

Human Resource Skills (Indicator 55)¹

Extent to which the institutional framework supports . . . Including the Capacity to Develop and Maintain Human Resource Skills Across Relevant Disciplines

Rationale and Interpretation

Extensive knowledge and skills applied by persons engaged in the development and implementation of forest resource policies and programs are critical to accomplishing the wide-ranging goals of forest sustainability and conservation. Of special importance to sustainability is access to a broad range of disciplines (for example, economics, statistics, ecology) and resource orientations (for example, timber, water, recreation, wildlife). These disciplinary and resource skills are developed via formal educational programs as well as via professional work experiences and access to continuing education opportunities. Educational programs are made available by a number of organizations and are provided in various forms, including professional societies, certification and licensing requirements, continuing education programs, extension outreach programs, and professional technical assistance programs (Roundtable on Sustainable Forestry 1999).

Useful data for measuring institutional capacity to accomplish this indicator are compilations and descriptions of laws and programs at national and subnational levels that promote conditions considered essential to maintaining human resource skills across relevant disciplines. Examples of potentially useful information are number of professionals (by discipline [for example, economics, statistics, ecology] and their resource orientation [for example, timber, water, recreation, wildlife], degrees confirmed by formal educational institutions (universities, colleges, technical schools), and continuing education offerings by subject, enrollment, and manner of presentation. Information types presented in combination can also be of importance, such as the number of professionals by discipline (or resource orientation) per unit of forested area. Challenges to accessing information include association lists of professionals that include only subscribing members, distorted intensity of professionals per unit of forest area (many professionals are not engaged directly in land management activities), underrepresentation of minority institutions in existing data bases, and information about accredited educational programs failing to identify cross-disciplinary integration and team building activities (Roundtable on Sustainable Forestry 1999).

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Suggested by Indicator 55 are various concepts and principles that need to be addressed from an information availability perspective. To guide this review, brief definitions of two important concepts within the context of a professional workforce necessary to accomplish forest sustainability interests are *human resource skills* — existence of interdisciplinary professional knowledge and insight required to develop and apply principles of sustainable forestry, and *across relevant disciplines* — occurrence of skills encompassing various disciplines (for example, economics, statistics, ecology) and various resources (timber, water, recreation, wildlife) important to forest sustainability. Acknowledged is the importance of information describing integration across disciplines and across resources as well as information demonstrating the integration of biophysical and social subject matter (Roundtable on Sustainable Forestry 1999).

Conceptual Background

Although thoughts of sustainable forestry immediately turn to concern over forests as a natural resource, there are additional resources that are critical to the sustainability of forests and the communities that depend on them, namely human resources and the talent, ingenuity, and creativity they represent. Ample supplies of skills symbolized by human resources are critical to decisions regarding the application (integration of ecological, economic, and social skills) of complex sustainability principles that are needed to ensure the continuity and endurance of forests. As is the case with forest resources generally, concern must be with the quality as well as the quantity of human resources, since both can have a direct bearing on the amount and quality of benefits provided by forest and related natural resources.

Development of quality human resources begins at an early age and continues through a lifetime of exposure to various experiences and learning opportunities. Much of the development of human resource skills relevant to the management of forest resources occurs through some formal education processes at universities, colleges, or technical schools. The maintenance of this knowledge base, and additions to it, are made through lifelong continuing education and direct professional work experience. Most of these opportunities for learning are provided (supported) by employers and educational institutions.

The rapid paces of scientific discoveries in the natural sciences, and the continuing improvement in understanding of human systems and processes, presents a substantial and very dynamic knowledge base that is relevant to the sustainability of forests. This knowledge base serves as a foundation for the many resource-impacting decisions made by forest resource professionals over their career. As such, it is important that professionals be exposed to this knowledge base on a continuing basis, absorbing knowledge about a variety of disciplines important to

informed assessments and judgments regarding forest sustainability. In a broader context, new and unforeseen circumstances regarding forest sustainability make it imperative that this foundation of knowledge is continually added to and updated. Such is essential if management decisions are to be relevant and forest resources are to be sustained.

Current Institutional Capacity

Professional Workforce Capacity

Comprehensive and insightful information describing the professional workforce relevant to forest sustainability is seriously deficient. When available, the information is often descriptive of only certain categories of employers (for example, a State agency) or for certain types of forestry professionals (for example, professionals engaged in research). Conflicting definitions of “expert,” “authority,” or “professional” are invariably at the core of the information problem. Who has talent relevant to forest sustainability, and what portion of the Nation’s workforce should be included under the umbrella of professional “human skills” required to ensure the sustainability of forests? Some suggest that professional relevancy to sustainability should be determined by the extent to which professionals focus on certain resources associated with forests (for example, professional timber manager, professional watershed manager), while others suggest that the professional sphere should be far more inclusive so as to include any person (forest resource professional) with a professional degree engaged in matters involving forests (for example, meteorologists engaged in fire weather forecasting). Also adding to information problems concerning professional capacity is the reality that employees of some Federal and State agencies with relatively new responsibilities involving forest sustainability have yet to be properly acknowledged, identified and made party to existing information gathering processes (for example, U.S. Environmental Protection Agency, U.S. Corps of Army Engineers, State and local pollution control agencies, and watershed management districts). Because nationwide comprehensive reviews of the forestry professional workforce have not been made, what follows are examples of the public and private professional workforces focused on matters involving forest sustainability.

Federal Agencies

The USDA Forest Service reported the employment of 34,511 full-time equivalent employees in fiscal year 2001. This workforce was distributed among agency programs as follows: National Forest System (15,893 FTEs, 46 percent); wildland fire management (7,178 FTEs, 21 percent); infrastructure improvement and maintenance (3,841 FTEs, 11 percent); forest and rangeland research (2,644 FTEs, 8 percent); State, private, and international programs (774 FTEs, 2 percent); land acquisition (112 FTEs, less than 1 percent); and other employees involved with trust

funds and permanent and discretionary appropriations (4,069 FTEs, 11 percent). The Forest Service also employs nearly 14,600 persons as part of the Youth Conservation Corps, Job Corps, and Senior Community Service Employment Program. Forty-nine percent of the agency's work force is composed of minorities, women, and persons with disabilities, approximately one-third of which are in leadership positions (Forest Service 2001).

Federal forestry research capacity is widely dispersed across many Federal agencies. In 1995, the Forest Service reported the employment of 607 research scientists distributed as follows: foresters (138), ecologist biologist botanists (72), plant pathologists (69), wildlife and fishery biologists (59), engineers (44), economist social scientists (28), forest products technologists (25), statistician mathematicians (19), geneticists (19), soil scientists (19), hydrologists (13) and other disciplines such as geologist, physicist and range scientists (102) (Forest Service 2002a). A more recent 2001 review of research capacity suggests the agency engaged the talents of 658 full-time equivalent researchers, or nearly half (49 percent) the total capacity employed by the agency, forest industry and academic institutions (Table 1). As for the number of research scientists employed by the agency, such has declined more than 45 percent during the period 1985 through 1999. The largest proportional declines were in the research forester and forest products technologist classifications, whereas the largest increase occurred in ecologists engaged in research (from nine in 1985 to 50 in 1999) (National Research Council 2002).

