participants also discussed the division that exists between forestry education and general education. One educator observed that forestry faculty often express frustration at the amount of time students must spend meeting their university's general education requirements, and fail to recognize the value of general education.

Collaborative opportunities for employers and educators

Ross Whaley, President of the State University of New York College of Environmental Science and Forestry, remarked that the inadequacy of forestry education in meeting employer needs has become a constant criticism. He issued a challenge to the employers to shoulder some of the burden of educating foresters. Several participating employers agreed, and offered suggestions for collaborative opportunities.

The opportunities for employers are immense, suggested Scott Wallinger of Westvaco. He noted that "a progressive employer has a major challenge to pick up where the forestry schools leave off and turn the raw material into polished, professional forest resource managers." Fred White of the Forestland Group noted that employers "must help the

educators produce that complex person who will be of most benefit to us as individual organizations.” He listed several opportunities for employer participation, including:

- offering internships,
- encouraging continuing education,
- providing graduate program assistance,
- mentoring new hires,
- facilitating in-house employee training,
- developing interactive education.

Barbara Weber, of the USDA Forest Service, suggested that employers are expecting increasingly more of graduates, particularly in understanding the challenges of meeting public needs. She called for better communication and stronger relationships between employers and universities, in order to facilitate a better understanding of each other’s needs.

Synthesis

Ross Whaley concluded by identifying several issues that deserve institutional attention, as opposed to individual campus attention. One is accountability and outcome assessment. He noted that government intrusion in higher education can be cumbersome, but it is not unreasonable for taxpayers to demand accountability from higher education. Many states are taking this issue quite seriously, and educators should examine the implications for forestry education. A second issue is individual responsibility for education. Whaley stressed that we cannot put all the responsibility on the educators and the employers, and questioned whether educators are doing a good job of teaching individual responsibility. He suggested that a third focal issue is continuing education, stating that “continuing education is going to be provided by almost everybody *except* the academic institutions unless we are attendant to it.” Whaley criticized universities for running continuing education like they run research projects, instead of examining client needs and developing continuing education that meets those needs. Finally, he issued several challenges to the Society of American Foresters (SAF) Task Force on Accreditation. Whaley stressed that the profession needs to consider how to reconcile the dichotomy between skills (like silviculture) and qualities (like citizenship), as well as the division between general education and forestry education.

The symposium provided a valuable opportunity for bolstering communication between forestry employers and forestry educators, and for discovering future opportunities for collaboration. Representatives of forestry employer organizations came away with a much better understanding of the political and financial environment in which the forestry schools are operating these days, and a better sense of how some universities are breaking out of past rigidities in structure and curriculum.

The forestry deans and department heads also came away with a clearer sense of what employers, both traditional and non-traditional, are seeking from emerging professionals. Participants were exposed to the growing need for forestry professionals to comprehend a broad array of specialties, including independent evaluation processes, financial planning, and community development. The skills desired of forestry professionals and the challenges

they are facing are continuing to grow. There is clearly still a need for the “core” forestry competencies to be taught, but there is a strong need to build upon them with life-long career skills.

The symposium produced an array of ideas for improved cooperation between forestry schools and forestry employers in meeting the changing needs of the practice of forestry. Forestry employers can contribute significantly to assisting the forestry schools by helping recruit high-aptitude students to forestry programs, providing targeted scholarship support and paid internships, and developing cooperative education programs that provide prospects for post-graduate career employment. These and similar efforts will help the schools evolve more quickly and to reflect changing social values toward forests and forestry as well as improvements in the natural and social science that underpins sustainable forest management.

CONCLUSION

Professional forestry practice today has become more challenging in virtually every aspect, from technical research to management planning. Moreover, society's expectations for the protection and sustainable management of forest ecosystems, and their level of involvement in resource management decision making, continue to grow. As a result, adequately educating future foresters to meet these challenges is an increasingly difficult task. Significant gaps exist between what both forestry employers and recent forestry graduates regard as highly important to their success, and what forestry education programs at U.S. colleges and universities are currently providing. Forestry educators are hard-pressed to address these gaps in light of external financial and political pressures on higher education.

In the face of these challenges, a number of schools have discovered creative ways of addressing this dilemma, heightening their ability to sense changes in the marketplace demand for professional forestry skills, and adapting internal organizational mechanisms to be more flexible and responsive to these changes. Many other schools are aware that changes are taking place around them, but are still trying to discover ways to be better attuned to their "markets," and to make processes such as curriculum review more responsive while maintaining rigorous academic standards.

While there are numerous opportunities for forestry education programs to become more sensitive and responsive to the changing market demand for professional forestry skills, there are also important opportunities for forestry employers to foster forestry schools' abilities to meet their needs. Schools are recognizing that they can call upon the resources of forestry employers and others who have a vested interest in educating forestry professionals who are technically competent, and who also can succeed in the complex social, economic, and ecological environment in which forestry is practiced today.

Forestry schools often have difficulty maintaining programs with limited enrollment – even those schools that show promise for expanding in the future. Employers with an interest in forestry graduates with particular sets of skills (e.g., forest products, watershed analysis, or independent, third-party certification) can take a number of steps to help forestry schools meet their needs, such as:

- Helping to direct, or even recruit, talented students to forestry programs;
- Making grants or scholarships available to high-achieving students enrolled in forestry programs;
- Offering current students paid summer internships that provide field experience and an exposure to the broader aspects of professional forestry practice;
- Developing or participating in cooperative education programs to give promising students greater assurance of career opportunities upon graduation;
- Guest lecturing in university courses or offering sites for field visits.

A crucial step towards making those opportunities a reality is promoting interaction between employers and educators as a basis for timely feedback and response. Implementing advisory committees that include potential employers of graduates is an excellent conduit for communication between employers and educators. Information sharing and mutual reinforcement can foster forestry program's efforts as they strive to discover their own means to better meet the needs of the forestry profession and society as a whole. The forestry profession should never be completely satisfied with the knowledge and skills that are being imparted to future professionals, but should instead be constantly seeking opportunities to enhance forestry education and keep it responsive to changing needs.

LITERATURE CITED

- American Association of State Colleges and Universities (AASCU). 1999. "Report Predicts Surge in College Enrollment"
<<http://www.aascu.org/news/memo/archive/9907reportpredicts.htm>>.
- American Pulpwood Association, Inc. (APA). 1987. The Decision to Hire: Desired Elements in a Candidate for Industrial Forestry Employment. Washington, DC: American Pulpwood Association, Inc.
- Association of American Colleges. 1991. The Challenge of Connecting Learning. Washington, DC: Association of American Colleges.
- Baughman, W.D. 1997. Forestry education needs from the viewpoint of an industrial employer. Speech delivered to SAF meeting, Clemson University, June 13, 1997.
- Bentley, W.R. and W.D. Langbein. 1996. Final Report -- Seventh American Forest Congress. Office of the Forest Congress, Yale University. 64 pp.
- Brown, T.L. and J.P. Lassoie. 1998. Entry-level competency and skill requirements of foresters. *Journal of Forestry* 96(2): 8-14.
- Business Week. 1998. "Welcome to the Virtual Ivy League." *Business Week*, September 7, 1998.
- Canham, H.O. (ed.). 1994. Education for Forest Resources: New Directions for the 21st Century, March 10-12, 1994. State University of New York College of Environmental Science and Forestry, Syracuse, NY.
- Chapman, H.H. 1934. Making the Society of American Foresters a professional organization. *Journal of Forestry* 32(2): 503-07.
- Chapman, H.H. 1943. Report on the committee accrediting schools of forestry. *Journal of Forestry* 41(3): 225-229.
- Cortner, H.J. 1992. Commitment to change: Forestry in the future. *Journal of Forestry* 90(3): 15-17.
- Council for Aid to Education (CAE). 1997. Breaking the Social Contract: The Fiscal Crisis in Higher Education. A report of the Commission on National Investment in Higher Education. <<http://www.cae.org>>.
- Daniels, S. and M. Reed. 1992. Enhancing forestry education through writing. *Journal of Forestry* 90(3): 27-32.
- DeSteiguer, J.E. and R.G. Marrifield. 1979. The Impact of the environmental era on forestry education in North America. *Unasylva* 31: 21-25.
- Duncan, D.P. 1975. Report of the SAF committee on educational policies. *Journal of Forestry* 73 (1):60.
- Duncan, D.P., R.A. Skok, and D.P. Richards. 1989. Forestry education and the profession's future. *Journal of Forestry* 87(9):31-37.
- Eagan, T. "The War on Drugs Retreats, Still Taking Prisoners." *New York Times*. February 28, 1999.
- Finley, J.C. and K.C. Steiner (eds.) 1996. Proceedings of the First Biennial Conference on University Education in Natural Resources. School of Forest Resources, Pennsylvania State University, University Park, PA. 261 pp.
- Flick, W.A., G. Somers, B. Jones, D. Brinker, and D. Gjerstad. 1995. Yet all will be foresters. *Journal of Forestry* 93(1): 20-24.

- Fox, B.E., T.E. Kolb, and E.A. Kurnes. 1997. An integrated forestry curriculum: The Northern Arizona University experience. *Journal of Forestry* 95(3):16-22.
- Gillespie, A.R., W.K. Rawlins, W.L. Mills Jr., P.R. Coppin, M. Olsson, K. Rosen, C. Fries, P. Backstrom, E. Agestam, and T. Magnusson. 1998. Teaching across cultures: A model for international education in the natural resources. *The Journal of Forestry* 96(2): 20-24.
- Giltmier, J.W. 1996. American Forestry Education: Conceived in Controversy, Building a Profession. Washington, DC: Pinchot Institute for Conservation. 16p.
- Gisborne, J.T. 1943. Is the society broad enough? *Journal of Forestry* 41(7): 543.
- Graves, H.S. 1928. Some considerations of policy in forest education. *Journal of Forestry* 26:430-453
- Graves, H.S. n.d. Biographical notes of Henry Graves. H.S. Graves Papers, Manuscript Division, Sterling Memorial Library, Yale University, New Haven, CT.
- Graves, H.S. and C. Guisse. 1932. Forest Education. New Haven: Yale University Press. 421 pp.
- Hammonds, K.H. and S. Jackson. 1997. The New U: A Tough Market is Reshaping Colleges. *Business Week*, Dec. 22, 1997, pp.96-102.
- Hays, S.P. 1997. From conservation to environment: Environmental politics since World War Two. In: C. Miller and H. K. Rothman (eds.) *Out of the Woods: Essays in Environmental History*. Pittsburgh: University of Pittsburgh Press.
- Heister, C.G. (ed.) 1998. Proceedings of the Second Biennial Conference on University Education in Natural Resources. Utah State University, Logan, UT. 251 pp.
- Helms, J.A. (ed.) 1998. The Dictionary of Forestry. Bethesda, MD: Society of American Foresters. 210 pp.
- Hersh, R.H. 1997. The liberal arts college: The most practical and professional education for the 21st century. *Liberal Education*. Summer:26-33.
- Hirt, P.W. 1994. A Conspiracy of Optimism: Management of the National Forests since World War Two. Lincoln: University of Nebraska Press. 416 pp.
- Hosmer, R. 1923. The progress of education in forestry in the United States. *Commonwealth Forestry Review* 2:88-89.
- Jensen, E.C., P.S. Doescher, and B. Shelby. 1998. A new natural resources degree for a new century. *The Journal of Forestry* 96(2):15-17.
- Kohm, K.A. and J.F. Franklin (eds.) 1997. Creating a Forestry for the 21st Century. Washington, DC: Island Press. 475 pp.
- Krueger, M. 1952. The Society of American Foresters and forestry education. *Journal of Forestry* 50(1): 6-7.
- Manning, R.E. 1998. Integration in natural resources education: Designing a core curriculum. *Society and Natural Resources* 11:179-190.
- McKinney, M.J. 1993. Dispute resolution courses in natural resource schools: Status and needs for the future. *Renewable Resources Journal* 11(2):6-13.
- National Association of Professional Forestry Schools and Colleges (NAPFSC). 1998. Strategic Plan, approved August 13, 1998. <<http://www.napfsc.org/strategy.htm>>.
- Miller, C. 1992. Wooden Politics: Bernhard Fernow and the Quest for a National Forest Policy, 1876-1898. In: *The Origins of the National Forests*, ed. H.K. Steen. Durham, NC: Forest History Society.
- Miller, C. 1994. Old growth: a reconstruction of Gifford Pinchot's "A training of a forester, 1914-1937." *Forest and Conservation History* 38(1): 7-15.

- National Association of State Universities and Land Grant Colleges (NASULGC). 1997. "Returning to our Roots: Student Access." <<http://www.nasulgc.org/Kellog/STATEMENTS/student/execsummary.htm>>.
- Pinchot, G. 1890. Letter to James W. Pinchot, 18 Feb; 31 August. Gifford Pinchot Papers, Library of Congress, Washington, DC.
- Pinchot, G. 1890. Diary. May 1. Gifford Pinchot Papers, Library of Congress, Washington, DC.
- Pinchot, G. 1899. Letter to Amos Pinchot, 19 December. Gifford Pinchot Papers, Library of Congress, Washington, DC.
- Pinchot, G. 1937. *The Training of a Forester*. Philadelphia: J.B. Lippincott. 129 pp.
- Pinchot, G. 1998. *Breaking New Ground*, with an Introduction by C. Miller and V. A. Sample. Reprint, Washington: DC: Island Press. 522 pp.
- Rodgers, III, A.D. 1951. *Bernhard Eduard Fernow: A Story of North American Forestry*. Princeton: Princeton University Press. 623 pp.
- Rupert, S.S. 1997. Introduction to a symposium "The Public Policy Implications of a Global Learning Infrastructure." Denver, Colorado, November 13-14, 1997.
- Sample, V.A., R. Weyerhaeuser, and J.W. Gilmier. 1997. *Evolving toward sustainable forestry: Assessing change in U.S. forestry organizations*. Washington, DC: Pinchot Institute for Conservation.
- Sample, V.A. 1998. "Meeting the challenges of education in sustainable forestry." Pinchot Letter. Washington, DC: Pinchot Institute for Conservation. Spring: 1-4.
- Schenck, C.A. 1955. *The Birth of Forestry in America: Biltmore Forest School, 1898-1913*. St. Paul, MN: Minnesota Historical Society. 224 pp.
- School of Forestry. 1996. *Strategic Plan: A Working Document for 1996-2000*. Flagstaff, AZ: Northern Arizona University.
- Skok, R.A. 1996. *Forestry Education in the United States*. In: *The Literature of Forestry and Agroforestry*. Edited by P. McDonald and J. Lassoie. Ithaca: Cornell University Press.
- School of Natural Resources and Environment (SNRE). 1998. *SAF Accreditation Self-Evaluation Report*. The University of Michigan.
- Society of American Foresters (SAF). 1992. *Forest Resource Management in the 21st Century: Will Forestry Education Meet the Challenge?* Proceedings of the October 30-November 2, 1991 NAPFSC/SAF Forest Resources Education Symposium. Bethesda, MD. 86 pp.
- Steen, H.K. 1976. *The U.S. Forest Service: A History*. Seattle: University of Washington Press. 356 pp.
- Stukel, J.J. 1998. "The Future of Land Grant Universities." Speech before the National Association of State Universities and Land Grant Colleges Extension Directors meeting, Corpus Christi, Texas, February 19, 1998. <<http://www.nsulgc.org>>.
- Tombaugh, L.W. 1998. The forces of change driving forestry education. *Journal of Forestry* 96(2):4-7.
- USA Today. 1998. "A Study by the U.S. Commerce Department Says that Traffic on the Internet is Doubling Every 100 Days." *USA Today*, April 16, 1998.
- Zack, I. "We Want U! How Madison Avenue Educated the American University." *New York Times*. August 5, 1998.

