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

by

V. Alaric Sample, Nadine E. Block, Paul C. Ringgold, and James W. Gilmnier

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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 convener 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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*Leadership in Forest Conservation Thought, Policy and Action*

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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-responsive ness 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 relev ance 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.

This effort was made possible by the generous support of the Pew Charitable Trusts, the Laird Norton Endowment Foundation, the John D. and Catherine T. MacArthur Foundation, the Weyerhaeuser Family Foundation, USDA Forest Service, WestvacO, and the Weyerhaeuser Company Foundation. This study would also not have been feasible without the efforts of all of the employers, recent graduates, and program heads who took the time to complete our surveys and participate in our spring symposium. I would like to offer a special word of thanks to several individuals whose insights and advice were of enormous value as this study proceeded, among them Scott Wallinger, Bill Baughman, Lincoln Bormann, Patrick de Frietas, Rick Weyerhaeuser, Barbara Weber, Ross Whaley, Dennis LeMaster, and Hanna Cortner. A number of other individuals made substantial contributions to the study and the thinking that went into it, including co-authors Paul Ringgold, Jim Giltmier, and Nadine Block, as well as contributor Char Miller. A particular debt of gratitude is owed Nadine, who exhibited an extraordinary talent for weaving together many assorted threads into a coherent tapestry.

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.

V. Alarie Sample
President
Pinchot Institute for Conservation
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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, 1898-1998

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 slips-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.

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1 This chapter was contributed by Char Millery 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.

Pinchot Institute for Conservation
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] forest organization 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 silviculturists 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>
<thead>
<tr>
<th>Table 1: Employer's Importance Ratings of Skills</th>
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<tr>
<td><em>Ability to work in teams</em> (9.0) -- Ability to work well in teams that include individuals with a variety of perspectives, both within and outside the organization.</td>
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<td><em>Ability to address public concerns</em> (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.</td>
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<tr>
<td><em>Understanding of sustainable ecosystem management</em> (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.</td>
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<tr>
<td><em>Innovative approaches to forest management</em> (8.0) -- Innovation - critical thinking and willingness to test new and non-traditional approaches to forest management.</td>
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<tr>
<td><em>Innovative approaches to working with the public</em> (7.7) -- Ability to utilize innovative approaches to working with the public to address forest management problems.</td>
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<tr>
<td><em>Ability to evaluate and synthesize information</em> (7.5) -- Ability to evaluate and synthesize input from a variety of specialists when developing resource management plans.</td>
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<tr>
<td><em>Landscape-level understanding</em> (7.3) -- A landscape-level understanding of forest ecosystems and how to manage them to meet ecological, economic, and social needs.</td>
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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.

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

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](image)

Pinchot Institute for Conservation
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).

![Graph showing performance and importance ratings of technical competencies.](image)

**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).

![Graph showing comparison of employers' ratings of the importance of technical competencies with the percentage of graduates educated in those areas.](image)

**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.

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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 education\(^2\) 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


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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 soon.

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.

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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 nation’s 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.

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

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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.

Pinchot Institute for Conservation
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 silviculturist with an emphasis on uneven-aged management, in contrast to even-aged management. One might still be hiring a silviculturist 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."

Pinchot Institute for Conservation
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.