Table 1. Forestry Research Scientist Capacity by Sustainable Management Focus and Research Institution, 2001

| Sustainable Forest Management Focus | Major Forestry Research Institutions (full-time equivalents in research) | | | Total |
|-------------------------------------|---|----------|-----------------|-------|
| | Forest Service | Academic | Forest Industry | |
| Biological Diversity | 112 | 136 | 10 | 258 |
| Productive Capacity | 158 | 96 | 67 | 321 |
| Ecosystem Health | 156 | 53 | 5 | 214 |
| Soil and Water | 86 | 84 | 20 | 189 |
| Carbon Cycles | 41 | 47 | 3 | 91 |
| Socioeconomics | 80 | 114 | 9 | 203 |
| Institutional Framework | 25 | 45 | 0 | 70 |
| TOTAL | 658 | 575 | 112 | 1,347 |

Source: National Research Council 2002, Forest Service 2002a.

Although not all are resource professionals, the USDI Bureau of Land Management reported in fiscal year 2001 employment of 2,846 FTE persons in 5 activity areas with a direct bearing on resource sustainability. They are as follows: land resources – 1,647 FTEs (of which 64 are assigned to the forest management subactivity); threatened and endangered species management – 193 FTEs; recreation management – 622 FTEs; and resource protection – 384 FTEs (USDI

Bureau of Land Management 2002). In fiscal year 2001, the USDI National Park Service employed 2,730 FTE employees in park resource stewardship and 4,628 FTE employees in visitor services, while the USDI Fish and Wildlife Service employed (fiscal year 2002) 5,540 FTE employees in the following resource management areas: ecological services – 1,887 FTE employees, law enforcement – 375 FTE employees; migratory bird management – 553 FTE employees, and refuge operations and management – 2,725 FTE employees (U.S. Fish and Wildlife Service 2002, USDI National Park Service 2002). Information about the professional workforce engaged in forest sustainability activities in other Federal agencies (for example, U.S. Environmental Protection Agency, U.S. Department of Commerce) has not been compiled.

Table 2. State Government Forestry Program Personnel by State and Type of Personnel, 1998

| State | Type of Forestry Program Personnel | | | | | Total |
|----------------|------------------------------------|--------------|------------|-----------------------------|------------------------|--------|
| | Managerial | Professional | Technician | Administrative and Clerical | Seasonal and Temporary | |
| Alabama | 82 | 119 | 199 | 39 | 0 | 439 |
| Alaska | NA | NA | NA | NA | NA | NA |
| Arizona | 8 | 19 | 6 | 5 | 4 | 42 |
| Arkansas | 5 | 65 | 216 | 17 | 37 | 340 |
| California | 592 | 78 | 3,057 | 628 | 1,500 | 5,855 |
| Colorado | 12 | 63 | 12 | 20 | 57 | 164 |
| Connecticut | 1 | 24 | 3 | 3 | 13 | 44 |
| Delaware | 4 | 9 | 9 | 2 | 2 | 26 |
| Florida | 27 | 348 | 715 | 27 | 150 | 1,267 |
| Georgia | 21 | 120 | 461 | 122 | 193 | 917 |
| Hawaii | 12 | 46 | 20 | 11 | 61 | 150 |
| Idaho | 24 | 132 | 5 | 50 | 210 | 421 |
| Illinois | 10 | 27 | 21 | 8 | 86 | 152 |
| Indiana | 20 | 63 | - | 64 | 228 | 375 |
| Iowa | 8 | 17 | 15 | 1 | 150 | 191 |
| Kansas | 4 | 8 | 3 | 4 | 25 | 44 |
| Kentucky | 43 | 61 | 113 | 24 | 80 | 321 |
| Louisiana | 18 | 73 | 200 | 19 | 220 | 530 |
| Maine | 4 | 120 | 20 | 12 | 15 | 171 |
| Maryland | 8 | 56 | 46 | 11 | 2 | 123 |
| Massachusetts | 5 | 27 | 13 | 7 | - | 52 |
| Michigan | 54 | 66 | 155 | 25 | 57 | 357 |
| Minnesota | 11 | 223 | 92 | 74 | 270 | 670 |
| Mississippi | 15 | 155 | 400 | 90 | 74 | 734 |
| Missouri | 23 | 58 | 134 | 11 | 37 | 263 |
| Montana | 26 | 104 | 28 | 16 | 76 | 250 |
| Nebraska | 5 | 20 | 3 | 9 | 5 | 42 |
| Nevada | 75 | 7 | 97 | 6 | 20 | 205 |
| New Hampshire | 7 | 6 | 23 | 5 | 25 | 66 |
| New Jersey | 33 | 33 | 31 | 10 | 30 | 137 |
| New Mexico | 12 | 36 | 2 | 9 | 2 | 61 |
| New York | 25 | 163 | 140 | 12 | 170 | 510 |
| North Carolina | 29 | 76 | 532 | 64 | 250 | 951 |
| North Dakota | 2 | 11 | 10 | 1 | 50 | 74 |
| Ohio | 25 | 55 | 15 | 25 | 120 | 240 |
| Oklahoma | 8 | 40 | 98 | 14 | 23 | 183 |
| Oregon | 160 | 222 | 17 | 110 | 527 | 1,036 |
| Pennsylvania | 74 | 130 | 85 | 60 | 200 | 549 |
| Rhode Island | 8 | 7 | 15 | 1 | 24 | 55 |
| South Carolina | 105 | 64 | 94 | 72 | 30 | 365 |
| South Dakota | 6 | 19 | 6 | 4 | 5 | 40 |
| Tennessee | 12 | 65 | 264 | 20 | 279 | 640 |
| Texas | 16 | 78 | 137 | 67 | 18 | 316 |
| Utah | 13 | 21 | 1 | 14 | 64 | 113 |
| Vermont | 10 | 34 | 11 | 9 | 2 | 66 |
| Virginia | 18 | 35 | 112 | 29 | 144 | 338 |
| Washington | 110 | 530 | 100 | 80 | 380 | 1,200 |
| West Virginia | 5 | 62 | 25 | 14 | 61 | 167 |
| Wisconsin | 7 | 223 | 148 | 18 | 398 | 794 |
| Wyoming | 4 | 16 | 12 | 5 | 3 | 40 |
| TOTAL | 1,806 | 4,034 | 7,921 | 1,948 | 6,377 | 22,086 |

Note: NA = not available.

Source: National Association of State Foresters 1998.

State Agencies

A variety of State government agencies employees professional personnel to address matters of forest sustainability (Ellefson and others 2001, 2002). However, a systematic and comprehensive compilation of the type and magnitude of these employees in State government has not been carried out. Focusing on traditional (or

lead) State forestry agencies, the National Association of State Foresters (1998) determined there were more than 22,000 employees engaged in State forestry programs in 1998 (Table 2). Of this total, 26 percent were considered to be managerial or professional employees. The latter ranged from States with relatively few such employees (Delaware and New Hampshire with 13) to the States with a sizable number of managerial and professional employees (California 670, Washington 640). The average number of such employees per State was approximately 37. Information of a similar nature is available for 1994 and 1996 and for some prior years.