APPENDIX A
Seventh American Forest Congress
Visions and Principles

(adapted from http://www.yale.edu/forest_congress/summary)

Approximately 6,000 citizens participated in the Seventh American Forest Congress gathering in Washington, DC, in February 1996 and in 51 local roundtables and 43 collaborative meetings held in various parts of the country prior to the Washington meeting. In addition, approximately 500 individual contributions were submitted. The purpose of this Forest Congress was to discover the common ground shared by a majority of Americans with a deep interest in the future of the nation's forests. This summary presents a brief glimpse of the common ground shared by most who participated in the Forest Congress process between January 1995 and February 1996, expressed as a "vision" for the future of forests and forestry in America, and a set of principles by which this vision should be achieved.

The following is a listing of those vision elements and principles that were agreed to by 50% or more of those participating in the Forest Congress. Of the 13 vision elements that were developed at the Forest Congress, 12 received votes of agreement by 50% or more of participants. Of the 21 revised principles, 15 received votes of agreement by 50% or more of participants.

Vision Elements

In the tally of these vision elements, Forest Congress participants were instructed to "indicate your level of affirmation using the green, yellow, or red indication" defined as:

Green: Agreement, include as a vision element.

Yellow: Mixed feelings, but willing to accept as a vision element.

Red: Disagreement, do not include as a vision element.

In the future our forests . . .

1. ...will be held in a variety of public, private, tribal, land grant, and trust ownerships by owners whose rights, objectives, and expectations are respected and who understand and accept their responsibilities as stewards.

Level of Agreement	Participants	Percent
Green	910	90%
Yellow	66	7%
Red	31	3%
Total	1007	100%

2. ...will be enhanced by policies that encourage both public and private investment in long-term sustainable forest management.

Level of Agreement	Participants	Percent
Green	899	89%
Yellow	65	6%
Red	45	5%
Total	1009	100%

3. ...will sustainably provide a range of goods, services, experiences, and values that contribute to community wellbeing, economic opportunity, social and personal satisfaction, spiritual and cultural fulfillment, and recreational enjoyment.

Level of Agreement	Participants	Percent
Green	887	88%
Yellow	84	8%
Red	37	4%
Total	1008	100%

4. ...will be maintained and enhanced across the landscape, expanding through reforestation and restoration where ecologically, economically, and culturally appropriate, in order to meet the needs of an expanding human population.

Level of Agreement	Participants	Percent
Green	861	85%
Yellow	100	10%
Red	48	5%
Total	1009	100%

5. ...will be shaped by natural forces and by human actions that reflect the wisdom and values of an informed and engaged public, community and social concerns, sound scientific principles, local and indigenous knowledge, and the need to maintain options.

Level of Agreement	Participants	Percent
Green	847	84%
Yellow	111	11%
Red	48	5%
Total	1006	100%

6. ...will be managed consistent with strategies and policies that foster forest integrity and maintain a broad range of ecological, economic, and social values and benefits.

Level of Agreement	Participants	Percent
Green	795	79%
Yellow	143	14%
Red	68	7%
Total	1006	100%

7. ...will be sustainable, support biological diversity, maintain ecological and evolutionary processes, and be highly productive.

Level of Agreement	Participants	Percent
Green	752	75%
Yellow	185	18%
Red	73	7%
Total	1010	100%

8. ...will contribute to strong and vital rural and urban communities that benefit from, protect, and enhance the forests in their vicinity.

Level of Agreement	Participants	Percent
Green	748	74%
Yellow	157	16%
Red	104	10%
Total	1009	100%

9. ...will be managed with consideration for the global implications of land stewardship.

Level of Agreement	Participants	Percent
Green	697	69%
Yellow	165	17%
Red	143	14%
Total	1005	100%

10. ...will maintain their essential role in protecting watersheds and aquatic systems.

Level of Agreement	Participants	Percent
Green	683	68%
Yellow	143	14%
Red	184	18%
Total	1010	100%

11. ...will be acknowledged as vital by citizens who are knowledgeable and involved in stewardship and who appreciate the contribution of forests to the economic and environmental quality of life.

Level of Agreement	Participants	Percent
Green	678	67%
Yellow	208	21%
Red	123	12%
Total	1009	100%

12. ...will be managed on the basis of a stewardship ethic with respect, reverence, and humility.

Level of Agreement	Participants	Percent
Green	544	54%
Yellow	192	19%
Red	271	27%
Total	1007	100%

Revised Principles

The Forest Congress participants were presented with 19 Draft Principles. Working groups were established to recraft the principles before a canvass on levels of agreement was taken of all the participants. Two of the 19 principles were broken into two revised principles, creating a total of 21. The 15 revised principles that received votes of agreement by 50% or more of participants are listed.

For each of the principles, the participants were instructed to: "Please indicate your agreement (green); your sense of un-ease or lack of information (yellow); or your disagreement (red); for each potential principle. Do this for each potential principle as a stand alone point, even if they overlap."

Green: Agreement, include as a vision element.

Yellow: Mixed feelings, but willing to accept as a vision element.

Red: Disagreement, do not include as a vision element.

1. Ensure that open and continuous dialogue is maintained and encouraged among all parties interested in forests.

Level of Agreement	Participants	Percent
Green	960	88%
Yellow	81	7%
Red	50	5%
Total	1091	100%

2. Voluntary cooperation and coordination among individuals, landowners, communities, organizations, and governments is encouraged to achieve shared ecosystems goals.

Level of Agreement	Participants	Percent
Green	924	85%
Yellow	97	9%
Red	70	6%
Total	1091	100%

3. Cohesive and stable policies, programs, and incentives should be available to allow forest owners and managers to sustain and enhance forests.

Level of Agreement	Participants	Percent
Green	910	84%
Yellow	115	11%
Red	62	6%
Total	1087	100%

4. Science-based information is accessible and understandable, distributed in a timely manner, and contributes to forest policy and management.

Level of Agreement	Participants	Percent
Green	881	80%
Yellow	143	13%
Red	73	7%
Total	1097	100%

5. Comprehensive, integrated, and well-organized research is well funded. It is designed and conducted in collaboration with stakeholders to ensure for society the countless benefits of our forest ecosystems. Knowledge and technology products are effectively distributed, tested, and implemented.

Level of Agreement	Participants	Percent
Green	834	76%
Yellow	134	12%
Red	125	11%
Total	1093	100%

6. All differences in goals and objectives of public, private, and tribal forest owners are recognized and respected. Forest owners, including the general public, recognize and embrace both the rights and responsibilities of ownership. All forest owners acknowledge that public interests (e.g., air, water, fish, and wildlife) exist on private lands and private interests (e.g., timber sales and recreation) exist on public lands.

Level of Agreement	Participants	Percent
Green	809	75%
Yellow	166	15%
Red	110	10%
Total	1085	100%

7. Urban and community forest ecosystems will be valued, enhanced, expanded, and perpetuated.

Level of Agreement	Participants	Percent
Green	809	74%
Yellow	169	15%
Red	120	11%
Total	1098	100%

8. People's actions should ensure that the management of forests should sustain ecosystem structure, functions, and processes at the appropriate temporal and spatial levels.

Level of Agreement	Participants	Percent
Green	763	70%
Yellow	217	20%
Red	113	10%
Total	1093	100%

9. Forestry policy and management decisions must reflect the interdependence of diverse urban, suburban, and rural communities.

Level of Agreement	Participants	Percent
Green	755	69%
Yellow	183	17%
Red	153	14%
Total	1091	100%

10. Forests provide a broad range of social, environmental, cultural, and economic resources and benefits.

Level of Agreement	Participants	Percent
Green	725	67%
Yellow	215	20%
Red	146	13%
Total	1086	100%

11. Forests are a global resource that sustains the health of the planet and its inhabitants. Our forest stewardship must recognize the trends of global population; consequential supply and demand; and the potential for ecological, social, and economic impacts worldwide. We will actively seek to learn from the global community.

Level of Agreement	Participants	Percent
Green	708	65%
Yellow	182	17%
Red	194	18%
Total	1084	100%

12. All federal public lands should be maintained for present and future generations and managed in accordance with national laws. Changes in those laws should be pursued through an open legislative process that allows the airing of views by the public.

Level of Agreement	Participants	Percent
Green	704	65%
Yellow	171	16%
Red	216	20%
Total	1091	100%

13. People's actions should ensure factual information and education concerning forests be readily available, engaging, and actively disseminated to all.

Level of Agreement	Participants	Percent
Green	662	61%
Yellow	223	20%
Red	203	19%
Total	1088	100%

14. Land area covered by forests is maintained and potentially increased.

Level of Agreement	Participants	Percent
Green	581	53%
Yellow	270	25%
Red	238	22%
Total	1089	100%

15. Forestry decisions should take into account the concerns of an increasingly diverse US population, as well as the needs of the forests, while linking benefits and responsibilities within the communities.

Level of Agreement	Participants	Percent
Green	547	50%
Yellow	283	26%
Red	257	24%
Total	1087	100%

APPENDIX B
Forestry Education –Employer Questionnaire
(Conducted by telephone)

Part I:

1. Do you . . .

		Yes	No	N.A.
a.	Supervise forestry school graduates?	1	2	3
b.	Participate in hiring decisions?	1	2	3
c.	Participate in recruiting new forestry school graduates?	1	2	3
d.	Help select the forestry schools where you recruit?	1	2	3

(IF YES TO ANY, CONTINUE, IF NO TO ALL, CLOSE.)

2. About how many forestry school graduates did you hire during the past five years?

_____ **IF ZERO, THANK AND CLOSE.**

2a. How many of those were graduates with bachelor's degrees? Master's degrees? PhDs?

_____ Bachelor's

_____ Master's

_____ PhDs

3. Now, I'd like you to think about the skills that are most important for a forester's long-term success in your organization. I'll read a list of skills that a new forestry school graduate might have. As I read each one, please tell me how important it is for long-term success in your organization on a 10-point scale, where "1" means not very important and "10" means extremely important. (WRITE IN "DK" OR "REF" AS NECESSARY.)

		Rating	Score	Pts
a	A landscape-level understanding of forest ecosystems and how to manage them to meet ecological, economic, and social needs.		1-6=0 7=1 8=2 9=3 10=4	
b	Understanding of the requirements of a healthy forest ecosystem, and the full variety of silvicultural and other tools available to manage that system sustainably.		1-6=0 7=1 8=2 9=3 10=4	
c	Innovation – that is, critical thinking and willingness to test new		1-6=0	

	and non-traditional approaches to forest management.		7=1 8=2 9=3 10=4	
d	Ability to work well in teams that include individuals with a variety of perspectives, both within and outside the organization.		1-6=0 7=1 8=2 9=3 10=4	
e	Ability to listen to and address public questions and concerns and to explain the principles of environmentally responsible forest management practices to the public.		1-6=0 7=1 8=2 9=3 10=4	
f	Ability to utilize innovative approaches to working with the public to address forest management problems.		1-6=0 7=1 8=2 9=3 10=4	
g	Ability to evaluate and synthesize input from a variety of specialists when developing resource management plans.		1-6=0 7=1 8=2 9=3 10=4	
TOTAL: IF < 14 PTS, ASK Q3A – 4B, THEN CLOSE IF ≥ 14 PTS. ASK Q3A AND THEN SKIP TO Q5				

3a. What other skills are important for a forester's long-term success in your organization?

4. We are also conducting a survey of recent graduates of forestry schools in which we will ask them to describe and evaluate the education they received. Since recent graduates are often highly mobile, it is difficult for us to reach them. Will you help us by *either* allowing us to send you a packet of questionnaires that you would distribute to these recent hires or by giving me the names and office mailing address of new forestry school graduates your company has hired during the past three years so we can mail them a questionnaire?

Yes	1	CONTINUE
No	2	THANK AND CLOSE

- 4a. Which would you prefer – to have us send you a packet of questionnaires or to give us the names?

Packet	1	CONTINUE
Names	2	COLLECT NAMES AND MAILING ADDRESSES. THANK AND CLOSE

- 4b. How many questionnaires may I send you? _____ Number

Part II:

5. Which comes closest to your definition of a forester – a specialist in some area of forest management, such as silviculture or timber management OR a generalist who works with a team of specialists to manage the entire forest ecosystem?

Specialist	1
Generalist	2
Both/depends: specify	3
DK/NA	4

6. When you hire new forestry graduates, do you find that they sometimes have to discard or ignore some concepts that they learned in forestry school before they can be fully productive in your work environment?

Yes	1	CONTINUE
No	2	SKIP TO Q7
DK/NA	3	SKIP TO Q7

- 6a. What concepts do they have to discard or ignore? PROBE FOR SPECIFIC TYPES OF:

SCIENTIFIC THEORY

NATURAL RESOURCE MANAGEMENT TECHNIQUES

HUMAN RESOURCE MANAGEMENT TECHNIQUES

7. What new concepts – if any – have recent forestry graduates brought to your organization? PROBE FOR SPECIFIC TYPES OF:

SCIENTIFIC THEORY (i.e., landscape ecology)

NATURAL RESOURCE MANAGEMENT TECHNIQUES (i.e., GIS)

HUMAN RESOURCE MANAGEMENT TECHNIQUES (i.e., alternative dispute resolution)

8. With which forestry schools – or other schools and colleges that confer forestry degrees – have you worked with most in recruiting or hiring foresters in the past 5 years? (ACCEPT UP TO THREE RESPONSES)

Alaska, University of -Fairbanks	1	Mississippi State University	32
Arkansas, University of - Monticello	2	Montana, University of	33
Auburn University	3	Duke University	34
Arizona, University of	4	North Carolina State University	35
(Northern) Arizona University	5	North Dakota State University	36
California University of-Berkeley	6	Nebraska, University of	37
California Polytechnic State University	7	New Hampshire, University of	38
Clemson University	8	New Mexico State University	39
Colorado State University	9	Nevada, University of -Reno	40
Connecticut, University of	10	New York, State University of	41
Cornell University	11	Ohio State University	42
Florida, University of	12	Oklahoma State University	43
Georgia, University of	13	Oregon State University	44
Hawaii, University of	14	Purdue University	45
Humboldt State University	15	Rutgers- State University of New Jersey	46
Iowa State University	16	Pennsylvania State University	47
Idaho, University of	17	Puerto Rico, University of	48
Illinois, University of	18	South Dakota State University	49
(Southern) Illinois University	19	Tennessee, Univ. of-Knoxville	50
Kansas State University	20	Stephen F Austin State University	51
Kentucky, University of	21	Texas A&M University	52
Louisiana Tech University	22	Utah State University	53
Louisiana State University	23	Virginia Polytechnic University	54
Massachusetts, University of	24	Vermont University of	55
Maryland, University of	25	Washington, University of	56
Maine, University of - Orono	26	Washington State University	57
Michigan, University of	27	Wisconsin, University of-Madison	58
Michigan State University	28	Wisconsin, Univ of -Stevens Point	59
Michigan Tech University	29	West Virginia University	60
Minnesota, University of	30	Wyoming, University of	61
Missouri, University of	31	Yale University	62
Other*			

*Do not include if the program does not grant a four-year degree or higher.

9. Now, I would like you to rate each of these schools – based on your experience with their graduates during the past five years – on a number of attributes using a scale of 1 to 10, where “1” means poor and “10” means excellent. How would you rate (FIRST SCHOOL) on (FIRST ATTRIBUTE)? How would you rate (SECOND SCHOOL)? (THIRD SCHOOL)? (WRITE IN “DK” OR “REF” AS NECESSARY.) (IF UNABLE TO RATE SCHOOLS, ASK FOR REFERRAL AND SKIP TO Q10 AND ASK Q10 AND Q10B, THEN SKIP TO Q12. CONDUCT COMPLETE INTERVIEW(S) WITH PERSON FOR PERSONS YOU ARE REFERRED TO.)

1st School _____

2nd School _____

3rd School _____

	(READ LIST ROTATING ATTRIBUTES)	1 st	2 nd	3 rd
a	A landscape-level understanding of forest ecosystems and how to manage them to meet ecological, economic, and social needs.			
b	Understanding of the requirements of a healthy forest ecosystem, and the full variety of silvicultural and other tools available to manage that system sustainably.			
c	Innovation – that is, critical thinking and willingness to test new and non-traditional approaches to forest management.			
d	Ability to work well in teams that include individuals with a variety of perspectives, both within and outside the organization..			
e	Ability to listen to and address public questions and concerns and to explain the principles of environmentally responsible forest management practices to the public.			
f	Ability to utilize innovative approaches to working with the public to address forest management problems.			
g	Ability to evaluate and synthesize input from a variety of specialists when developing resource management plans.			

10. Now, I'll read a list of technical competencies. As I read each one, please tell me how important it is to the long-term success of foresters in your organization on a 10-point scale, where "1" means not very important and "10" means extremely important. (READ LIST ROTATING ATTRIBUTES) (IF UNABLE TO RATE SCHOOLS, ASK FOR REFERRAL AND SKIP TO Q10B, THEN SKIP TO Q12. CONDUCT COMPLETE INTERVIEW(S) WITH PERSON FOR PERSONS YOU ARE REFERRED TO.)

10a. (FOR EACH RATED "7" OR MORE) (Based on your experience with the schools and their graduates during the past five years) How would you rate (FIRST SCHOOL) on (ATTRIBUTE)? How would you rate (SECOND SCHOOL)? (THIRD SCHOOL)?

10b. (FOR EACH RATED "7" FOR MORE) At what level would you expect employees to gain that competency – through their undergraduate education, their graduate education or through continuing education?

	(READ LIST ROTATING ATTRIBUTES) (WRITE IN "DK" OR "REF" AS NECESSARY)	Q10	Q10a			Q10b		
			1 st	2 nd	3 rd	Under-grad	Grad	Continuing
a	Forest ecology					1	2	3
b	Forest soils					1	2	3
c	Tree and plant species identification					1	2	3
d	Forest pathology					1	2	3
e	Fire dynamics in forest ecosystems					1	2	3
f	Conservation biology					1	2	3
g	Wildlife biology					1	2	3
h	Forest inventory and biometry					1	2	3
i	Forest engineering and transportation systems					1	2	3
j	Silvicultural systems					1	2	3
k	Landscape analysis and geographic information systems					1	2	3
l	Resource economics					1	2	3
m	Rural community development					1	2	3

n	Wildland/protected areas mgmt					1	2	3
o	Watershed management					1	2	3
p	Range management					1	2	3
q	Resource policy and law					1	2	3
r	Resource management planning					1	2	3
s	Alternative dispute resolution					1	2	3
t	Managerial leadership					1	2	3
u	Organizational development					1	2	3
v	Human resource management					1	2	3
w	Government relations					1	2	3
x	Financial management					1	2	3
y	Collaborative problem solving					1	2	3
z	Oral communication skills					1	2	3
aa	Written communication skills					1	2	3
bb	Foreign language					1	2	3
cc	Ethics					1	2	3

11. Again using a scale of 1 to 10, where "1" means poor and "10" means excellent, how would you rate the overall performance of the graduates you have recruited or hired during the past five years from (FIRST SCHOOL)? (SECOND SCHOOL)? (THIRD SCHOOL)?

11a. (AFTER EACH RATING ASK) Why do you feel that way?

Q11 Rating	Q11a Reason
1 st	
2 nd	
3 rd	

- 11b. (ASK ONLY TO BREAK A TIE FOR 1ST PLACE) Which school do you prefer to recruit or hire from?

- 11c. Which school does your organization recruit from most often?

- 11d. (IF THE RESPONSES TO Q11b AND Q11c ARE DIFFERENT, ASK WHY)

12. (ASK EVERYONE) We are also conducting a survey of recent graduates of forestry schools in which we will ask them to describe and evaluate the education they received. Since recent graduates are often highly mobile, it is difficult for us to reach them. Will you help us by *either* by allowing us to send you a packet of questionnaires that you would distribute to these recent hires or giving me the names and office mailing address of new forestry school graduates your company has hired during the past three years so we can mail them a questionnaire?

Yes	1	CONTINUE
No	2	THANK AND CLOSE

- 12a. Which would you prefer – to have us send you a packet of questionnaires or to give us the names?

Packet	1	CONTINUE
Names	2	COLLECT NAMES AND MAILING ADDRESSES AND IF POSSIBLE, TELEPHONE NUMBERS, OR ARRANGE TO DO SO. THANK AND CLOSE

- 12b. How many questionnaires may I send you? _____ Number

THANK AND CLOSE

APPENDIX C
Forestry Education – Recent Graduate Survey
(Conducted by Mail)

1. Please tell us about your **most recent** forestry degree. *If you have been awarded more than one forestry degree during the past five years, answer the questions on the white questionnaire in terms of your most recent degree and use the blue questionnaire for your next most recent degree.*

<i>Your Degree(s)</i>	<i>Year of Graduation</i>	<i>College or University</i>	<i>Field/Major</i>
2-year degree	①		
Bachelor's degree	②		
Master's degree	③		
Ph.D.	④		

2. Which of the following best describes the goal of the forestry school you attended?

To prepare foresters to work in specialized areas of forest management	①
To prepare foresters to be forest management generalists	②

3. Please rate your forestry school's performance in helping you acquire the following *general* skills using a 10-point scale, where "1" means poor and "10" means outstanding.

	<i>1=</i> Poor	<i>10=</i> Outstanding
A landscape-level understanding of forest ecosystems and how to manage them to meet ecological, economic, and social needs.	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩	
Understanding of the requirements of a healthy forest ecosystem, and the full variety of silvicultural and other tools available to manage that system sustainably.	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩	
Innovation - that is, critical thinking and willingness to test new and non-traditional approaches to forest management.	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩	
Ability to work well in teams that include individuals with a variety of perspectives, both within and outside the organization.	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩	
Ability to listen and address public questions and concerns and to explain the principles of environmentally responsible forest management practices to the public.	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩	
Ability to utilize innovative approaches to working with the public to address forest management problems.	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩	
Ability to evaluate and synthesize input from a variety of specialists when developing resource management plans.	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩	

4. For each of the competencies listed below, please answer the following questions.
- 4a. Was any specific education in this competency available through either courses taught at the forestry school, or through other departments in the university?
- 4b. Check ☒ the competencies required for your degree program.
- 4c. For each not required. Check ☒ the competencies for which your forestry school encouraged you to get education within the university.

	Q4a Available Through....		Q4b ☒ If Required	Q4c ☒ If Encouraged
	Forestry School	Other Departments		
Forest ecology	①	②	☐	☐
Forest soils	①	②	☐	☐
Tree/plant species identification	①	②	☐	☐
Forest pathology	①	②	☐	☐
Fire dynamics in forest ecosystems	①	②	☐	☐
Conservation biology	①	②	☐	☐
Wildlife biology	①	②	☐	☐
Forest inventory and biometry	①	②	☐	☐
Forest engineering/transportation systems	①	②	☐	☐
Silvicultural systems	①	②	☐	☐
Landscape analysis/geographic information systems	①	②	☐	☐
Resource economics	①	②	☐	☐
Rural community development	①	②	☐	☐
Wildland/protected areas management	①	②	☐	☐
Watershed management	①	②	☐	☐
Range management	①	②	☐	☐
Resource policy and law	①	②	☐	☐
Resource management planning	①	②	☐	☐
Alternative dispute resolution	①	②	☐	☐
Managerial leadership	①	②	☐	☐
Organizational development	①	②	☐	☐
Human resource management	①	②	☐	☐
Government relations	①	②	☐	☐
Financial management	①	②	☐	☐
Collaborative problem solving	①	②	☐	☐
Oral communication skills	①	②	☐	☐
Written communication skills	①	②	☐	☐
Foreign language	①	②	☐	☐
Ethics	①	②	☐	☐

5. Please check ✓ the competencies for which you received education within your forestry school, then check ✓ those for which you received education through another department in the university.

5a. Then, rate the education you received – both within your forestry school and through other departments in the university -- on a 10-point scale where “1” means poor and “10” means outstanding.

Q5. ✓ Received education			Q5a									
Forestry School	Other Department		1=Poor									10=Outstanding
☐	☐	Forest ecology	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Forest soils	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Tree/plant species identification	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Forest pathology	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Fire dynamics in forest ecosystems	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Conservation biology	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Wildlife biology	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Forest inventory and biometry	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Forest engineering/transportation systems	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Silvicultural systems	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Landscape analysis/geographic information systems	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Resource economics	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Rural community development	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Wildland/protected areas management	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Watershed management	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Range management	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Resource policy and law	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Resource management planning	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Alternative dispute resolution	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Managerial leadership	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Organizational development	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Human resource management	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Government relations	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Financial management	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Collaborative problem solving	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Oral communication skills	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Written communication skills	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Foreign language	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
☐	☐	Ethics	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩

6. Again using a scale of 1 to 10, where "1" means poor and "10" means outstanding, how would you rate the overall performance of your school in helping you prepare for your career?

Poor ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ Outstanding

- 6a. Why do you feel that way?

7. How would you change your forestry school program to make it more relevant to the work you do today?

8. How would you change your forestry school program to make it more relevant to the position you hope to hold in 10 years?

9. How many years have you been in your current position _____ Years

10. How many years have you been working in forestry? _____ Years

*You may use the stamped, self-addressed envelope to return the survey to us.
Thanks again for your time, effort and opinions.*

APPENDIX D

Profiles of Forestry Schools (Alphabetical by State)

A total of 55 schools that offer baccalaureate or higher degree programs in forestry were contacted for the purpose of this study. They include the 48 schools that are accredited by the Society of American Foresters (SAF); one school that is a candidate for SAF accreditation; the members of the National Association of Professional Forestry Schools and Colleges (NAPFSC) that offer forestry studies; and a few additional small colleges where forestry studies are offered. All information was obtained from documents made available by the schools, including catalogs, brochures, websites, strategic plans, and letters from programs heads, or through conversations with program heads.

The following profiles of programs include a descriptions of the program's mission, undergraduate degrees offered, graduate degrees offered, and SAF accreditation (where applicable). Note that SAF grants accreditation only to specific educational curricula, not to the school itself. Degree descriptions are generally limited to professional forestry degrees, although other degrees are listed to indicate the breadth of a department or college.

The following is a list of the programs that are included in this appendix:

State	University	Program
Alabama	Alabama A&M	Center for Forestry and Ecology
	Auburn University	School of Forestry and Wildlife Sciences
Alaska	University of Alaska	Department of Forest Sciences
Arizona	Northern Arizona University	School of Forestry
Arkansas	University of Arkansas	School of Forest Resources
California	California Polytech	Natural Resources Management Department
	Humboldt State University	Department of Forestry
	University of California (Berkeley)	College of Natural Resources
Colorado	Colorado State University	Department of Forest Sciences
Connecticut	University of Connecticut	Department of Natural Resources and Engineering
	Yale University	School of Forestry and Environmental Studies
Florida	University of Florida	School of Forest Resources and Conservation
Georgia	University of Georgia	School of Forest Resources
Idaho	University of Idaho	College of Forestry, Wildlife, and Range Sciences
Illinois	Southern Illinois	Department of Forestry
	University of Illinois	Department of Natural Resources and Environmental Sciences
Indiana	Purdue University	Department of Forestry and Natural Resources
Iowa	Iowa State	Department of Forestry
Kentucky	University of Kentucky	Department of Forestry
Louisiana	Louisiana State University	School of Forestry, Wildlife, and Fisheries
	Louisiana Tech University	School of Forestry
Maine	University of Maine	College of Natural Sciences, Forestry, and Agriculture

Massachusetts	University of Massachusetts	Department of Natural Resources Conservation
Michigan	Michigan State	Department of Forestry
	Michigan Tech	School of Forestry and Wood Products
	University of Michigan	School of Natural Resources and Environment
Minnesota	University of Minnesota	College of Natural Resources
Mississippi	Mississippi State	College of Forest Resources
Missouri	University of Missouri	School of Natural Resources
Montana	University of Montana	School of Forestry
Nevada	University of Nevada	Department of Environmental Resource Sciences
New Hampshire	University of New Hampshire	Department of Natural Resources
New Jersey	Rutgers University	Department of Ecology, Evolution, and Natural Resources
New York	Cornell University	Department of Natural Resources
	Paul Smith's College	Natural Resources, Sciences, and Liberal Arts Division
	SUNY ESF	Faculty of Forestry
North Carolina	Duke University	School of the Environment
	North Carolina State	Department of Forestry
Ohio	Ohio State	School of Natural Resources
Oklahoma	Oklahoma State	Department of Forestry
Oregon	Oregon State	College of Forestry
Pennsylvania	Penn State	School of Forest Resources
South Carolina	Clemson University	Department of Forest Resources
Tennessee	University of Tennessee	Department of Forestry, Wildlife, and Fisheries
Tennessee	University of the South	Department of Forestry and Geology
Texas	Stephen F Austin State	College of Forestry
	Texas A&M	Department of Forest Science
Utah	Utah State	Department of Forest Resources
Vermont	University of Vermont	School of Natural Resources
Virginia	Virginia Polytech	Department of Forestry
Washington	University of Washington	College of Forest Resources
	Washington State	Department of Natural Resource Sciences
West Virginia	West Virginia University	Division of Forestry
Wisconsin	University of Wisconsin (Madison)	Department of Forest Ecology and Management
	University of Wisconsin (Stevens Point)	College of Natural Resources

Alabama A&M
School of Agriculture and Environmental Sciences
Center for Forestry and Ecology

Mission:

Information not provided.

Undergraduate Degrees Offered:

- **BS in Forestry**

The curriculum in forestry integrates biological, physical, and social aspects of forest management while providing students with a fundamental appreciation for the various resources associated with forests. Two options are available. The Forest Management option is designed for those students who desire immediate employment in forestry. Those students who desire a more specialized education (in such areas as soil science biotechnology, environmental protection, molecular genetics, etc.), with the intention of pursuing post-graduate education, may elect to pursue the more flexible Forest Science option. In addition to these two options, several minors are available to students.

Graduate Degrees Offered:

Information not provided

SAF Accreditation: Candidate for SAF accreditation for the BS in Forestry, option in Forest Management.

Auburn University (Auburn University, AL)
School of Forestry and Wildlife Sciences

Mission:

As the State of Alabama's only accredited forestry degree program, the School's mission is to develop and disseminate knowledge to enhance the understanding and stewardship of forests and related resources for the benefit of students, forestry professionals and society.