Table 3. Lead State Forestry Agency Staffing for the Administration of Comprehensive Forest Practice Regulatory Programs by State, 1985–1991

| State | Staffing (full-time equivalents) | | | | | | |
|---------------|----------------------------------|-------|-------|-------|-------|-------|-------|
| | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
| Alaska | 6.5 | 6.5 | 4.5 | 2.5 | 2.5 | 3.0 | 3.0 |
| California | 68.0 | 68.0 | 68.0 | 68.0 | 74.0 | 83.0 | 94.0 |
| Connecticut | - | - | - | - | - | - | - |
| Idaho | 4.5 | 5.5 | 5.5 | 8.0 | 10.0 | 8.0 | 13.7 |
| Maine | - | - | - | - | - | 6.0 | 6.0 |
| Massachusetts | 16.0 | 16.0 | 17.0 | 16.0 | 15.0 | 15.0 | 15.0 |
| Nevada | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| New Mexico | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| Oregon | 44.1 | 48.2 | 48.2 | 53.6 | 62.6 | 64.3 | 64.3 |
| Washington | 58.1 | 58.1 | 73.0 | 73.0 | 77.5 | 77.5 | 112.8 |
| TOTAL | 209.2 | 214.3 | 228.2 | 233.1 | 253.6 | 273.1 | 320.8 |

Note: Connecticut Forest Practices Act established June 28, 1991.

Source: Ellefson and Others 1995.

Information regarding State government agency staff assigned administration of comprehensive forest practice regulatory programs has been gathered periodically since the early 1980s. Unfortunately, the most recent national assessment occurred in 1991 (since then Kentucky, Tennessee, and Wisconsin have enacted comprehensive forest practice regulatory programs). In that year, more than 320 full-time equivalent staffs were assigned such responsibilities in the 10 States with comprehensive forest practice laws, with California, Oregon, and Washington accounting for 84 percent of the total (Table 3). Even though staffing in the 10 States with comprehensive programs increased more than 53 percent from 1985 through 1991, staffing in some States remained the same or decreased slightly. The level of regulatory staffing (full-time equivalents) by a State's lead forestry agency per 100,000 acres of private timber land in 1991 was approximately as follows: Alaska -- 0.05 per 100,000 acres, California -- 1.26, Idaho -- 0.42, Maine -- 0.04, Massachusetts -- 0.59, Nevada -- 4.46, New Mexico -- 0.36, Oregon -- 0.75, and Washington -- 1.26 per 100,000 acres. In 1991, staffs with regulatory responsibilities were a modest part of a State forestry agency's total staffing (about 5 percent). The staffing of forest practice regulating programs administered by State agencies other than a State's lead forestry

agency has not been determined (for example, pollution control agencies, agricultural agencies, labor regulating agencies).

Private Organizations

Information about the professional workforce of private organizations focused on forest sustainability is particularly limited in quantity and quality. Professionals focused on sustainability are known to be employed in many different private organizations, including advocacy interest groups, business investment firms, professional societies, timber harvesting companies, forestry consulting firms, and corporations engaged in industrial forestry operations. As for forestry consultants, they typically are affiliated with corporations, partnerships, and sole proprietorships (one to 100+ employees), and most are general foresters although many have professional specialties within forestry. Clients include landowners, forest industries, investment & financial industries, attorneys, government agencies, bankers, trusts, and native American corporations. Consulting foresters are often represented by the Association of Consulting Foresters of America which currently has 610 members in 38 States and 2 Canadian provinces (Association of Consulting Foresters in America 2002).

Table 4. Industrial Foresters Employed by 70 Leading U.S. Wood-based Companies by primary Responsibility and Region, 1986

| Responsibility | Region | | | Total |
|---|--------|-------|------|-------|
| | North | South | West | |
| Manage Company Owned or Leased Land | 226 | 1,082 | 401 | 1,709 |
| Procure Timber from Noncompany Land | 121 | 983 | 122 | 1,226 |
| Provide Services to Private Woodland Owners | 28 | 153 | 8 | 189 |
| Total | 375 | 2,218 | 531 | 3,124 |

Note: Excludes 445 foresters engaged in administrative supporting activities at company headquarters.

Source: Ellefson and Irving 1989.

The most recent known national assessment of forest resource professionals affiliated with industrial forestry concerns was conducted in 1986 (Ellefson and Irving 1989). The assessment focused on 70 timber land owning companies that accounted for 72 percent (49.4 million acres) of the Nation's 1986 industrial timber land ownership (68.6 million acres). A total of 3,569 professional foresters was employed by the 70 companies, of which 445 were considered to be in administrative positions in a company's central headquarters (Table 4). The remainder (3,124) was either directly engaged in the management of company lands, procured timber from noncompany land or provided services to owners nonindustrial private forests. The 1,709 foresters with company land as their primary concern were responsible for

more than 49,400,000 acres of timber land, with each on average having responsibility for 28,814 acres of timber land. The latter varied depending on a company's total timber land ownership: 28,300 acres per forester for companies with less than 300,000 acres of timber land, 24,917 acres per forester for companies with 300,000 to 1,000,000 acres, and 32,246 acres per forester for companies with more than 1,000,000 million acres of timber land. Such information is available on a regional basis.

Formal Professional Education

Formal professional education, meaning professional education received prior to employment in a field of forestry or related resource employment, is generally provided by universities, colleges, and technical schools (Table 5). Because these institutions generally have responsibility for education and research involving an enormously wide array of subjects and disciplines, they are well suited to the task of providing educational experiences involving the broad array of subject matter that is required to apply principles of forest sustainability. Unfortunately, information about this professional educational landscape is not always uniform across information gathering organizations nor consistent in form over time. Important information sources regarding capacity to offer formal professional education involving forest resources are: Society of American Foresters (SAF), Society of Wood Science and Technology (SWST), Food and Agricultural Educational Information System (FAEIS), and the National Association of Professional Forestry Schools and Colleges (NAPFSC). Also relevant to human skill development regarding forest sustainability is the Southeastern Section of The Wildlife Society that offers accreditation to programs that meet the section's criteria for professional education.

The Society of American Foresters is the organization officially charged with accreditation of professional forestry educational programs in the United States. It does so by judging such programs in light of various criteria, including program goals and objectives, curriculum, faculty and students, physical facilities, and organizational and administrative support (Society of American Foresters 2000). The broad scope of these criteria reflects the forest resource professional's need for a spacious range of knowledge and skills. In 2001, 136 programs offered forestry or natural resource educational programs in the United States (Table 5). Of these, the Society of American Foresters accredited 47 as professional degree programs and recognized 23 as technical education programs in involving forest resources.

Table 5. Selected Colleges, Universities, and Technical Schools with Professional, Technical, or Preprofessional Education in Forestry or Related Natural Resources, 2001