Undergraduate Degrees Offered:

- **BS in Forestry**

The objectives of the forestry curriculum are to provide: 1) the fundamental knowledge regarding the resources that professional foresters typically manage and the multiple uses of those resources; 2) a general education integrating physical, social and biological sciences to prepare the forester for the role as steward of public and private forest resources; 3) training and skills needed for initial forestry employment, as well as for advancement to higher levels of managerial responsibility. The forestry degree is appropriate for students who seek employment in any aspect of forestland management from industrial lands where timber production is the primary objective, to public lands where recreation or environmental protection is often paramount. The curriculum emphasizes biological, ecological and economic considerations in forest management.

- **BS in Forest Engineering** (offered in conjunction with the College of Engineering)

Forest Engineering students receive academic training that addresses the engineering of forest systems, natural resources, and related manufacturing industries. The goal of the program is to produce engineers grounded in basic and applied principles in engineering, forestry, natural resources, and biosystems.

- **BS in Wildlife Sciences**

Graduate Degrees Offered:

- **Master of Forestry (MF)**

The MF programs prepare students for a professional employment in business, public agencies, consulting firms and forest industry. Two MF options are available; both are non-thesis programs. One, for students with undergraduate degrees in forestry, involves primarily advanced course work and can be completed in one year. A second MF program, for individuals with baccalaureate degrees in fields other than forestry, is a two-year program that begins with a 10-week summer field practicum.

- **MS, PhD**

The MS program, which involves research and a thesis and normally requires two years for completion, can be tailored for students with degrees in forestry, the biological sciences, physical sciences, economics, engineering, and business who are interested in sciences and research basic to their areas of prospective employment. The MS and PhD degrees are offered in the fields of forest biology and ecology, forest measurements, forest management/economics, timber harvesting/forest operations, and forest products.

SAF Accreditation: BS in forestry; BS in forest engineering.

University of Alaska (Fairbanks, AK)
College of Natural Resource Development and Management
Department of Forest Sciences

Mission:

Natural resources management is making and implementing decisions to develop, maintain, or protect ecosystems to meet human needs and values. The core natural resources management curriculum provides students with a broad education in the various natural resources and their related applied fields. Programs can be tailored to enhance a student's depth or breadth in a given field of interest. The program is designed for students desiring careers in resources management or in other fields requiring knowledge of resources management, students planning advanced study, as well as those wishing to be better informed citizens.

The goals of the forestry program are: to produce graduates who are highly competitive in obtaining professional employment, who have the knowledge to perform well on the job and who are valued for work in Alaska and the circumpolar North; maintain close student interaction with faculty and provide opportunity for students to obtain practical professional experience as part of their education; and to prepare students for lifelong learning and responsible participation in decision making about the use of natural resources.

Undergraduate Degrees Offered:

- **BS in Natural Resources Management**

The Bachelor's degree has three concentrations: Forestry; Plant, Animal, and Soil Sciences; and Resources. The forestry concentration offers students the opportunity to focus on the multi-resource management of forests and associated ecosystems for the sustained production of goods and services and to prepare for forestry related employment.

The University provides students with a foundation in the biological, social, and physical sciences and a blend of classroom, laboratory, and fieldwork to develop skills for a career in forestry. The forestry concentration leads to a professional degree in forestry.

Graduate Degrees Offered:

- **MS in Natural Resources Management**

The courses and curriculum for this program were developed in cooperation with groups and agencies that work professionally with resource management in Alaska.

The MS program offers both thesis and non-thesis options. The thesis option is designed for those intending to pursue management careers requiring thorough familiarity with research procedures and techniques in one or more of the resource fields, to proceed to doctoral programs, and/or to conduct research in management problems. The non-thesis option is designed for those planning a management career involving largely non-research responsibilities such as general planning and administration, communication and public information, and impact assessment.

SAF Accreditation: BS in Natural Resources Management, concentration in Forestry.

Northern Arizona University (Flagstaff, AZ)
College of Ecosystem Science and Management
School of Forestry

Mission:

The fundamental mission of the School is to foster the intellectual and personal development of our students, at both the undergraduate and graduate levels. We intend that our students be, first of all, liberally educated, secondly good citizens, and finally skilled professionals.

The School of Forestry educates students in ecosystem science and management by integrating instruction in biophysical and human systems. In Forestry, we cross traditional boundaries by applying a transdisciplinary approach and multiple resource knowledge to ecosystem studies. In Parks and Recreation Management, we emphasize human to nature interactions.

Undergraduate Degrees Offered:

- **BS in Forestry**

In the School of Forestry's professional program, undergraduate students take three sequential semesters of integrated, immersion, team-taught instruction. Students learn about forest ecosystems in the fall semester of their junior year; the emphasis shifts to management practices and human values of wildlands in the spring semester. In the capstone course (fall of senior year), students collect research data on a large forest area, use a computer-aided decision-support system to develop a management plan for that land, and write a report that comprehensively describes and analyzes how various management alternatives can meet multiple and often conflicting goals.

- **BS in Parks and Recreation Management**

Students select one of four emphasis areas: community/commercial recreation, outdoor/environmental leadership, wildland recreation management, or an individualized program of study.

- **BS in Native American Forestry Program**

The mission of the Native American Forestry Program is to develop educational and research activities that support Native American tribes in achieving self-determination in the management of their forest ecosystems.

Graduate Degrees Offered:

- **MS in Forestry**

The masters program offers both thesis and non-thesis options. The non-thesis option is a terminal degree with the goal of preparing individuals for careers as land managers, in contrast to careers in research or education. The thesis option is an individually tailored program of study requiring two calendar years of academic work. It is designed to give students experience in carrying out the kind of research they desire to do in their professional careers.

- **PhD in Forest Science**

The goal of the PhD program is to prepare individuals for a career in research and/or education. The program has three emphasis areas: ecosystem science, forest management sciences and economics, and forest social science.

SAF Accreditation: BS in Forestry.

University of Arkansas (Monticello, AR)
School of Forest Resources

Mission:

The mission of the School of Forest Resources is to educate professional forest and wildlife resource managers, to enlarge the body of knowledge in renewable forest resources and to disseminate new ideas and technology. Successful accomplishment of this mission will promote and enhance management, conservation and appreciation of public and private forests, thereby providing for continuous production and optimum attainment of a variety of forest resources for the people of Arkansas, the South, and the nation. These resource benefits include the production of wood and fiber, wildlife, and clean water; as well as provision for recreation, aesthetic and other special values.

Undergraduate Degrees Offered:

- **BS in Forestry**

In the forestry major, students are given a balance of general and professional course work. General course work includes both the General Education sequence and twelve hours of free electives. The professional sequence consists of a forestry core curriculum and a block of supportive requirements. A major component of the forestry core curriculum is the required eight-week Forestry Summer Camp, an outdoor experience that enhances the student's leadership skills, decision-making abilities, and other professional expertise.

- **BS in Wildlife Management**

The Wildlife Management major is a professional program designed to give students a broad scientific background for management and perpetuation of wildlife resources.

Graduate Degrees Offered:

- **MS in Forest Resources**

SAF Accreditation: BS in Forestry.

California Polytechnic State University (San Louis Obispo, CA)
Natural Resources Management Department

Mission:

The mission is to provide the highest quality undergraduate program in sustainable forestry and natural resources management that integrates related disciplines and strives for a forest ecosystem perspective. This integrated program consists of unique areas of study in watershed, fire and chaparral management, urban forestry, hardwood management, environmental management, and parks and forest recreation.

Undergraduate Degrees Offered:

- **BS in Forestry and Natural Resources**

The Bachelor of Science degree program in Forestry and Natural Resources prepares students for important careers in the protection, management, and development of our forest and natural resources. Students may elect to emphasize forest and land management disciplines, such as recreation management; urban forestry; environmental management; watershed, chaparral and fire management; hardwood management; wildlife biology.

- **BS in Recreation Administration**

The BS degree program in Recreation Administration offers professional preparation for employment in public, non-profit, private, and commercial leisure service organizations.

Graduate Degrees Offered:

- **MS in Forestry Sciences**

SAF Accreditation: BS in Forestry and Natural Resources.

Humboldt State University (Arcata, CA)
College of Natural Resources and Sciences
Department of Forestry

Mission:

The forestry program has six goals: Attract and retain well-qualified and motivated students; maintain relevancy and excellence in undergraduate forestry education and instill a recognition for the need for interdisciplinary cooperation; educate students to be thinking, responsible citizens, well prepared to be leaders in their communities and profession; produce graduates who possess the technical knowledge and professional qualities needed by a rapidly

changing society; provide continuing education for professionals in the field of forestry; and provide for faculty development and increased teaching effectiveness through active involvement in research, professional activities, and continuing education.

Undergraduate Degrees Offered:

- **BS in Forestry**

The program in forestry is an incorporative discipline, drawing from the biological, physical, social, and managerial sciences. The curriculum aids in understanding the biological complexities of the forest and the interactions between the forest and social and economic demands. The program provides sufficient background and depth of education to give students a sound basis for professional growth within a broad range of forestry-related careers.

Options are available in Forest Production Management; Forest Resource Conservation; or Forest Resources Management.

Graduate Degrees Offered:

- **MS in Natural Resources**

The MS degree in Natural Resources is available for those wishing to pursue a graduate degree in forestry/watershed management and other natural resources. The MS degree may be pursued as either a research degree or as a professional degree.

SAF Accreditation: BS in Forestry.

University of California – Berkeley (Berkeley, CA)

College of Natural Resources

Department of Environmental Science, Policy, and Management

Mission:

The Department of Environmental Science, Policy, and Management (ESPM) was formed in 1993 by the merging of the Departments of Conservation and Resource Studies, Entomological Sciences, Forestry and Resource Management, Plant Pathology, and Soil Science. Each former department had world-recognized expertise in disciplines relevant to natural resource and environmental issues. ESPM integrates these disciplines into a single academic unit that combines both disciplinary and interdisciplinary education.

Undergraduate Degrees Offered:

- **BS in Forestry**

The forestry major is the primary vehicle for students intending to enter the profession of forestry. Its objective is the education of men and women to manage forests and related wildlands to yield their full capacity of wood, water, forage, wildlife habitat, recreational opportunities and other desired environmental benefits.

The forestry curriculum is composed of three parts: (1) a two-year preparatory program in basic physical, biological, and social sciences; (2) a required eight-week summer field program immediately preceding the junior year, and (3) a two-year professional program. More than one-third of the upper division program is taken as a combination of restricted and free electives. This enables students to acquire either a highly specialized or a broad knowledge of professional forestry. In addition, students may develop specialized programs in such areas as forest ecology, silviculture, and timber management; range ecology and management; wildlife biology and management; watershed management and hydrology; recreation and park management; and resource economics and planning.

Graduate Degrees Offered:

- **Master of Forestry (MF)**

The MF degree is the advanced professional forestry degree granted by the Department. The student who has completed an undergraduate curriculum in forestry is usually broadly trained in the principles of forestry, but has not yet had the opportunity to become proficient in the application of these principles to diverse problems involved in professional practice. The MF program is designed to advance the student's understanding of the essentials of

professional forest management at the graduate level within the context of resource and environmental planning of sustainable systems. The program consists of three components: course work, an internship, and a professional paper.

- **MS and PhD in Environmental Science, Policy, and Management**

The Department offers both the MS and the PhD degrees in Environmental Science, Policy, and Management. The degree programs address current and future anthropogenic environmental problems of major social and political impact, which are based in the biological and physical sciences. The goal of the program is to provide both a strong disciplinary education and broadly based experience in cross-disciplinary communication and problem solving.

SAF Accreditation: BS in Forestry.

Colorado State University (Fort Collins, CO)
College of Natural Resources
Department of Forest Sciences

Mission:

The mission of the Department of Forest Sciences is to serve the University and the profession of forestry by providing a high quality educational program in the discipline of forest sciences, by contributing new knowledge to the field through scholarly endeavors, and to disseminate that knowledge to the profession, the public, and the University through service and outreach activities.

Undergraduate Degrees Offered:

- **BS in Forestry**

The major in forestry emphasizes professional training in multiple-use forestry. It also provides a broad education in the basic sciences as well as an introduction to the behavioral and social sciences, and arts and humanities. All students in the major must choose one of four concentrations (Forest Biology, Forest Fire Science, Forest Management, and Forest Business) that best suits their career objectives.

- **BS in Natural Resources Management**

This curriculum is designed to provide the broadest possible exposure to natural resources. Opportunities exist for individualized advising to meet specific student objectives.

Graduate Degrees Offered:

- **Master of Forestry (MF)**

The Department of Forest Sciences offers a Plan C (coursework only) Master of Forestry degree. Currently, MF specializations are offered in Forest Management and Spatial Data Analysis.

- **MS, PhD in Forestry**

MS and PhD degrees are offered in the following specializations: Remote Sensing/Geographic Information Systems; Quantitative Analysis of Natural Resource Policy and Management; Forest Economics and Policy Analysis; Wood Engineering/Wood Science; Forest Ecology; Forest Ecosystem Management; and Forest Fire Science.

SAF Accreditation: BS in Forestry, with concentrations in Forest Biology, Forest Fire Science, and Forest Management; BS in Natural Resources Management.

University of Connecticut (Storrs, CT)
College of Agriculture and Natural Resources
Department of Natural Resources and Engineering

Mission:

The focus of the Department is to provide high-quality undergraduate and graduate education, to generate new knowledge by conducting research, and to provide extension and outreach programs in the field of natural resource management and engineering and environmental science.

Specific concentrations in the department are directed toward water, air, forests, fisheries, and wildlife resources, and remote sensing/geographic information systems. The department's overall purpose is to contribute to the solution of environmental problems, to increase the understanding of natural resources systems, and to enhance the wise management of these resources.

Undergraduate Degrees Offered:

- **BS in Natural Resources Management and Engineering (NRME)**

The principle objective of the undergraduate program in the Department is to provide students with a rigorous education in natural resources management and technology, with a strong background in basic sciences and liberal arts. Courses selected by the student can be interdisciplinary or can emphasize a specific discipline such as wildlife, fisheries, or forest management, earth resource information systems, and atmospheric or water resources.

Graduate Degrees Offered:

- **MS in Land, Air, and Water Resources**

SAF Accreditation: None.

Yale University (New Haven, CT)

School of Forestry and Environmental Studies

Mission:

The mission of the School of Forestry and Environmental Studies is to provide leadership, through education and research, in the management of natural resource systems and in the solution of environmental problems. Through its focused educational programs, the School develops leaders for major institutions concerned with the earth's environment. Through its research activities, the School fosters study in selected areas of particular importance for resource and environmental management. The School encourages long-range thinking about natural resources and the environment and urges its students to pass beyond the mere identification of problems to the actual design and management of their solutions.

Undergraduate Degrees Offered:

None

Graduate Degrees Offered:

- **Master of Forestry (MF)**

The Master of Forestry program is a professional study aimed at training practitioners of forestry for administration and management of forest lands. The School of Forestry and Environmental Studies rejects departmentalization and strives to cooperate and integrate between disciplines as a faculty. The MF program reflects this. To address the future roles of the resource professional, the MF curriculum has a thematic pathway for the education of an individual within a graduate professional degree program. Conceptually, the pathway relies upon having three educational stages within the curriculum that facilitates the educational development of the student. Stage 1 is "Basic Knowledge," Stage 2 is "Frameworks and Skills for Integrating Knowledge," and Stage 3 includes "Synthesis and Analysis of Knowledge" and the "Capstone."

- **Master of Forest Science (MFS)**

This degree is intended for students who seek a master's program with focus on a specific discipline, most often as preparation for a research career and doctoral study. Each MFS curriculum will have a disciplinary focus.

- **Master of Environmental Studies (MES)**

This degree is designed for students with primary interests in regulatory, stewardship, education, consulting, or management careers dealing with natural resource or environmental issues.

- **Doctor of Forestry and Environmental Studies (DFES), PhD in Forestry**

Doctoral work is concentrated in areas of faculty research, which currently encompass the following broad foci: ecosystem dynamics, structure, and function; conservation of biological diversity; management of forest ecosystems; coastal and watershed systems; property, institutions, and environment; and valuation, risk, and environmental decision

making. The PhD degree is oriented toward research in the natural and social sciences as applied to natural resource and environmental problems. The DFES degree is intended for people whose career interests are oriented toward problem solving.

SAF Accreditation: MF.

University of Florida (Gainesville, FL)
College of Agriculture
School of Forest Resources and Conservation

Mission:

The School's mission is to develop, communicate, and apply knowledge for management and conservation of forest resources in an economically, ecologically, and socially sustainable manner.

Undergraduate Degrees Offered:

- **BS in Forest Resources and Conservation (BSFRC)**

Students may pursue majors in Forest Resources and Conservation (FRC) or in Natural Resource Conservation (NRC). Both majors provide a broad education, allowing graduates to advance in their careers to positions of greater responsibility and leadership. In addition to general education in the arts, history, humanities, and social sciences offered within the university, students receive thorough training in the basic sciences and in essential aspects of their chosen field. All students follow a common pre-professional curriculum and take five school-wide, required courses in addition to the specific curriculum designed for their major. These curricula provide a thorough understanding of natural ecosystems and the impacts imposed upon them by the varied and multiple needs they serve. Also stressed are the interrelationships between the various professional disciplines needed for effective management and conservation of natural resources.

The FRC major provides understanding of forest resources and develops the expertise in forest resource management that is essential to meet contemporary and future needs for the vast array of social, environmental, and physical products of forest ecosystems. Students may select any of four specializations: forest resource management, urban forestry, international agroforestry, and forest science.

Graduate Degrees Offered:

- **Master of Forest Resources and Conservation (MFRC)**

The MFRC is a non-thesis degree intended primarily for individuals interested in additional professional training and specialization. An MFRC program can be developed in any area of interest such as: Forest Business Management, Agro/Tropical Forestry, Urban Forestry, Natural Resource Conservation, and Natural Resource Education and Extension.

- **MS; PhD**

The MS degree is intended for students wanting to further their knowledge and conduct research in any discipline related to forest resources. The PhD is an advanced research degree that entails mastery of a field of knowledge and research leading to a significant contribution in a discipline related to the broad area of forest resources and conservation.

SAF Accreditation: BS in Forest Resources and Conservation.

University of Georgia (Athens, GA)
Daniel B. Warnell School of Forest Resources

Mission:

Information not provided.

Undergraduate Degrees Offered:

- **BS in Forest Resources (BSFR)**

The curriculum for the BSFR degree consists of two parts: the pre-professional portion that gives students a two-year foundation in the biological, physical and social sciences and the humanities; and the professional portion consisting of two years of forest resources courses (soils, ecology, dendrology, silviculture, hydrology, fish and wildlife biology, resource economics, resource management, and engineering). In addition to this general background, students are required to select one of four majors leading to the BSFR: Forestry, Wildlife, Fisheries and Aquaculture, or Forest Environmental Resources.

Graduate Degrees Offered:

- **Master of Forest Resources (MFR)**

The MFR degree is normally a terminal degree, well suited for students desiring additional coursework in Forest Resources. No thesis is required.

A joint degree program between the BSFR and the MFR will be offered starting in the fall of 1999. Admission to the joint BSFR/MFR program will generally occur at the end of the student's first year in the School of Forest Resources' Professional Program.

- **MS, PhD**

The MS degree is suitable for students wishing to specialize in particular academic or scientific areas, for those planning academic, research, or staff specialist careers, and for those planning to pursue a PhD. The PhD is often regarded as a degree of specialized education within a relatively narrow field of expertise. However, in a professional school it may also be regarded as a broadening degree, particularly when the program is designed with planning, administration, and managerial goals in mind.

SAF Accreditation: BS in Forest Resources.

University of Idaho (Moscow, ID)
College of Forestry, Wildlife, and Range Sciences

Mission:

The mission of the College of Forestry, Wildlife, and Range Sciences is to be a dynamic, responsive educational institution of choice in the West that serves Idaho's citizens, communities, natural resource organizations and industries, and the northern Rocky Mountain region, the nation and the international community by: 1) educating students, and graduating resource professionals with knowledge and skills that allow them to function in integrated resource management environments and science organizations; 2) creating knowledge and finding solutions to natural resource problems and regional development issues faced by communities, organizations, and industries; and 3) transferring ideas, information and technologies that foster learning, education, and economic development.

Undergraduate Degrees Offered:

- **BS in Forest Resources**

The program provides students with a broad, integrated perspective of the diversity of forest ecosystems and the many resources – amenities, products, services, and values – that sustainable forest management makes possible for the people of the world. The BS in Forest Resources degree has four options: Administration, Production, Science, and Ecosystem Management.

- **BS in Forest Products**
- **BS in Natural Resources Ecology and Conservation**
- **BS in Fishery Resources**
- **BS in Rangeland Ecology**
- **BS in Resource Recreation and Tourism**
- **BS in Wildlife Resources.**

Graduate Degrees Offered:

- **MS, PhD**

Graduate programs are offered in most areas of specialization of forest resources. For the Master of Science, both thesis and non-thesis options are offered. The PhD degree is available with a major in forestry, wildlife, and range sciences.

SAF Accreditation: BS in Forest Resources.

Southern Illinois University (Carbondale, IL)

College of Agriculture

Department of Forestry

Mission:

The mission of the Department of Forestry is to foster responsible stewardship of forest resources in Illinois, the Midwest, the nation, and on the international level. In pursuit of this mission, the departmental faculty engage in a coordinated program of teaching, research, and service that is dedicated to developing and disseminating appropriate technology, practices, and information.

Undergraduate Degrees Offered:

- **BS in Forestry**

Students can specialize in forest resources management or outdoor recreation resources management. The forest resources management curriculum is designed to prepare a student for a career in forest management and production, multiple-use resource management, or the forest products industry. The specialization in outdoor recreation resources management provides interdisciplinary training for students who plan to become managers of the nation's wealth of outdoor recreation sites.

Graduate Degrees Offered:

- **MS in Forestry**

The Department of Forestry offers a program of study leading to the Master of Science degree in Forestry. Three areas of concentration are available: Forest Resource Management, Outdoor Recreation Resources Management, and Wood Science and Technology. Joint programs with departments such as Botany and Geography, leading to the PhD degree, are also available.

SAF Accreditation: BS in Forestry.

University of Illinois (Urbana, IL)

College of Agricultural, Consumer, and Environmental Sciences

Department of Natural Resources and Environmental Sciences

Mission:

The Department of Natural Resources and Environmental Sciences endeavors to establish and implement research and educational programs that enhance environmental stewardship in the management and use of natural, agricultural and urban systems in a socially responsible manner.

Undergraduate Degrees Offered:

- **BS in Forestry**

The Forestry program prepares students for all phases of the management of forest properties (private or public, large or small) for the production of valuable wood products and for watershed protection, wildlife habitat, recreational enjoyment and other benefits. The program focuses on the management of natural resources in forested areas, including environmental quality and ecology. A separate option in Wood Products Industries was recently eliminated.

- **BS in Natural Resources and Environmental Sciences**

Within the Natural Resources and Environmental Sciences curriculum, students can choose from biological, social, or soil science options.

- **BS in Horticulture**

Within the Horticulture curriculum, students can choose from options in production and management, horticultural science, and urban forestry.

Graduate Degrees Offered:

- **MS; PhD**

The Department includes five major areas of research and teaching: agricultural entomology, fiber science, forestry, horticulture, and soil science. Two options -- thesis or non-thesis --are open to students who wish to pursue a Master of Science degree.

SAF Accreditation: BS in Forestry.

Purdue University (West Lafayette, IN)

College of Agriculture

Department of Forestry and Natural Resources

Mission:

The mission of the Department of Forestry and Natural Resources is to develop and disseminate knowledge in the natural resource sciences associated with the protection, management, and sustainable use of forests and related ecosystems. Such resources include fish and wildlife, outdoor recreational opportunities, timber, and water. The department also has as part of its mission to develop and disseminate knowledge in wood science and technology since wood is a raw material derived from timber.

Undergraduate Degrees Offered:

- **BS in Forestry**

The forestry program prepares students for professional careers with organizations that manage forest and related lands. Students apply biological, ecological, economic, and social knowledge to develop and administer forest management plans. The Department curriculum has common core requirements with the fisheries and aquatic sciences, natural resources, and wildlife curricula. Sustainable management of natural resource systems -- focusing on forests, watersheds, and associated flora and fauna to meet the needs of society -- is emphasized.

- **BS in Natural Resources**
- **BS in Fisheries and Aquatic Sciences**
- **BS in Wildlife**
- **BS in Wood Products Manufacturing Technology** (A joint effort of the Department of Forestry and Natural Resources and the School of Technology)

Graduate Degrees Offered:

- **MS in Forestry; MS; and PhD**

The Department of Forestry and Natural Resources offers graduate study leading to the Master of Science in Forestry, Master of Science, and PhD in the following areas of specialization: forest biology, quantitative resources analysis, outdoor recreation and tourism, and wildlife science. The MS in Forestry is a research-oriented degree that prepares the individual for employment in his or her area of specialty or may provide background to continue for the PhD degree.

SAF Accreditation: BS in Forestry.

Iowa State (Ames, IA)
College of Agriculture
Department of Forestry

Mission:

The Department of Forestry is committed to providing the highest quality education possible to undergraduate and graduate students interested in forest resource management or wood science. The Department offers courses that are concerned with the management of forest ecosystems for multiple benefits including wood and fiber products, biodiversity, recreation, water, wilderness, and wildlife.

Undergraduate Degrees Offered:

- **BS in Forestry**

The primary goal of the undergraduate curriculum in forestry is to educate foresters to be capable of scientifically managing the nation's forestlands. The purpose of the undergraduate curriculum in forestry is to prepare students for professional employment in management and utilization of natural resources, and to equip them to function effectively in a complex society. Students majoring in forestry are required to choose one of the following options at the end of their sophomore year: forest resource management or forest products.

Graduate Degrees Offered:

- **MS, PhD in Forestry**

The graduate program offers students the opportunity to specialize, and it further prepares them to identify problems related to forestry and to seek solutions to those problems through scientific inquiry. Areas of specialization for the MS degree are forest administration and management, forest biology, forest biometry, forest economics and marketing, and wood science. Areas of specialization for the PhD are forest biology-wood science, forest biometry, and forest economics.

SAF Accreditation: BS in Forestry.

University of Kentucky (Lexington, KY)
College of Agriculture
Department of Forestry

Mission:

The purpose of the Department of Forestry is to create and disseminate knowledge concerning renewable forest resources and to foster integrated solutions to forest resource challenges for the mutual benefit of the resource and the citizens of Kentucky. This vision is achieved through excellence in the three land-grant missions of the University of Kentucky: research, instruction, and extension.

Undergraduate Degrees Offered:

- **BS in Forestry**

Students in Forestry study the biological and managerial principles of renewable natural resources and the use of wood, a major forest product. Students develop the skills required to formulate land management recommendations for particular tracts of land. The curriculum consists of university, pre-professional, professional, and specialty support components, as well as an eight-week summer camp.

- **BS in Natural Resource Conservation and Management**

Natural Resource students focus on the inevitable conflicts that arise between society's needs to use natural resources and simultaneously to protect environmental quality. Within the Natural Resource major, students specialize in a "Science" or "Policy" option.

Graduate Degrees Offered:

- **MS in Forestry; PhD**

The graduate program in the Department of Forestry offers the degree of Master of Science in Forestry. Students can choose from a thesis or a non-thesis option in pursuing the MS. The PhD is offered through related fields, particularly interdisciplinary graduate programs in agricultural economics, animal science, biological science, crop science, plant physiology, and soil science.

SAF Accreditation: BS in Forestry.

Louisiana State University (Baton Rouge, LA)

College of Agriculture

School of Forestry, Wildlife, and Fisheries

Mission:

The mission of the School of Forestry, Wildlife and Fisheries is to maintain excellence in undergraduate and graduate education, basic and applied research, and development of technical expertise for the conservation, use, and economic development of the renewable natural resources.

Undergraduate Degrees Offered:

- **BS in Forestry**

All students in the forestry curriculum take a core of courses and choose one of two areas of concentration: forest management or ecosystem management. The curriculum is designed to educate students in fundamental sciences and in the theory and practice of renewable natural resources management and to prepare students for graduate study in more specialized areas of forestry.

- **BS in Wildlife and Fisheries**

Graduate Degrees Offered:

- **MS in Forestry; PhD**

The School offers the MS degree with a major in forestry, wildlife, or fisheries and the PhD degree in forestry or wildlife and fisheries science.

SAF Accreditation: BS in Forestry, major in Forest Management.

Louisiana Technical University (Ruston, LA)

School of Forestry

Mission:

To enhance the social, ecological and economic value of forest resources for the citizens of Louisiana and the nation through professional education, basic and applied research, and service to the public and various natural resource management professional groups.

Undergraduate Degrees Offered:

- **BS in Forestry**

The forestry major offers four areas of concentration: forest management, forestry business, wildlife management, and natural resources management. The curriculum consists of a University core, a Forestry core, and Professional Electives chosen within the student's concentration.

Graduate Degrees Offered:

None

SAF Accreditation: BS in Forestry.

University of Maine (Orono, ME)

College of Natural Sciences, Forestry, and Agriculture

Departments of Forest Management and Forest Ecosystem Science

Mission:

The College of Natural Sciences, Forestry, and Agriculture specializes in programs related to understanding and responsible management of the world's natural resources. It consists of ten departments and one school that offer academic programs at both the undergraduate and graduate level. The basic mission of the College is to provide education, conduct research, and supply other public services in an academic unit with a proven and continuing reputation for superior performance.

Undergraduate Degrees Offered:

- **BS in Forestry**

The goal of the program is to combine instruction in 1) the basic sciences and liberal arts that are fundamental to a college education, 2) practical forestry skills that will allow a graduate to compete for entry-level positions, and 3) fundamentals of applied forest resources and management sciences on which graduates can build throughout their careers.

- **BS in Forest Engineering**

The Forest Engineering curriculum, a joint administrative responsibility of the Bio-Systems Engineering program and the Department of Forest Management, combines study in engineering and mathematics, the physical sciences, and forestry to provide a unique background so that students may solve engineering problems and produce engineering designs in the field of forestry while following careers emphasizing the design, planning, and management of tree harvesting systems, logging equipment, and environmental engineering in general.

- **BS in Parks, Recreation, and Tourism**
- **BS in Wood Science and Technology**
- **BS in Forest Ecosystem Science**

Graduate Degrees Offered:

- **Master of Forestry (MF)**

The MF program is a professional, non-thesis master's program. The program prepares students for a career in forest management by enhancing the abilities of professional foresters with prior experience and by allowing a career change for non-foresters.

- **MS in Forestry; PhD in Forest Resources**

Students may choose from a wide range of specialties, including wood science and technology; forest biological sciences; forest biometrics; forest economics and policy; management sciences; forest engineering; forest business administration; and forest-based park science, recreation, and tourism.