| | |
|---|---|
| Abraham Baldwin Agriculture College. GA (3) | Ohio State University. OH (1,2) |
| Alabama A & M University. AL(1) | Oklahoma State University. OK (1,2) |
| Alcorn State University. MS (1) | Oregon State University. OR (1,2) |
| Allegheny College. MD (3) | Oregon Graduate Institute of Science & Technology. OR |
| Arizona State University. AZ | Paper Industry Management Association. IL |
| Auburn University. AL (1,2) | Paul Smith's College of Arts and Sciences. NY (3) |
| Augustana College. IL | Pennsylvania College of Technology. PA (3) |
| Ball State University. IN | Pennsylvania State University. PA (1,2) |
| Brown University. RI | Pennsylvania State University –Mont Alto. PA (3) |
| California Polytechnic State University. CA (2) | Pittsburgh State University. KS |
| Central Lakes College. MN | Princeton University. NJ |
| Central Oregon Community College. OR (3) | Purdue University. IN (1,2) |
| Chemeketa Community College. OR | Reedy College. CA (3) |
| Clark University. MA | Rutgers University. NJ |
| Clemson University. SC (1,2) | San Diego State University. CA |
| College of the Redwoods. CA | Santa Rosa Junior College. CA |
| College of William and Mary. VA | Sierra College. CA |
| Colorado State University. CO (1,2) | South Carolina State University. SC (1) |
| Columbia University. NY | South Dakota State University. SD (1) |
| Cornell University. NY (1) | Southern University. LA (1) |
| Dabney S. Lancaster Community College. VA (3) | Southern Illinois University. IL (2) |
| Delaware State University. DE (1) | Southeastern Illinois College. IL (3) |
| Duke University. NC (2) | Southwest Texas State University. TX |
| Eastern Oklahoma State College. OK (3) | Southwestern Oregon Community College. OR |
| Florida A & M University. FL (1) | Spokane Community College. WA (3) |
| Florida Atlantic University. FL | State University of New York. NY (2,3) |
| Hocking College OH. (3) | Stephen F. Austin University. TX (2) |
| Horry–Georgetown Technical College. SC (3) | Technical Association of Pulp and Paper Industry. GA |
| Humboldt State University. CA (2) | Tennessee State University. TN (1) |
| Indiana University. IN | Texas A & M University. TX (1,2) |
| Iowa State University, IA (1,2) | Texas Tech University. TX |
| Kansas State University. KA (1) | Tuskegee University. AL (1) |
| Kentucky State University. KY (1) | University of Alaska. AK ((1,2) |
| Lake City Community College. FL (3) | University of Arizona. AZ (1) |
| Langston University. OK (1) | University of Arkansas. AR (1,2) |
| Lincoln University. MO (1) | University of California-Berkeley. CA (1,2) |
| Louisiana State University. LA (1,2) | University of California-Davis. CA |
| Louisiana Tech University. LA (2) | University of Colorado. CO |
| Lurleen B. Wallace State Junior College. AL (3) | University of Connecticut. CT (1) |
| Michigan State University. MI (1,2) | University of Delaware. DL (1) |
| Michigan Technological University. MI (2,3) | University of Denver. CO |
| Mississippi State University. MS (1,2) | University of Florida. FL (1,2) |
| Montana State University–Bozeman. MT (1) | University of Georgia. GA (1,2) |
| Mt. Hood Community College. OR | University of Hawaii. HI (1) |
| New Mexico State University. NM (1) | University of Idaho. ID (1,2) |
| New York State Ranger School. NY | University of Illinois. IL (1,2) |
| North Carolina A&T University. NC (1) | University of Kansas. KS |
| North Carolina State University. NC (1,2) | University of Kentucky. KY (1,2) |
| North Dakota State University. ND (1) | University of Maine. ME (1,2) |
| Northern Arizona University. AZ (2) | University of Maine–Fort Kent. ME (3) |
| Northeastern Illinois College. IL | University of Maryland. MD (1) |

Table 5 (continued)

| | |
|--|---|
| University of Massachusetts. MA (1,2) | University of Vermont. VT (1,2) |
| University of Michigan. MI (2) | University of Virginia. VA |
| University of Minnesota–Duluth. MN | University of Washington. WA (2) |
| University of Minnesota– Twin Cities. MN (1,2) | University of Wisconsin-Madison (1,2) |
| University of Missouri. MO (1) | University of Wisconsin-Stevens Point. WI (2) |
| University of Montana. MT (2) | University of Wyoming. WY |
| University of Nebraska–Lincoln. NE (1) | Utah State University. UT (1,2) |
| University of Nevada. NV (1) | Vermillion Community College. MN (3) |
| University of New Hampshire. NH (1,2,3) | Virginia Polytechnic Institute & State University. VA (1,2) |
| University of Oregon. OR | Virginia State University. VA |
| University of Pennsylvania. PA | Washington State University. WA (1,2) |
| University of Rhode Island. RI (1) | West Virginia University. WA (1,2) |
| University of the South. TN | Western Michigan University. MI |
| University of Tennessee. TN (1,2) | Yale University. CT (2) |

Note: 1= Land grant university; 2=Society of American Foresters Accredited Professional Degree Program; and 3=Society of American Foresters recognized technical educational program.

The Society of Wood Science Technology is the accrediting organization for professional programs leading to the bachelorette degree in wood science and wood technology. Initiated in 1984, the program accreditation standards are very similar to those applied by the Society of American Foresters. As of 2001, 25 university-level programs were known to offer professional education in wood science and technology. The SWST accredited 9 of these 25 programs (Society of Wood Science and Technology 2002).

The Food and Agricultural Education Information System (FAEIS) provides a broad range of higher education statistics related to agricultural and natural resources. The system is a cooperative endeavor involving the USDA Cooperative State Research Extension Education Service and the Department of Agricultural Economics, Texas A&M University. Its purpose is to provide empirical information for use in planning and coordinating efforts, directed toward supporting higher education in the food, agricultural, and natural resource sciences. Focusing on topics such as enrollment, faculty, degrees awarded, and placement, the system annually surveys institutions that are members of National Association of Professional Forestry Schools and Colleges (NAPFSC) (62 colleges or departments), American Association of State Colleges of Agriculture and Renewable Resources (AASCARR) (56 colleges or departments), Society of American Foresters (48 colleges, schools, or departments), and National Association of State Universities and Land Grand Colleges/Academic Committee on Organization and Policy/Academic Programs Section (colleges of agriculture, forestry, and renewable resources) (NASULGC/ACOP/APS) (85 departments or colleges). Some institutions are members of more than one of these organizations. Not all institutions respond to the system’s annual survey (average response rate about 70 percent), therefore the following may be conservative estimates of faculties, enrollment, and degrees-granted.

As a measure of institutional capacity, an estimated 1,596 faculty (full-time resident instruction) were engaged in forestry or natural resources instruction in 2001, of which 44 percent (705 faculty, 360 full-time equivalents) focused on specializations directly related to forest resources (Table 6). In descending order, the most frequent specialization for faculty instruction was forestry generally (18 percent of faculty), forest biology (15 percent), forest management (14 percent), and forest sciences (12 percent). A significant number of faculty are engaged in instruction involving broader environmental or natural resource topics (891 faculty, 449 full-time equivalents), nearly all of which are important to the development of professional skills as might be applied to the use, management, and protection of forests. Most common is faculty specialization focused on wildlife and wildlands management and renewable natural resources and conservation generally (Table 6).

Table 6. Faculty (Resident Full-Time) Engaged in Forest Resources and Natural Resources Instruction at Colleges and Universities by Academic Specialization and Academic Rank,

| Academic Specialization | Academic Faculty Rank | | | | | Total |
|--|-----------------------|---------------------|---------------------|------------|--------|------------|
| | Professor | Associate Professor | Assistant Professor | Instructor | Other | |
| FOREST RESOURCES | | | | | | |
| Forestry, General | 64(46) | 31(21) | 29(18) | 3(1) | 2(1) | 129(87) |
| Forest Harvesting and Production | 6(3) | 3(1) | 0(0) | 0(0) | 0(0) | 9 (4) |
| Forest Products Technology | 27(9) | 20(5) | 9(4) | 0(0) | 4(2) | 60(20) |
| Timber Harvesting | 4(1) | 6(2) | 0(0) | 0(0) | 0(0) | 10(3) |
| Forest Sciences | 46(17) | 24(10) | 15(8) | 2(0) | 0(0) | 87(35) |
| Forest Biology | 53(32) | 35(17) | 15(11) | 0(0) | 0(0) | 103(60) |
| Forest Engineering | 10(6) | 6(2) | 7(3) | 3(2) | 1(1) | 27(14) |
| Forest Hydrology | 9(4) | 5(1) | 4(1) | 1(1) | 0(0) | 19(7) |
| Forest Management | 40(17) | 32(18) | 22(12) | 3(2) | 0(0) | 97(49) |
| Forest Mensuration | 23(13) | 15(8) | 10(6) | 1(1) | 0(0) | 49(28) |
| Urban Forestry | 4(2) | 4(2) | 3(1) | 0(0) | 1(1) | 12(6) |
| Wood Science | 29(11) | 11(5) | 5(3) | 0(0) | 1(0) | 46(19) |
| Pulp and Paper Technology | 12(7) | 5(3) | 8(5) | 0(0) | 0(0) | 25(15) |
| Forest Soils | 10(4) | 5(2) | 2(1) | 0(0) | 0(0) | 17(7) |
| Forest Sciences, Other | 9(4) | 3(1) | 3(1) | 0(0) | 0(0) | 15(6) |
| SUBTOTAL | 346(176) | 205(98) | 132(74) | 13(7) | 9(5) | 705(360) |
| NATURAL RESOURCES | | | | | | |
| Renewable Natural Resources and Conservation, General | 72(32) | 44(23) | 29(16) | 0(0) | 3(1) | 148(72) |
| Environmental Science-Studies | 33(16) | 21(9) | 30(13) | 2(1) | 3(3) | 89(42) |
| Natural Resources Management & Policy | 52(19) | 27(15) | 20(7) | 2(1) | 5(1) | 106(43) |
| Natural Resources Law Enforcement & Protection Service | 3(1) | 0(0) | 0(0) | 0(0) | 0(0) | 3(1) |
| Fishing & Fisheries Sciences Management | | | | | | |
| Wildlife & Wildlands Management | 53(22) | 22(12) | 23(11) | 0(0) | 2(1) | 100(46) |
| Rangeland Science Management | 79(42) | 44(26) | 37(24) | 2(1) | 0(0) | 162(93) |
| Parks, Recreation & Leisure Studies | 57(26) | 23(13) | 14(8) | 0(0) | 1(0) | 95(47) |
| Parks, Recreation & Leisure Facilities Management | 21(10) | 18(12) | 14(8) | 1(1) | 1(1) | 55(32) |
| Water Resources | 10(6) | 7(5) | 10(6) | 0(0) | 0(0) | 27(17) |
| Natural Resources, Other | 16(6) | 14(6) | 6(3) | 0(0) | 0(0) | 36(15) |
| SUBTOTAL | 33(19) | 17(7) | 18(13) | 1(1) | 1(1) | 70(41) |
| | 429(199) | 237(128) | 201(109) | 8(5) | 16(8) | 891(449) |
| TOTAL | 775(375) | 442(226) | 333(183) | 21(12) | 25(13) | 1,596(809) |

Note: Numbers in “()s” are full-time equivalent faculty. Source: Texas A&M University 2002.

Table 7. Student Enrollment in Forest Resources and Natural Resources Instruction at Colleges and Universities by Academic Specialization and Type of Degree, 2001

| Academic Specialization | Academic Program – Enrollment | | | | Total |
|--|-------------------------------|-----------------------|-----------------|-------------------|---------------|
| | 2-year Program | Baccalaureate Program | Masters Program | Doctorate Program | |
| FOREST RESOURCES | | | | | |
| Forestry, General | 45 | 2,672 | 354 | 170 | 3,241 |
| Forest Harvesting and Production | 31 | 50 | 3 | 4 | 88 |
| Forest Products Technology | 0 | 147 | 17 | 4 | 168 |
| Timber Harvesting | 0 | 0 | 0 | 0 | 0 |
| Forest Sciences | 0 | 436 | 206 | 145 | 787 |
| Forest Biology | 0 | 464 | 180 | 139 | 783 |
| Forest Engineering | 0 | 250 | 15 | 10 | 275 |
| Forest Hydrology | 0 | 18 | 29 | 7 | 54 |
| Forest Management | 25 | 1,756 | 187 | 151 | 2,119 |
| Forest Mensuration | 0 | 0 | 32 | 20 | 52 |
| Urban Forestry | 39 | 222 | 30 | 4 | 295 |
| Wood Science | 0 | 281 | 64 | 53 | 398 |
| Pulp and Paper Technology | 0 | 543 | 11 | 9 | 563 |
| Forest Soils | 0 | 5 | 15 | 4 | 24 |
| Forest Sciences, Other | 49 | 111 | 29 | 44 | 233 |
| SUBTOTAL | 189 | 6,955 | 1,172 | 764 | 9,080 |
| NATURAL RESOURCES | | | | | |
| Renewable Natural Resources and Conservation, General | 0 | 2,089 | 290 | 154 | 2,533 |
| Environmental Science-Studies | 27 | 4,016 | 576 | 348 | 4,967 |
| Natural Resources Management and Policy | 0 | 1,389 | 135 | 108 | 1,632 |
| Natural Resources Law Enforcement and Protection Service | 0 | 33 | 0 | 0 | 33 |
| Fishing and Fisheries Sciences Management | 0 | 1,492 | 301 | 111 | 1,904 |
| Wildlife and Wildlands Management | 58 | 5,029 | 747 | 296 | 6,130 |
| Rangeland Science Management | 0 | 454 | 158 | 80 | 692 |
| Parks, Recreation & Leisure Studies | 0 | 1,338 | 86 | 56 | 1,480 |
| Parks, Recreation and Leisure Facilities Management | 0 | 1,387 | 133 | 38 | 1,558 |
| Water Resources | 0 | 287 | 132 | 75 | 494 |
| Natural Resources, Other | 0 | 203 | 118 | 226 | 1,147 |
| SUBTOTAL | 85 | 18,317 | 2,676 | 1,492 | 22,570 |
| TOTAL | 274 | 25,272 | 3,848 | 2,256 | 31,650 |

Source: Source: Texas A&M University 2002.

Students enrolled in forest resources and natural resources instructional programs at colleges and universities totaled 31,650 in 2001, of which only 29 percent (9,080) were focused on academic specializations directly related to forest resources (Table 7). Of this 29 percent, 5,360 students (59 percent of forest resource focused students) focused on forestry generally or forest management as areas of specialization. The largest number of forest resources oriented students were pursuing the baccalaureate degree (6,955 students). As is the pattern with faculty specialization, a large number of students (22,570) were engaged in professional skills instruction involving wildlife and wildlands management, environmental science and studies, and general renewable natural resources and conservation. These areas of specialization all have relevance to the use, management, and protection of forests. In 2001, 7,921 degrees were awarded in fields of forest resources (27 percent) and natural resources (73 percent), of 78 percent were baccalaureate degrees (Table 8).

As stressed by Indicator 55, the integration of various subjects and disciplines into professional education is critical to the sustainable management of forest resources. Through program accreditation procedures and standards, organizations such as the Society of American Foresters provide direction as to the appropriate mixture of skills, disciplines, and technical competencies within a forestry curriculum. In 1998, employers' ratings of the importance of skills needed for long-term professional success were (in descending order): ability to work in teams, ability to address public concerns, understanding requirements of healthy ecosystems, adoption of innovation approaches to forest management, using creative approaches for working with the public, ability to evaluate and synthesize information, and understanding landscape-level planning and management (Sample and others 1999). The largest gap, in the employers' perspective, between importance and performance of a skill was the new professional's ability to work in teams and address public concerns.