SAF Accreditation: BS in Forestry; BS in Forest Engineering; MF.

University of Massachusetts (Amherst, MA)

College of Food and Natural Resources

Department of Natural Resources Conservation

Mission:

The Department of Natural Resources Conservation will promote the stewardship of healthy and sustainable ecosystems that provide diverse human and community benefits. Teaching, research, and public service will fulfill this mission by emphasizing conservation and integrated natural resources management. By virtue of this mission and the

breadth of expertise, the Department is uniquely qualified to provide an integrated environmental education, research results to professionals, and vital service to society in response to environmental problems and issues.

Undergraduate Degrees Offered:

- **BS in Forestry**

Forests support and provide wood, water, and wildlife habitat, and the Forestry curriculum places special emphasis on coordinating the management of forests to produce a balance of these goods. The objective of the undergraduate forestry program is to provide a well-balanced education with both sound technical training in forest resources management and an exposure to social and behavioral sciences, the arts, history, and literature. The program emphasizes the unique forest resource problems of the region so that graduates are well equipped to deal with the complex, multiple-resource decision making required of public, consulting, and industrial foresters in the Northeast.

During the first two years, students take a science-oriented core of basic courses, plus courses that provide an understanding of the ecological interactions of trees and other plants, animals, soil, water, and climate. In the junior and senior years, students take a core of courses that deal directly with the management of forests and other natural resources. Additionally, students choose one of four curriculum options: Forest Conservation, New England Forestry, Urban Forestry/Arboriculture, and Wildlife Habitat Management.

- **BS in Wildlife and Fisheries Biology**
- **BS in Wood Science and Technology**
- **BS in Natural Resource Studies**

Graduate Degrees Offered:

- **MS; PhD**

The MS program offers thesis and non-thesis options.

SAF Accreditation: BS in Forestry, option in Forest Conservation.

Michigan State University (East Lansing, MI)
College of Agriculture and Natural Resources
Department of Forestry

Mission:

The programs of the Department of Forestry are at the forefront of teaching and research in management policy, economics, conservation, and other aspects of the human dimension, as well as ecology, physiology, silviculture, and soil science. In fulfilling the university's land-grant mission, the Department is committed to serving the needs of Michigan's citizens.

Because of increased demand for forest products, concern for the environment, and rapidly changing technology, ensuring forests for our future requires forest specialists and managers not only trained in the principles of forest ecology, soil science, and silviculture, but also attuned to the fundamentals of other disciplines that affect forestry, such as political science, sociology, and the humanities.

Undergraduate Degrees Offered:

- **BS in Professional Forestry**

Management is required to sustain our forests, and the professional forestry program provides graduates with the in-depth understanding of natural and social sciences necessary to manage forest ecosystems. Through hands on laboratory experiences and field studies, students develop the ability to manage forests for goals ranging from providing biological diversity to producing timber to creating wildlife habitat.

- **BS in Forest Conservation**

The Bachelor of Science degree in forest conservation prepares graduates for careers in the public and private sectors that deal directly with forest conservation issues, ecological analysis, policy, planning, and decision making. The program emphasizes developing strong communication skills, which makes graduates highly qualified for analyzing and interpreting complex resource issues.

Graduate Degrees Offered:

- **MS, PhD**

SAF Accreditation: BS in Professional Forestry.

Michigan Tech University (Houghton, MI)
School of Forestry and Wood Products

Mission:

The mission of the School of Forestry and Wood Products is to solve natural resource problems in response to the needs of science and industry. A major part of the School's mission is to provide graduates with a general university education as well as knowledge and skills in the historical, ethical, conceptual, and practical bases of forestry, ecology, and wood science so they can effectively communicate this information to others and contribute to continued development of their profession.

Undergraduate Degrees Offered:

- **BS in Forestry**

The baccalaureate program in forestry introduces students to all aspects of the profession. This degree is designed to educate students for scientific, technical, and management careers in forestry and renewable resource management. Forestry students choose from one of the following specializations: ecosystem management, wildlife ecology, or forest ecology.

- **BS in Wood Science**

Wood Science students select from one of five areas of emphasis: business, wood chemistry, engineering, environmental science, and biotechnology.

- **BS in Applied Ecology and Environmental Sciences**

Graduate Degrees Offered:

- **MS in Forestry and PhD in Forest Science**

Current research areas in forestry focus on Forest Ecology and Quantitative Forest Science

SAF Accreditation: BS in Forestry.

University of Michigan (Ann Arbor, MI)
School of Natural Resources and Environment

Mission:

The mission of the School of Natural Resources and Environment is to provide leadership in the generation of knowledge and the development of policies and skills to help practitioners manage and conserve natural and environmental resources to meet the full range of human needs on a sustainable basis.

Undergraduate Degrees Offered:

- **BS in Natural Resources**

The BS degree program includes three concentrations: Resource Ecology and Management, Environmental Policy and Behavior, and Landscape Design and Planning.

Graduate Degrees:

- **MS in Terrestrial Ecosystems**

The School of Natural Resources and Environment has recently eliminated its Master of Forestry program and gained SAF accreditation for its MS degree in Terrestrial Ecosystems with an emphasis in forestry. The overall mission of the Terrestrial Ecosystems Program (TEP) is to synthesize existing knowledge and develop new knowledge on the

composition, structure, and function of forest landscape ecosystems. The teaching, research, and service of faculty in the TEP deal with forest landscapes of uplands and wetlands as influenced by their associated aquatic ecosystems. This kind of information is used to manage, conserve, and restore ecosystems in an ecological and sustainable manner.

The TEP falls within the Resource Ecology and Management (REM) concentration of the School of Natural Resources and Environment. The REM concentration focuses on the development and use of scientific research to generate new knowledge about species and ecosystems, and on the application of this knowledge to develop effective management plans and policies for solving critical resource problems. This concentration includes fields of study in aquatic ecosystems and terrestrial ecosystems.

SAF Accreditation: MS in Terrestrial Ecosystem Management.

University of Minnesota (St. Paul, MN)
College of Natural Resources

Mission:

The College of Natural Resources' mission is to foster a quality environment by contributing to the management, protection, and sustainable use of our natural resources through teaching, research, and outreach.

Undergraduate Degrees Offered:

- **BS in Forest Resources**

This degree prepares students to plan, implement, and research the management, protection, and sustainable use of forest and related resources, including timber, water, wildlife, recreation, and aesthetics. Forest resources students may select between two tracks: Forest Management or Forest Science. Forest Management is for students who wish to become directly involved in forestland management or find employment in specialized areas such as resource planning, forest protection, or policy development. Forest Science is for students who wish to learn the fundamentals of forest resource management while gaining some depth in a self-selected basic or applied science related to forest resources.

- **BS in Urban Forestry**

The urban forestry curriculum prepares students to plan and manage vegetation and associated natural resources in and near urban and rural communities. The curriculum prepares students for direct involvement in resource management or for specialized supporting roles in areas such as urban planning and environmental education. Biological and managerial sciences are emphasized.

- **BS in Wood and Paper Science**
- **BS in Fisheries and Wildlife**
- **BS in Natural Resources and Environmental Studies**
- **BS in Recreation Resource Management**

Graduate Degrees Offered:

- **MS, PhD, MF**

The MS and the PhD in forestry, fisheries, or wildlife conservation, and the MF are offered through the Graduate School in cooperation with the College of Natural Resources. The forestry graduate programs include graduate offerings in the Department of Forest Resources and the Department of Wood and Paper Science.

SAF Accreditation: BS in Forest Resources; BS in Urban Forestry.

Mississippi State (Mississippi State, MS)
College of Forest Resources

Mission:

The mission of the College of Natural Resources is to promote the professional and intellectual development of its students, expand through research the fundamental knowledge upon which the natural resources disciplines are based,

and help with the development and use of the forest, wildlife, and water resources of the state and nation through appropriate applied research, service, and technology transfer activities.

Undergraduate Degrees Offered:

- **BS in Forestry**

The objective of the Forestry major is to prepare its graduates for professional, science-based careers in the management and use of forested ecosystems. By combining courses offering a broad general education with specialized professional courses, the curriculum of the Forestry major is designed to produce professionally competent graduates who have appropriate development in interpersonal relations, written and oral communications, cultural understanding, environmental awareness, and in professional ethics. In addition to completing the core curriculum of the Forestry major, each student must complete one of the three academic options for specialized study offered: Forest Management, Wildlife Management, and Environmental Conservation.

- **BS in Wildlife and Fisheries Science**
- **BS in Forest Products**

Graduate Degrees Offered:

- **MS, PhD**

Graduate programs leading to a MS or PhD degree are offered in the Departments of Forestry, Forest Products, and Wildlife and Fisheries.

SAF Accreditation: BS in Forestry.

University of Missouri (Columbia, MO)
College of Agriculture, Food, and Natural Resources
School of Natural Resources

Mission:

The mission of the School of Natural Resources is to enrich the quality of life through discovery and dissemination of knowledge to sustain natural resource and agricultural systems.

Undergraduate Degrees Offered:

- **BS in Forestry**

Four emphasis areas are offered in forestry at the undergraduate level: forest resource management, urban forestry, industrial forestry, and individualized studies in forestry. The forestry degree is based on a foundation of communication, analytical, social science, humanities, and professional courses that provide students with prerequisites for additional professional courses as well as with a basic liberal education.

- **BS in Fisheries and Wildlife**
- **BS in Parks, Recreation, and Tourism**
- **Bs in Soil and Atmospheric Science**

Graduate Degrees Offered:

- **MS, PhD**

Graduate research programs leading to the MS or PhD in Forestry are designed to prepare students for professional careers in industry, academic institutions, state and federal agencies, and consulting firms.

SAF Accreditation: BS in Forestry, option in Forest Resource Management.

University of Montana (Missoula, MT)
School of Forestry

Mission:

The School of Forestry's mission is to pursue excellence and foster understanding of biophysical and social processes among its graduates, faculty, and constituents to positively affect forest and wildland ecosystems, natural resource management, and associated human communities.

Undergraduate Degrees Offered:

- **BS in Forestry**

This degree emphasizes the training and preparation of students in the art and science of multiple-use land management. Two areas of emphasis are offered in this degree: Forest Resources Management and Range Resources Management. The Forest Resources Management curriculum is designed to provide students with education and training in the art and science of resource analysis and in making and implementing land management decisions to provide for the best use of all resources of the forest environment.

- **BS in Resource Conservation**
- **BS in Recreation Management**
- **BS in Wildlife Biology**

Graduate Degrees Offered:

- **MS, PhD**

The School of Forestry offers Master of Science degrees in Forestry, Resource Conservation, Ecosystem Management, Wildlife Biology, and Recreation Management, as well as a Doctor of Philosophy.

SAF Accreditation: BS in Forestry, option in Forest Resource Management.

University of Nevada (Reno, NV)
College of Agriculture
Department of Environmental Resource Sciences

Mission:

To provide superior instruction, research, and outreach benefiting Nevada's diverse landscapes.

Undergraduate Degrees Offered:

- **BS in Environmental and Natural Resource Sciences**

The Environmental and Natural Resource Sciences major balances a basic interdisciplinary background with flexibility in career choice. Students are educated in the physical, biological, chemical, and ecological sciences as they learn to apply analytical skills to diverse problems in rural and urban environments. Students are required to complete an option in the major. This can be Environmental Science, Natural Resources Management, Conservation Biology, or Hydrology.

Within the Natural Resources Management option, students choose between Forest Management and Range Management. Forest management courses prepare students for careers as managers of forested lands. Emphasis is placed on the socioeconomic and technical forestry principles involved in the production and sustainability of forestlands including wood, water, wildlife habitat, forage, and recreation.

Graduate Degrees Offered:

Information not provided.

SAF Accreditation: None.

University of New Hampshire (Durham, NH)
College of Life Sciences and Agriculture
Department of Natural Resources

Mission:

The primary objective of the Department is to provide young people with the knowledge and skills necessary to become future leaders in the stewardship of the world's natural resources.

The long-term goals of the forestry program are to (1) educate professional foresters in a continuously improving SAF accredited Bachelor of Science in Forestry program oriented toward the practice of forestry in New Hampshire and the Northeast, but broad enough in scope to provide a BSF graduate background in national and international forestry practice, issues, and problems; (2) conduct advanced education in forestry through our Master of Science program and the University-wide PhD in Natural Resources; (3) conduct forest research required to advance the practice and study of forestry within New Hampshire, the Northeast region, and beyond; (4) actively assist in the extension mission of the College of Life Science and Agriculture.

Undergraduate Degrees Offered:

- **BS in Forestry**

A major in forestry at UNH combines a basic education in social and natural sciences with a professional forestry education. As juniors, students choose between two options: Forest Management, for students who want a career in managing forest resources, and Forest Science, for those interested in biology, ecology, international forestry, or other areas of specialization.

- **BS in Soil Science**
- **BS in Water Resources Management**
- **BS in Wildlife Management**
- **BS in Environmental Conservation**

Graduate Degrees Offered:

- **MS in Natural Resources; PhD**

Options in Forestry, Environmental Conservation, Soil Science, Water Resources, and Wildlife.

SAF Accreditation: BS in Forestry.

Rutgers University (New Brunswick, NJ)
Cook College
Department of Ecology, Evolution, and Natural Resources

Mission:

The Department of Ecology, Evolution, & Natural Resources was created in 1996 to foster research, teaching, and outreach at Rutgers University. The department is made up of faculty with similar interests drawn from Cook College/NJAES and the Faculty of Arts and Sciences.

The Department focuses on: the structure, function, and behavior of ecological systems and related natural resources; the theory and application of population genetics and evolution in natural and managed systems; the study of biodiversity and systematics; the interactions among ecological systems, natural resource systems, physical environments, and human society; the ways in which individual organisms, populations, ecological systems, and natural resource systems change as a consequence of natural and anthropogenic processes; and the management, conservation and restoration of ecological systems and related natural resources, including the development of environmental planning and policy.

Undergraduate Degrees Offered:

- **BS in Natural Resources**

The program offers major options in Professional Resource Management, Natural Resource Studies, and Conservation and Applied Ecology. The Professional Resource Management option replaces previous majors in Forestry, Wildlife, and Fisheries, and responds to the growing belief among practicing professionals and Rutgers faculty that breadth at the undergraduate level is the best preparation for professional natural resource management. By selecting appropriate courses in consultation with a faculty advisor, students interested in forestry can complete coursework that has been recommended by the Society of American Foresters.

Graduate Degrees Offered:

- **MS in Ecology and Evolution**

The program offers graduate education and training in microbial, plant, animal, and human ecology.

SAF Accreditation: None.

Cornell University (Ithaca, NY)

**College of Agriculture and Life Sciences
Department of Natural Resources**

Mission:

The mission of the Department of Natural Resources is to improve society's stewardship of natural environments and their resources for enduring human use.

Undergraduate Degrees Offered:

- **BS in Natural Resources**

The Department's undergraduate curriculum is designed to provide an enduring and broadly applicable education for students who choose to study natural resources. Early specialization is undesirable because most students redefine or more sharply define their goals during their four years of undergraduate study. Also, five or six years of college-level work are now needed to achieve professional competence in the specialties with which this department is concerned. Consequently, the Department urges a broadly-based education that emphasizes biological sciences and study of natural resources and their management. Students are expected to gain an understanding of the world around them and are exposed to ecological concepts and management approaches that may form a principal basis for their future decisions and education.

Students may choose to focus on one of the Department's emphases: Fish and Wildlife Biology and Management; Ecology and Management of Landscapes; and Resource Policy, Management, and Human Dimensions.