Employers also have an interest in securing persons with appropriate technical competencies (Sample and others 1999). In descending order of importance, the following were identified: ethics, written communication, oral communication, silvicultural systems, managerial leadership, collaborative problem-solving, resource management, forest ecology, forest inventory and biometry, landscape analysis (GIS), tree and plant species identification, human resource management, watershed management, resource economics, financial management, alternative dispute resolution, fire dynamics, organizational development, forest soils, resource policy and law, wildlife biology, government relations, forest pathology, conservation biology, forest engineering, transportation systems, rural community development, wildland and protected areas management, range management, and foreign languages. Except for plant identification, the gaps between performance and importance of a technical skill were largest for various aspects of communicating and managing people.

Table 8. Degrees Granted in Forest Resources and Natural Resources at Colleges and Universities, Academic Specialization, and Type of Degree,

| Academic Specialization | Academic Program – Degrees Awarded | | | | Total |
|---|------------------------------------|-----------------------|-----------------|-------------------|--------------|
| | 2-year Program | Baccalaureate Program | Masters Program | Doctorate Program | |
| FOREST RESOURCES | | | | | |
| Forestry, General | 43 | 529 | 198 | 16 | 786 |
| Forest Harvesting and Production | 12 | 30 | 2 | 0 | 44 |
| Forest Products Technology | 0 | 22 | 4 | 0 | 26 |
| Timber Harvesting | - | - | - | - | - |
| Forest Sciences | 0 | 121 | 44 | 8 | 173 |
| Forest Biology | 0 | 116 | 54 | 20 | 190 |
| Forest Engineering | 0 | 79 | 2 | 0 | 81 |
| Forest Hydrology | 0 | 6 | 9 | 1 | 16 |
| Forest Management | 4 | 389 | 80 | 17 | 490 |
| Forest Mensuration | 0 | 0 | 2 | 6 | 8 |
| Urban Forestry | 15 | 60 | 2 | 0 | 77 |
| Wood Science | 0 | 85 | 20 | 12 | 117 |
| Pulp and Paper Technology | 0 | 104 | 6 | 4 | 114 |
| Forest Soils | 0 | 1 | 1 | 2 | 4 |
| Forest Sciences, Other | 26 | 2 | 7 | 2 | 37 |
| SUBTOTAL | 100 | 1,544 | 431 | 88 | 2,163 |
| NATURAL RESOURCES | | | | | |
| Renewable Natural Resources and Conservation, General | 0 | 446 | 94 | 28 | 568 |
| Environmental Science-Studies | 7 | 1,197 | 184 | 46 | 1,434 |
| Natural Resources Management and Policy | 0 | 391 | 41 | 15 | 447 |
| Fishing and Fisheries Sciences Management | 0 | 306 | 96 | 19 | 421 |
| Wildlife and Wildlands Management | 29 | 1,153 | 230 | 38 | 1,450 |
| Rangeland Science Management | 0 | 93 | 43 | 22 | 158 |
| Parks, Recreation & Leisure Studies | 0 | 382 | 28 | 14 | 424 |
| Parks, Recreation and Leisure Facilities Management | 0 | 360 | 58 | 8 | 426 |
| Water Resources | 0 | 79 | 50 | 4 | 133 |
| Natural Resources, Other | 0 | 242 | 19 | 36 | 297 |
| SUBTOTAL | 36 | 4,649 | 843 | 230 | 5,758 |
| TOTAL | 136 | 6,193 | 1,274 | 318 | 7,921 |

Source: Texas A&M University 2002.

Continuing and Life-Long Education

Continuing education is generally viewed as those learning experiences (or informational updates) occurring after completion of formal professional education. The intent of continuing education is to “. . . constantly refine the sensitivities of professionals, enlarge their concepts, add to their knowledge, and perfect their skills so they can discharge their responsibilities within the context of their own personalities and the needs of society of which they are a collective part.” (Houle 1980, pg 316). Continuing education has always been recognized as important to maintaining human resource skills across forestry disciplines (a need suggested by Indicator 55) (Miller and Lewis 1999). However, it has only been since the 1970s that concepts of lifelong learning experiences for forest resource professionals began to gel and become formal programs assumed by accountable institutions. Such has not occurred without acrimony, most notably the struggle with issues involving the purposes of continuing education and the degree to which such should emphasize scientific and technical updates (increase productivity of the workforce) versus development of the professional as a contributor to broader interests of society (Swanson and Arnold 1996).

Public and private organizations employing forest resource professionals typically offer (or require) programs focused on professional development and in-service education. Information documenting the extent and nature of these programs has not been collected in a comprehensive sense. Although not widespread, legal requirements for provision of (or encouragement of) continuing education opportunities for natural resource professionals do exist at both the State and Federal government levels. cursory examination of such indicates that most of the relevant laws simply call for agencies to collaborate with universities and related institutions on continuing education matters. Examples of Federal legal requirements are as follows:

- TITLE 7 – AGRICULTURE; Chapter 64 – Agricultural Research, Extension, and Teaching; Subchapter III – Agricultural Research and Education Grants and Fellowships; Sec. 3152. Grants and fellowships for food and agricultural sciences education; “(g) Continuing education. The Secretary shall conduct special programs with colleges and universities, and with organizations in the private sector, to support educational initiatives to enable food and agricultural scientists and professionals to maintain their knowledge of changing technology, the expanding knowledge base, societal issues, and other factors that impact the skills and competencies needed to maintain the expertise base available to the agricultural system of the United States. The special programs shall include grants and technical assistance.”

- TITLE 16 – CONSERVATION; Chapter 36 –Forest and Rangeland and Renewable Resources Planning; Subchapter III – Extension Programs; Sec. 1672. General program authorization: “(a) Types of programs; preconditions and cooperation with State program directors, etc. The Secretary of Agriculture (hereinafter in this subchapter referred to as the “Secretary”), under conditions the Secretary may prescribe and in cooperation with the State directors of cooperative extension programs and eligible colleges and universities shall . . . (6) assist in providing continuing education programs for professionally trained individuals in fish and wildlife, forest, range, and watershed management and related fields;

- TITLE 25 – INDIANS; Chapter 33 – National Indian Forest Resources Management; Sec. 3114. Postgraduation recruitment, education and training programs: “The Secretary shall maintain a program within the Division of Forestry of the Bureau of Indian Affairs, Alaska Native, and Indian forestry personnel. Such program shall provide for – (1) orientation training for Bureau of Indian Affairs forestry personnel in tribal-Federal relations and responsibilities; (2) continuing technical forestry education for Bureau of Indian Affairs, Alaska Native, and tribal forestry personnel; and (3) developmental training of Indian and Alaska Native personnel in forest land based enterprises and marketing.”

State governments also have legal authorities requiring continuing education of natural resource professionals. In some States, the requirements are part of general forest resource law while in other States the programs are integral parts of licensing and regulatory programs. An example of the former is Minnesota’s Center for Continuing Education which is called for by the MN Sustainable Forest Resources Act that encourages (established State policy) “. . . timber harvesters and forest resource professionals to establish continuing education programs within their respective professions that promote sustainable forest management . . . the Forest Resources Council shall, where appropriate, facilitate the development of these programs” (Minnesota Forest Resources Council 2002). An example of the licensing regulatory continuing education requirements is California’s Forest Practice Rules which authorize the Director of the California Division of Forestry and Fire Protection to “. . . conduct timber operator education programs in addition to or in-lieu of approving programs conducted by others . . . courses shall use educational materials approved by the Director . . . and shall address the content of rules established by the Board” (California Department of Forestry and Fire Protection 1997).