Graduate Degrees Offered:

- **MS, PhD, and MPS**

The Graduate Field of Natural Resources offers opportunities for graduate study in the ecology, management, and policy of fishery, forest, wetland, wildlife, and other environmental resources. The Field of Natural Resources offers two research degrees – the MS and the PhD, and one professional degree – the Master of Professional Studies (MPS). The MPS is designed for individuals who have already embarked on a professional career and desire to upgrade their skills and knowledge.

SAF Accreditation: None.

Paul Smith's College (Paul Smiths, NY)
Natural Resources, Sciences, and Liberal Arts Division

Mission:

The Paul Smith's College community provides a dynamic educational environment which encourages students to be actively engaged in their own learning experience by fostering creative ethical and intellectual growth.

Undergraduate Degrees Offered:

- **BS in Natural Resources**

The purpose of the Bachelor of Science degree in Natural Resources is to study the interaction between human society and nature in regions under a protected area status. The program is centered in the Adirondack Park, six million acres of public and private lands. Students will gain through their studies an understanding of sustainable development of the national and global attempts to maintain ecosystem viability, along with economic activity.

Students in the baccalaureate program in Natural Resources will have the option of pursuing concentrations in either Environmental Science or Management and Policy. The program is based on a 2+2 model of education. The students start their freshman year in one of the existing two-year programs. After receiving technical associate degrees, students stay on for an additional two years to receive a baccalaureate degree.

Graduate Degrees Offered:

None

SAF Accreditation: None.

State University of New York (Syracuse, NY)
College of Environmental Science and Forestry
Faculty of Forestry

Mission:

The Faculty of Forestry, one of the nation's major forestry programs, shares with companion forestry schools a search for truth and excellence through the scholarly endeavors of instruction, research, and public service. The Faculty of Forestry seeks to enlarge the body of knowledge in forestry and natural resources and to share that knowledge with society. The Faculty strives to provide quality educational opportunities which encourage students to think critically, synthesize knowledge, communicate effectively, and utilize technology responsibly.

Undergraduate Degrees Offered:

- **BS in Forest Resources Management**

There are four options leading to the BS in Forest Resources Management: forestry, recreation resources management, water resources management, and wood products, as well as a joint biology/forestry option. The overall educational objectives of all these options are to: integrate biophysical and social processes into a framework for forest resources management; develop the basic knowledge of disciplines that contribute to intelligent forest resources management; develop data-gathering skills and the knowledge of measurement and analysis necessary to develop adequate information for management; integrate computing and communication skills across courses and laboratory exercises; integrate problem-solving processes and techniques, decision making, creative thinking, and ecosystem management concepts across courses and laboratory exercises; develop professionals who understand and incorporate ethics, professionalism, and citizenship as responsible resource managers and citizens.

All students complete a seven-week summer session in Field Forestry at the Wanakena campus in the western Adirondacks. Upper division courses are specific to the particular program option.

Graduate Degrees Offered:

- **Master of Professional Studies (MPS); MS; PhD**

Graduate study programs in forest resources management are created to suit the needs of each individual student and are designed to prepare students for careers in resource administration, management, scientific research, professional education, and a variety of other specialized positions. Areas of study include: Policy and Economics; Forest Management; Recreation and Tourism; Watershed Management/Forest Hydrology; Silviculture and Tree Improvement; Forest Soil Science; Quantitative Methods and Geographic Information Systems.

SAF Accreditation: BS in Forest Resources Management, with options in forestry, recreation resources management, and wood products; plus the dual program in biology/forestry leading to the BS.

Duke University (Durham, NC)
Nicholas School of the Environment

Mission:

The mission is education, research, and service to understand basic environmental processes and to protect and enhance the environment and its natural resources for future generations. Intrinsic to this mission are (1) a commitment to interdisciplinary approaches, (2) a commitment to objective and, where possible, quantitative approaches, (3) a commitment to principles of ecological integrity, (4) a commitment to the sustainable use of natural resources, and (5) a commitment to environmental education at all levels. The overall objective is to assist in the definition and resolution of problems confronting society, through excellence in natural resource and environmental education and research.

Undergraduate Degrees Offered:

None

Graduate Degrees Offered:

- **Master of Forestry (MF)**

The MF degree concentrates on forest and associated resources, including timber, water, biodiversity, and recreation, and their management from an ecological and economic point of view. The graduate with an MF degree is qualified for employment as a professional forester in an administrative or staff position with federal and state agencies, industries, consulting firms, and other organizations concerned with forest and land management.

- **Master of Environmental Management (MEM)**

The MEM degree is designed to develop expertise in planning and administering the management of the natural environment for maximum human benefit with minimum deterioration of ecosystem stability. MEM degree candidates choose one of five programs of study: Coastal Environmental Management; Environmental Toxicology, Chemistry and Risk Assessment; Resource Ecology; Resource Economics and Policy; or Water and Air Resources.

SAF Accreditation: MF.

North Carolina State University (Raleigh, NC)
Department of Forestry

Mission:

The mission is to teach and promote the science and practice of forestry and natural resource management. The Department will (1) educate excellent baccalaureate foresters, who will combine diverse liberal arts and critical thinking skills, exceptional technical and field skills, and international awareness; (2) produce exceptional baccalaureate natural resource analysts and practitioners who have a detailed mastery of the natural sciences and public policies, combined with knowledge of professional managerial and resource ethics; (3) train superb graduate students who have advanced knowledge of scientific principles and methods and resource management practices; (4) maintain and enhance national leadership in forest-related biological and social science research; and (5) disseminate new knowledge through outreach

and extension efforts to the citizens, interest groups, policy-makers, and professionals in North Carolina, the South, and the world.

Undergraduate Degrees Offered:

- **BS in Forest Management**

The curriculum prepares students for professional careers as foresters. The curriculum teaches students how to measure and monitor forest conditions and health, regenerate and grow forest stands, manage wildlife habitat, and implement laws and policies.

- **BS in Natural Resources – Ecosystem Assessment**
- **BS in Natural Resources – Policy and Administration**
- **BS in Environmental Science – Watershed Hydrology**
- **BS in Wildlife Science**

Graduate Degrees Offered:

- **Master of Forestry**
- **Master of Wildlife Biology**
- **Master of Natural Resources Administration**
- **MS, PhD**

SAF Accreditation: BS in Forest Management.

Ohio State University (Columbus, OH)
School of Natural Resources

Mission:

The School of Natural Resources offers professionally oriented educational programs in the area of environmental science and natural resources management. These programs are interdisciplinary and draw upon University-wide resources and capabilities. The instructional program is designed to develop persons qualified to perform effectively in managerial, research, and educational roles in natural resources and the improvement of environmental quality. The school, through its course offerings, strives to develop in students of all disciplines an awareness of humankind's dependence upon a finite resource base and of its responsibility to manage resources in a manner which assures a quality environment.

The mission of the forestry program is to provide a balanced, integrated program of teaching, research, and service focusing on forest ecosystem science and management. Specific goals include: a) to provide a professionally accredited undergraduate program stressing education of students in the ecological principles of forest ecosystem science, and in integrated management of ecosystem components for diverse benefits and values; b) to maintain research and graduate education programs emphasizing specific strengths in forest ecosystem science and management; and c) to provide leadership, service, and educational opportunities in issues related to forest ecosystem science and management to professionals and other interested persons within the university, the state of Ohio, and the region.

Undergraduate Degrees Offered:

- **BS in Natural Resources**

Specializations are offered in environmental communication, education, and interpretation; environmental science; fisheries management; forestry; parks, recreation, and tourism administration; soil science; sustainable resource management; urban forestry; and wildlife management.

The forestry program provides a balanced, integrated program of teaching, research, and service with specific strengths in forest biology, management, and reclamation. The program's goal is to educate professional forest managers who can think critically and integrate ecological principles within socio-political frameworks.

The forestry curriculum combines an intensive liberal arts core with a comprehensive professional forestry major; integrates social, biological, and applied sciences through senior capstone courses; and emphasizes private, non-industrial forestland management.

Graduate Degrees Offered:

- **MS in Natural Resources**

The major areas of study within the forestry specialization include forest ecology, quantitative silviculture, forest economics, forest policy and management, utilization and marketing of forest products, spatial modeling approaches to forest management, ecosystem restoration, forest recreation, and tree improvement and forest genetics.

SAF Accreditation: BS in Natural Resources, with a major in forestry.

Oklahoma State University (Stillwater, OK)

Department of Forestry

Mission:

The mission of the OSU Department of Forestry has three components. First, to serve the people of Oklahoma, the nation and the world by providing educational opportunities that allow individuals to enter the profession of forestry and be leaders in the stewardship of forest resources. Secondly, to conduct scientific inquiries into the nature of forest resources and their sustained use by mankind. Finally, to provide existing knowledge of forest resources and the practice of forestry to people who manage public and private forest lands.

Undergraduate Degrees Offered:

- **BS in Agricultural Sciences and Natural Resources**

Considerable breadth exists in the forestry curriculum, affording the student and faculty adviser the opportunity to develop a specialized curriculum focused on a wide array of natural resource specialties, such as water, recreation, range, or wildlife.

Requirements include the successful completion of a nine-week summer camp, which has been held across the U.S. from Maine to Oregon to Montana to Florida, and even in Brazil. Students learn field forestry skills and state-of-the-art operations.

Graduate Degrees Offered:

- **MS in Forest Resources**

The MS degree is for students interested in graduate training with a research orientation.

- **Master of Agriculture**

The Master of Agriculture degree with an emphasis in forestry is offered for students interested in graduate professional training with an emphasis on applied problem-solving.

SAF Accreditation: BS in Agricultural Sciences and Natural Resources, with a major in forestry.

Oregon State University (Corvallis, OR)

College of Forestry

Mission:

The mission of the College of Forestry, as part of Oregon's Land-Grant University, is to conduct distinctive problem-solving and fundamental research on the nature and use of forests and related resources, to effectively share our discoveries and knowledge with others, and to educate and engage the next generation of scholars, practitioners, and users of the world's forest resources.

Undergraduate Degrees Offered:

- **BS in Forest Engineering**

The Forest Engineering curriculum prepares students to perform a wide range of engineering tasks associated with the management of forestlands.

- **BS in Forest Products**

The Department of Forest Products prepares students for a broad range of careers in forest products and associated industries. Students in this curriculum receive a combination of science and business with a specific education in wood science and technology.

- **BS in Forest Resources**

The Forest Resources Department provides broad-based education for those interested in natural resource systems and how to manage them. Two degree options are offered: Forest Management, which emphasizes the understanding and management of forest resources for multiple uses; and Forest Recreation Resources, which prepares managers of recreational opportunities in forests and other natural resource areas.

- **BS in Natural Resources**

Graduates in Natural Resources will have an understanding of a range of natural resource problems. The program is a broad-based curriculum involving studies from the Colleges of Agricultural Sciences, Forestry, Liberal Arts, and Science, organized around a natural resources theme.

Graduate Degrees Offered:

- **Master of Forestry (MF); MS; PhD**

The college of Forestry offers the MF, MS, and PhD degrees in four departments: Forest Engineering, Forest Products, Forest Resources, and Forest Science.

Master of Forestry programs are designed to provide advanced technical and professional education and are intended for professional forestry specialists and natural resource administrators. A technical project, rather than a research thesis, is required. The MS and PhD degrees are research-oriented programs offering the opportunity to gain specialized knowledge and research skills in one or more academic disciplines.

SAF Accreditation: BS in Forest Engineering, BS in Forest Resources (both the Forest Management option and the Forest Recreation Resources option), MF in Forest Resources, MF in Forest Science with a concentration on Silviculture.

Pennsylvania State University (University Park, PA)

College of Agricultural Sciences

School of Forest Resources

Mission:

The school's mission is to provide educational opportunities and science-based information to protect, manage, and use natural resources for sustained benefits. This is accomplished through educational, research, and service programs in forestry, wildlife and fisheries, wood products, and related areas.

Undergraduate Degrees Offered:

- **BS in Forest Science**

The Forest Science program is designed to help students develop the knowledge, skills, and professional ethics for understanding and managing forest ecosystems and living as responsible members of society. Students pursue one of four options: Forest Biology; Forest Management; Urban Forestry; and Watershed Management.

- **BS in Wildlife and Fisheries Science**

- **BS in Wood Products**

Graduate Degrees Offered:

- **Master of Forest Resources (MFR)**

The Master of Forest Resources is a professional degree program for training students in applying a variety of technical skills towards interpreting and resolving forest resource-related problems. It emphasizes analysis, synthesis, and applications of knowledge, as compared to the traditional research goals of MS and PhD programs.

- **Master of Agriculture (MAgr)**

The Master of Agriculture is a professional degree program that enables a student to develop communications skills applicable to forest resources or wildlife and fisheries science.

- **MS, PhD**

The objectives are to gain proficiency in research, education, and scientific technology in forest science, wildlife and fisheries science, or wood products, and in allied basic science disciplines.

SAF Accreditation: BS in Forest Science, with options in Forest Management and Forest Biology.

Clemson University (Clemson, SC)
Department of Forest Resources

Mission:

Information not provided

Undergraduate Degrees Offered:

- **BS in Forest Resource Management**

The BS in forest resource management prepares students for employment opportunities in both the public and private sectors. During the first two years in the forest resource management curriculum, students establish a strong base in liberal arts, mathematics, and biology. After sophomore year, students spend the summer in the field at the department's summer camp program, developing hands-on forestry skills. During the last two years, students concentrate on natural resource management studies, developing an awareness of the interrelationship of wood, wildlife, water, and recreation resources.

- **BS in Forest Products**

The program in forest products offers a broad education in humanities, social sciences, science, and technology, coupled with a thorough understanding of the properties and processing of wood.

Graduate Degrees Offered:

- **Master of Forest Resources**

The Master of Forest Resources is a professional degree designed to broaden forestry skills and enhance understanding of natural resource management. This degree is often advised for non-forestry undergraduates.

- **MS; PhD**

The MS is a research-oriented degree designed to enhance knowledge of a forestry discipline. The PhD degree is a research-oriented degree designed to help students understand and manipulate complex and diverse forest ecosystems and the products derived from them.

SAF Accreditation: BS in Forest Resource Management.

University of Tennessee (Knoxville, TN)
College of Agricultural Sciences and Natural Resources
Department of Forestry, Wildlife, and Fisheries

Mission:

The mission of the department is to advance the management and utilization of natural resources in Tennessee, the region, and beyond through programs in teaching, research, and extension.

Undergraduate Degrees Offered:

- **BS in Forestry**

The forestry major has two concentrations: Forest Resources Management and Wildland Recreation. The Forest Resources Management Concentration provides an opportunity to obtain an education related to the management of the broad spectrum of wildland resources. Students can specialize in forest biology, forest business management, forest economics, forest inventory, forest recreation, and wildlife management. The Wildland Recreation Concentration is an

interdisciplinary degree that prepares students to work in natural resource based recreation settings on private and public lands.

- **BS in Wildlife and Fisheries Science**

Graduate Degrees Offered:

- **MS in Forestry or Wildlife and Fisheries Science**

SAF Accreditation: BS in Forestry.

University of the South (Sewanee, TN)
Department of Forestry and Geology

Mission:

The main goal is to teach students to analyze, interpret, and predict natural phenomena in forested and geological systems. The emphasis is an interdisciplinary approach because of the very significant degree to which forest ecosystems and geological environments affect one another. To accomplish this goal, the department emphasizes study both within and outside the classroom, linking the classroom to the rest of the world by synthesizing (1) theoretical and conceptual aspects of the sciences of forestry and geology with (2) extensive fieldwork emphasizing detailed observations and careful data collection.

Undergraduate Degrees Offered:

Three majors are offered within the department: **Forestry, Geology, and Natural Resources**. Students may select either a **BS** or **BA** degree from each of these.

- **Forestry**

The Forestry major stresses an understanding of the basic biological and physical processes that affect the functioning of the forested ecosystems. Forestry majors integrate traditional forestry courses (such as dendrology, silviculture, biometrics, forest ecology, and natural resource management) with a wide-ranging number of courses outside the department, including economics, biology, statistics, chemistry, and mathematics. In addition, courses in soils, hydrology, and geology are encouraged or required. Forestry majors also may participate in a 3-2 program with Duke University, taking three years of work at Sewanee and two years at Duke, culminating in both a Sewanee's Bachelor's degree and a Duke Master's degree.

- **Natural Resources**

The natural resource major is an interdisciplinary major which allows students with roughly equal interests in the forestry discipline and the geology discipline to gain a clearer understanding of the interrelationships between forested ecosystems and geological processes.

Graduate Degrees Offered:

None

SAF Accreditation: None.

Stephen F. Austin State University (Nacogdoches, TX)
Arthur Temple College of Forestry

Mission:

The College of Forestry's mission is to provide leadership in addressing societal needs and to promote management, protection, and sustainable productivity and use of forest resources.

The College is dedicated to meeting teaching, research, and service needs encountered in professional management of land and related forest resources. Its primary purpose is to provide students with the education and field experience required for success in their chosen professions. A secondary goal is to make available the knowledge and expertise required to solve problems of resource management and use.

Undergraduate Degrees Offered:

- **BS in Forestry (BSF)**

The Forestry program requires completion of: a general education core of courses designed to provide broad education in the Arts and Sciences; a core of forestry courses designed to provide broad exposure in all areas of Forest Land Management; a field station program designed to integrate previous course work into practical field experience; and a major designed to provide added expertise in a specialized field of forestry. Major options include: Forest Management; Forest Wildlife Management; Forest Recreation Management; Range Management; and Forestry (individually tailored program).

- **BS in Environmental Science**

Graduate Degrees Offered:

- **Master of Forestry (MF)**

This degree is for students with a bachelor's degree in a field other than forestry but who wish to become practicing foresters.

- **MS in Forestry (MSF)**

This degree is for students with a bachelor's degree in forestry who wish to further their education in forest resources either for professional career or future work towards a doctoral degree.

- **Doctor of Forestry (DF)**

The DF degree is designed to provide in-depth education and training in a specific area of forestry.

SAF Accreditation: BS in Forestry, with options in Forest Management, Forest Wildlife Management, Forest Recreation Management, and Forestry.

Texas A&M University (College Station, TX)
College of Agriculture and Life Sciences
Department of Forest Science

Mission:

The mission of the Department of Forest Science is to meet the education, research, and extension needs related to the development and application of knowledge and technology for forestry policy and management, forest regeneration, and wood products manufacture and use.

Undergraduate Degrees Offered:

- **BS in Forestry**

Students choose options in Forest Management or Urban Forestry. Urban Forestry is for students interested in the management of trees and forests in an urban environment leading to careers with municipalities, tree care firms, utility companies, and consulting firms. Students enrolling in Forest Management work with their advisor to select courses allowing them to specialize their training in areas such as: Education and Public Relations; Information Technology; Integrated Resource Studies; International Forestry; Management; Production Technology; Restoration Forestry.

Graduate Degrees Offered:

- **Master of Agriculture (MAgr)**

The MAgr degree is a professional degree for students who are seeking greater scientific and managerial competence.

- **MS; PhD**

These programs are designed to provide a background for career opportunities in forestry research, management and operational activities in natural resources and related fields. A non-thesis option for the MS degree is available to students not intending to pursue a research career.

SAF Accreditation: BS in Forestry, option in Forest Management.

Utah State University (Logan, UT)
College of Natural Resources
Department of Forest Resources

Mission:

The faculty and staff of the Forest Resources Department are committed to providing quality education, research, and service in the science and management of forest ecosystems. These ecosystems will be addressed at various scales in such a way as to ensure their long-term viability, while providing a sustainable array of social values for existing and future generations.

Undergraduate Degrees Offered:

- **BS in Forestry**

Forestry majors work to gain the knowledge and skills they will need to manage public or private forests for a wide variety of resources: timber, recreation, water, biological diversity, and more. The goal is to provide America's future foresters with the broadest possible understanding of the biological, physical, economic, political, and social environment that they will be working in as forestry professionals.

- **BS in Recreation Resource Management**

The Recreation Resource Management major prepares students for careers managing outdoor recreation settings. Because those jobs require an understanding of both the land itself and the people who visit these areas, the major offers a solid foundation in both biological and social sciences.

- **BS in Environmental Studies**

Graduate Degrees Offered:

- **Master of Forestry (MF)**

The MF has been developed to provide an opportunity for professional forestry work at an advanced level. It is designed for students who do not have a bachelor's degree in forestry and who wish to qualify as professional foresters.

- **MS; PhD**

The Department offers the Master of Science and PhD degrees in forestry, forest ecology, recreation resources management, and watershed management.

SAF Accreditation: BS in Forestry; BS in Recreation Resource Management; MF.

University of Vermont (Burlington, VT)
School of Natural Resources

Mission:

The School of Natural Resources seeks to cultivate an appreciation and enhanced understanding of ecological and social processes and values aimed at maintaining the integrity of natural systems and achieving a sustainable human community. The School pursues this goal by generating and broadly disseminating knowledge and by challenging students, colleagues, and citizens to acquire knowledge, skills, and values to become innovative, environmentally responsible, and accountable leaders.

Undergraduate Degrees Offered:

- **BS in Forestry**

The Forestry Program emphasizes the health, productivity, and sustainability of forest ecosystems across a mosaic of ownerships with diverse management objectives. Valuing diversity in all its forms, the program provides an education that integrates the principles of biological, ecological, and social sciences, with an appreciation for the humanities. The program promotes the ethics of good stewardship and emphasizes practical experience, good judgement, and creativity.

The required core of Forestry courses builds directly on the SNR core curriculum and provides an interdisciplinary, field-oriented understanding of the fundamental knowledge and skills that are needed to meet the numerous and changing demands put on our forests. The Forestry program offers three options: Forest Biology; Forest Resources Management; and Urban Forestry and Landscape Horticulture.

- **BS in Wildlife and Fisheries Biology**
- **BS in Recreation Management**
- **BS in Resource Economics**
- **BS in Environmental Studies**
- **BS in Natural Resources**
- **BS in Environmental Sciences**

Graduate Degrees Offered:

- **MS; PhD**

The goal of the MS program is to provide graduate students with advanced training in forestry science and the opportunity to further their knowledge and proficiency in some specialized aspect of forestry. Specializations include: Forestry, Wildlife and Fisheries Biology, Natural Resource Planning, or Water Resources. There is a Thesis Option and a Project Option. The PhD program provides the opportunity for focused, in-depth research in any of the specialties of the school, while fostering an interdisciplinary appreciation and perspective through course work and interactions with ecological, physical, and social scientists in an integrated academic setting.

SAF Accreditation: BS in Forestry, option in Forest Resources Management.

Virginia Polytechnic Institute and State University (Blacksburg, VA)

College of Natural Resources

Department of Forestry

Mission:

The mission of the Department of Forestry is the education of undergraduate and graduate students, professional foresters, and the general public, and the generation of new knowledge concerning the management of forest resources.

Undergraduate Degrees Offered:

- **BS in Forestry and Wildlife Resources**

The Department of Forestry prepares students for careers in the various aspects of production, maintenance, and utilization of forests for their commercial and social values. The options available are: Forest Resource Management; Industrial Forestry Operations; Environmental Resource Management; and Natural Resource Recreation. An important part of the options in Forest Resource Management and Forestry Operations is the hands-on experience that students gain at the field camp.

Graduate Degrees Offered:

- **MS; PhD; Master of Forestry (MF)**

The MS (thesis option) and PhD are research oriented and require the completion of a thesis or dissertation and appropriate course work. Areas of focus include: Forest Biology, Forest Biometrics, Forest Management/Economics, Forestry Operations, and Outdoor Recreation. The MF is professionally oriented.

SAF Accreditation: BS in Forestry and Wildlife (all options).

University of Washington (Seattle, WA)
College of Forest Resources

Mission:

The College of Forest Resources is dedicated to generating and disseminating knowledge for the stewardship of natural and managed environments and the use of their products and services through teaching, research, and professional and public outreach.

Undergraduate Degrees Offered:

- **BS in Forest Resources**

Six undergraduate majors leading to the Bachelor of Science in Forest Resources degree are offered: Conservation of Wildland Resources; Forest Engineering; Forest Management; Paper Science and Engineering; Urban Forestry; and Wildlife Science.

The goal of the Forest Management curriculum is to educate students to be able to perform as professional forestland managers in the public and private sectors. Four components of specialized education are the cornerstones of the program: forest biology and soils; measurement techniques; resources management skills including political science, economics, planning, and multiple-use aspects; and forest resource policy and administration.

Graduate Degrees Offered:

- **Master of Forest Resources (MFR); MS; PhD**

Graduate program areas include: Forest Economics; Forest Engineering and Hydrology; Forest Products Marketing; Quantitative Resources Management; Silviculture and Forest Protection; Social Sciences; Forest Ecosystem Analysis; Forest Soils; Wildlife Science; Paper Science and Engineering; and Urban Horticulture.

SAF Accreditation: BS in Forest Resources, curriculum in Forest Management.

Washington State University (Pullman, WA)
Department of Natural Resource Sciences

Mission:

The objectives of the Department of Natural Resource Sciences are to prepare students for careers in forestry, range, wildlife, and wildland recreation professional areas with a holistic perspective on resource management and an ability to conduct research in natural resource sciences that will increase the basic knowledge and productivity of the resources while maintaining or improving the aesthetic qualities.

Undergraduate Degrees Offered:

- **BS in Natural Resource Management**

Students pursuing the BS in Natural Resource Management must major in one (or more) of four areas: forestry, range management, wildlife management, and wildland recreation management. All majors share a set of basic science and General Education requirements and a core of natural resource courses. In addition, each major has a specialized curriculum designed to meet the requirements of the appropriate profession and specific objectives set by the department's faculty.

- **BS in Natural Resource Sciences**

This area is offered for students most interested in the scientific basis of natural resource management and includes three majors: plant resource science, wildlife resource science, and a general natural resource science major which is developed by the student and his/her advisor.

Graduate Degrees Offered:

- **MS in Natural Resource Sciences**

The MS in Natural Resource Sciences emphasizes the conduct of original research by the student.

- **MS in Natural Resources**

The MS in Natural Resources is a non-thesis degree with options in forestry, range management, wildland recreation, and wildlife. This degree serves the needs of professionals seeking to upgrade their education and is coursework-oriented.

- **PhD in Environmental and Natural Resource Sciences**

The program in Environmental Science and Regional Planning and the Department of Natural Resource Sciences offer a joint PhD degree.

SAF Accreditation: BS in Natural Resource Management, with a major in Forestry.

West Virginia University (Morgantown, WV)
College of Agriculture and Forestry
Division of Forestry

Mission:

The mission of the College is teaching, research, and outreach.

Undergraduate Degrees Offered:

- **BSF in Forest Resources Management**

The Forest Resources Management program prepares students for an active role in the guidance or management of forests. The curriculum emphasizes the management of land for production of timber and wood products with due consideration given to other forest values such as wildlife habitat, recreational opportunity, and water quality. Students graduate with a clear understanding of how societal and economic goals can be met while maintaining the long-term productivity of forested lands. The program is one of the few baccalaureate programs in the nation that emphasizes the management of Appalachian hardwood forests.

- **BSF in Wood Industries**
- **BSR in Recreation and Parks Management**
- **BS in Wildlife Resources**

Graduate Degrees Offered:

- **MS; PhD**

Graduate programs are available in Forest Resource Management, Wood Industries, Recreation and Parks Management, and Wildlife Resources.

SAF Accreditation: BSF in Forest Resources Management.

University of Wisconsin – Madison (Madison, WI)
Department of Forest Ecology and Management

Mission:

The mission is to: advance excellence in education, research and extension related to forest ecosystems and their management through programs integrating biological, physical and social sciences and the humanities; provide a well-integrated interdisciplinary education based on science and management skills essential for leadership and service in the conservation and management of forest ecosystems; generate new knowledge about domestic and international forest resources through basic and applied research; promote sound management and utilization of forest resources by transferring knowledge to the public for use in solving practical problems; assist in the development and implementation of the UW-System Center of Excellence for the Management and Conservation of Biological Resources.

Undergraduate Degrees Offered:

- **BS in Natural Resources**

There are four “tracks” available to students in the Department of Forestry. All lead to a BS degree in Natural Resources, with a major in Forest Science. During the first two years, the program emphasizes basic courses in the natural and social sciences. During the junior and senior years, students focus on a core curriculum of forestry courses and select one of four curricular tracks: Public Forestry, Industrial Forestry, Natural Resource Conservation and Management, and International Agriculture and Natural Resources. The first two tracks are designed for students who prefer to take an accredited degree program emphasizing knowledge and skills typically required of professional forest managers.

- **Dual BS/MS program**

The dual BS/MS program in forestry allows students to simultaneously accrue credits toward their undergraduate and graduate requirements. In the BS/MS program, students concentrate on a field in which they are most interested. They can select from areas such as forest soils, forest biology, wood and fiber science, forest management, administration, biometrics, business, remote sensing, or biotechnology.

Graduate Degrees Offered:

- **MS**

Graduate studies are offered in Forest Biology, Forest Management, and Wood and Fiber Science. There is a thesis and a non-thesis option.

SAF Accreditation: BS in Natural Resources, tracks in Public Forestry or Industrial Forestry; BS/MS program.

University of Wisconsin – Stevens Point (Stevens Point, WI)
College of Natural Resources

Mission:

The objectives of the Forestry Program are: (a) to provide a sound undergraduate program of forestry education, (b) to support and enhance the other majors in the College of Natural Resources and other academic programs of the university, (c) to pursue new knowledge, (d) to apply contemporary forestry knowledge through continuing education and extension, and (e) to develop professionalism and esprit de corps among students alumni and faculty.

Undergraduate Degrees Offered:

- **BS in Forestry**

The forestry curriculum is built on a core of selected forestry courses that meet the requirements of the Society of American Foresters, and the need of the student to understand the application of forestry to a broad range of resource management situations. Natural and physical sciences, mathematics, wildlife, water, and soils courses are prerequisites for advanced forestry courses. The five emphases within the forestry curriculum (Forest Management, Forest Administration, Wood Utilization and Marketing, Urban Forestry, and Forest Recreation) allow students to select course options that meet their career goals.

- **BS in Paper Science**
- **BS in Resource Management**
- **BS in Soil and Waste Resources**
- **BS in Water Resources**
- **BS in Wildlife**

Graduate Degrees Offered:

- **MS in Natural Resources**

In the graduate program, students have the opportunity for advanced study, research, and involvement in natural resource-related professional activities. There is a thesis option and a non-thesis option.

SAF Accreditation: BS in Forestry, with majors in Forest Management, Forest Administration, Urban Forestry, and Forest Recreation.

APPENDIX E

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