Continuing education opportunities are provided by an incredibly large number of institutions that have diverse expertise and equally diverse capabilities. However, most continuing education is provided by employers and of that so offered, 90 percent

is accomplished in collaboration with other organizations (Cervero 2000). Colleges and universities are major sources of continuing education in forestry and related natural resource fields, with most, if not all, the colleges, universities, and technical schools previously identified (Table 4) providing such opportunities. Examples are:

- Executive Management Program for Natural Resource Managers, Pennsylvania State University.
- Institute for Sustainable Natural Resource Continuing Education Programs, University of Minnesota's.
- Continuing Education Coordinating Committee Programs in Forestry and Range Continuing Education, Universities of Oregon and Washington.
- Center for Environmental Continuing Education, Duke University.
- Consortium for Continuing Education for Ecosystem Management, Northern and Southern Rocky Mountain Universities.
- Georgia Center for Continuing Education, School of Forest Resources University of Georgia
- Center for Ecological Management of Military Lands, Department of Forest Sciences, Colorado State University.
- Center for Continuing Education, University of Montana.

Federal natural resource agencies provide professional resource managers with numerous opportunities for continuing education. For example, the Forest Service provides a two-track program involving a technical leadership component (workshops on fish habitat management, wildlife habitat and plant management, vegetation monitoring, and managing forested ecosystems) and a program leadership component (workshops on leadership and communication, natural resource policy, values and economics, and program management) (Forest Service 2002b). A number of other Federal agencies have similar efforts and programs that are relevant to needs of natural resource professionals, for example:

- National Training Center, U.S. Geologic Survey.
- National Education and Training Center, USDI Fish & Wildlife Service.
- The Learning Place, USDI National Park Service.
- National Training Center, USDI Bureau of Land Management.
- National Employee Development Center, USDA Natural Resource and Conservation Service.
- National Environmental Training Center, U.S. Environmental Protection Agency

These Federal programs and centers provide a wide variety of continuing education opportunities, meeting the employee performance needs of professionals in various career stages (entry-level employees, new employees, mid-career professionals). Most often, the programs consist of short courses and workshops with some

opportunities for longer periods of formal study (university graduate education). In addition to these single-agency oriented programs, there are multiagency collaborative efforts to offer continuing education opportunities for forest and natural resource professionals. An example is the Carhart Natural Wilderness Training Center that is sponsored by the USDI Bureau of Land Management, USDI National Park Service, USDI Fish and Wildlife Service, and the Forest Service. The center provides educational opportunities for land managers assigned wilderness management responsibilities.

State forestry and related natural resource agencies also offer continuing education programs. Unfortunately, they have not been systematically identified and subsequently assessed as to their focus and intensity. As with Federal agency programs, State agency programs probably take a variety of forms ranging from technical and scientific training, to computer technology training, to management training, to safety in the-work-place training. Most of these opportunities are probably offered in conjunction with other State, Federal, and local agencies or universities.

Continuing education opportunities for forest resources professional are also provided by various private organizations, including professional societies, industry associations, conservation groups and environmental advocacy organizations. As might be expected, they offer a wide variety of continuing education opportunities addressing an equally diverse array of subjects and disciplines (Table 9). Some organizations, such as the Society of American Foresters, offer member certification programs that require some type of continuing education for certification maintenance. Other groups, such as the American Forest and Paper Association (AF&PA), encourage member continuing education involving knowledge and application of sustainable forestry principles (AF&PA Sustainable Forestry Initiative). And yet other private organizations, such as The Nature Conservancy, sponsor periodic workshops and conferences focused on critical natural resource issues. Many private corporations and interest groups involved in forest management also offer (often require) some type of professional development or in-service training programs for their employees.

Table 9. Private Organizations Providing Continuing Education Opportunities Involving Timber and Wood-based Commodities

| | | |
|---|---|---|
| <ul style="list-style-type: none"> •Alaska Forest Association •American Chestnut Foundation •American Conifer Society •American Forest and Paper Association •American Institute of Biological Sciences •American Institute of Chemical Engineers–Forest Products Division •American Institute of Timber Construction •American Plywood Association •American Wood Council •American Wood Preserves Institute •Appalachian Hardwood Manufacturers •Architectural Woodwork Institute •Arkansas Wood Manufacturers Association •Association for Temperate Agroforestry •California Forest Products Commission •California Forestry Association •California Redwood Association •Composite Panel Association •Empire State Forest Products Association •Empire State Paper Research Institute •Evergreen Partnership •Florida Wood Council •Forest Industries Telecommunications •Forest Industry Training and Education Council •Forest Landowners of California •Forest Products Society •Georgia Forestry Association •Hardwood Manufacturers Association | <ul style="list-style-type: none"> •Hardwood Plywood and Veneer Association •Hardwood Utilization Consortium •Hawaii Forest Industry Association •Idaho Forest Products Commission •Independent Forest Products Association •Indiana Lumber and Builders' Supply Association •Intermountain Forest Industry Association •Intermountain Woodnet •International Association of Pallet Recyclers •International Society of Wood Anatomists •Kentucky Wood Products •Competitiveness Corporation •Lignin Institute •Lumberman's Association of Texas •Lumbermen's Credit Association •Maine Council on Sustainable Forest Management •Maine Wood Products Association •Michigan Forest Association •Michigan Lumber and Building •Materials Association •Minnesota Forest Industries •Mississippi Forestry Association •National Arbor Day Foundation •National Forest Foundation •National Hardwood Lumber Association •Material Dealers Association •National Lumber and Building Material Dealers Association •National Paper Trade Association •National Particleboard Association | <ul style="list-style-type: none"> •North American Horse and Mule Logger's Association •North American Wholesale Lumber Association •Northeastern Retail Lumber Association •Northwest Forestry Association •Northwest Timber Workers Resource Council •Northwest Wood Products Association •Ohio Forestry Association •Oregon Forest Industries Council •Particleboard and Medium Density Fiberboard Institute •Pulp and Paperworkers Resource Council •Secondary Wood Products Consortium •Society of Wood Science and Technology •Southern Forest Products Association •Southern Lumber Exporters Association •Southern Pine Council •Technical Association of the Pulp and Paper Industry •Temperate Forest Foundation •Tennessee Forestry Association •Timber Trade Federation •Washington Contract Loggers Association •Washington Forest Protection Association •Western Forestry and Conservation Association •Western Red Cedar Lumber Association •Western Wood Products Association •World Timber Network |
|---|---|---|

Certification and Licensing Program Education

Institutional capacity to maintain human resource skill is also present in occupational registration, certification, and licensing programs focused on forest resource professionals and timber harvesters. Most such programs usually have an educational component which is a prerequisite to being granted the favored status. The terminology of these programs is very confusing, although *registration* implies individuals voluntarily listing their name on an official roster managed by some public or private organization; *certification* acknowledges the meeting of certain minimum qualifications (education, experience); and *licensing* is exclusionary in that government authorization is required to engage in professional practices (MacKay and others 1996). Such programs are usually established to assure the public that only competent persons are providing a service or practicing a trade. Proponents argue that the programs are necessary to protect the public's interest in matters of health and safety. Unfortunately, the programs are often beset by a myriad of issues, including voluntary versus mandatory application, roles of the professional versus the general public, procedure, and substance of eligibility standards, need for an approach to educational requirements, imposition of penalties for noncompliance, and responsibility for program financial support (Garland 1996, MacKay and others 1996, Young 1997).

Table 10. State-Initiated Professional Forester Registration and Licensing Programs by State and Programs Characteristics, 2001

| State | Type of Program | Voluntary or Mandatory Program | Foresters Registered or Licensed | Term of License or Registration | Credentialing Requirements | Continuing Education Requirements |
|----------------|-----------------|--------------------------------|----------------------------------|---------------------------------|----------------------------|-----------------------------------|
| Alabama | Licensing | Mandatory | 1,000 | 1 Year | E, ED | 10 credits per year |
| Arkansas | Registration | Mandatory | 450 | 1 Year | E, ED&EX | 6 credits per year |
| California | Licensing | Mandatory | 1,550 | 2 Years | E, ED&EX | None |
| Connecticut | Certification | Mandatory | 120 | 5 Years | E | 6 credits per 2 years |
| Georgia | Registration | Mandatory | 1,220 | 2 Years | E, ED&EX | 12 credits per 2 years |
| Maine | Licensing | Mandatory | 1,000 | 1 Year | E, ED&EX | 12 credits per 2 years |
| Maryland | Licensing | Mandatory | 206 | 2 Years | E, ED&EX | 8 credits per 2 years |
| Massachusetts | Licensing | Mandatory | 45 | 1 Year | E, ED&EX | 20 credits per year |
| Michigan | Registration | Voluntary | 500-600 | Indefinite | ED&EX | None |
| Mississippi | Registration | Mandatory | 2,000 | 2 Years | E, ED | 16 credits per 2 years |
| New Hampshire | Licensing | Mandatory | 350 | 2 Years | E, ED&EX | 20 credits per 2 years |
| New Jersey | Registration | Voluntary | 64 | Indefinite | ED&EX | 6-9 credits per year |
| North Carolina | Registration | Mandatory | 1,050 | 1 Year | E, ED&EX | 10 credits per year |
| Oklahoma | Registration | Voluntary | 116 | 1 Year | ED&EX | None |
| South Carolina | Registration | Mandatory | 1,600 | 1 Year | E, ED&EX | 10 credits per year |
| West Virginia | Registration | Voluntary | 350 | 1 Year | ED&EX | 10 credits per year |

Note: E = Written or oral exam; ED = Education only requirements; EX = Experience only requirements; ED&EX = Education and experience requirements. Connecticut's certification program is the same as a licensing program.

Source: Society of American Foresters 2001.

State registration, certification, and licensing programs for forestry professionals were implemented in 16 States in 1996 (Block 2000, Society of American Foresters 2001). (Table 10). All programs had some minimum educational requirements; many had continuing education requirements. The States with such programs are: *voluntary registration* – Michigan, New Jersey, Oklahoma, West Virginia; *mandatory registration* – Arkansas, Georgia, Mississippi, North Carolina, South Carolina; *mandatory licensing* – Alabama, California, Maine, Maryland, Massachusetts, New Hampshire; and *mandatory certification* – Connecticut. Florida's forester registration program was allowed to expire since there were too few public complaints to justify the program.

State governments have also seen fit to establish occupational registration, certification and licensing programs focused on timber harvesters or timber buyers (MacKay and others 1996). Twenty-five such programs existed in 1995, namely: *registration* – Iowa, Rhode Island; *certification* – Alabama, Connecticut, Florida, Kentucky, Maine, Maryland, Michigan, Minnesota, Montana, New Hampshire, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Vermont, Washington, West Virginia; *licensing* – California, Illinois, Massachusetts, West Virginia. Maryland has both a registration and certification programs and West Virginia has a certification and a licensing program.

Private organizations also engage in the design and implementation of occupational registration and certification programs, nearly all of which have some continuing education component. The American Forest and Paper Association has a long history of working with States to develop effective registration and certification programs focused on timber harvesters. Similarly, the Society of American Foresters sponsors (began in 1994) the SAF Certified Forester Program. Professional foresters granted certification status must complete 60 contact hours in continuing forestry education prior to recertification every 3 years (Society of American Foresters 2002).

Summary of Conditions

Professional education programs focused on maintaining human resource skills are an important component of forest sustainability and conservation. This review of professional education programs suggests the following:

- Professional educational opportunities occur in some form in virtually all public and private natural resource and related organizations. These activities range from formal professional education in a university setting to professional continuing education via electronic media, and from forest practice workshops for timber harvesters to national and international conferences on forest sustainability and conservation. Educational endeavors to maintain human resource skills are enormous in breadth and substance.

- Formal education of resource professionals is generally provided by universities, colleges, and some technical schools. The educational programs embodied therein offer students an opportunity to select from an enormously wide array of subjects and disciplines. Information about the type, focus, and investments in these educational programs is widely available, although often questionable in quality and consistency.

- Resource professionals can gain their formal education experiences from university and college programs that focus strictly on forest resources as well as from broad natural resource and environmental studies programs offered by such institutions. The breadth of subjects and disciplines applicable to the sustainability of forests makes such a condition possible. In 2001, less than half the faculty engaged in the education of forest and natural resource professionals claimed forest resources as a focus for their expertise.

- In recent years, formal professional education programs appear to have increased student exposure to a wider range of disciplines (for example, mathematics, economics, sociology, communication, administration, conflict management) and a broader set of resources (timber, water, wildlife, range, recreation). Unclear, however, is the magnitude of this increase and the extent to which integration of knowledge actually occurs across disciplines and across resources.

- Formal programs educating forest resource professionals are often required to conform to standards specified by accreditation programs. The Society of American Foresters (47 professional degree programs, 23 technical education programs) and the Society of Wood Science and Technology (9 baccalaureate degree programs) are the most widely known organizations accrediting educational programs in professional forestry and wood science. Except for professional wildlife education programs in the Southeast, accreditation of other natural resource programs (fisheries, range, wildlife, water resource, environmental conservation) are not known to be subject of accreditation procedures.

- Continuing education programs for forest resource professionals are offered by an enormously wide array of organizations, often implemented in a partnership fashion. The approaches to continuing education range from correspondence courses to formal doctoral programs and from short-term workshops to extensive international forest-study tours. Universities and colleges are major sources of continuing education, although employers and some private organizations (professional associations, special interest groups) provide such opportunities. At least three Federal statutes provide for the continuing education of forest resource and related professionals.

- Occupational registration and certification programs focused on forest resource professionals and timber harvesters commonly require the maintenance of professional skills applied to forest and related natural resources. State governments have been most active in developing and implementing such programs. At least 16 States (1996) register, certify, or license forestry professionals, while 25 States (1995) apply similar occupational programs to timber harvesters.

Issues and Trends

The literature identifies a number of major issues and trends involving educational programs focused on the maintenance of human resource skills in general and sustainable forestry in specifically. Consider the following (Alford 1980, Cervero 2000, DeSteiguer and Merrifield 1979, Ellefson 1989, Garland 1995, Houle 1980, Levine 1997, MacKay and others 1996, National Research Council 2002, Sample and others 1999, Society of American Foresters 1994, Swanson and Arnold 1996, Tombaugh 1998, Young 1987).

- Formal education of professionals at the university and college level is increasingly beleaguered by shrinking financing support for university programs generally (both educational and research) and by requirements to make educational program decisions on the basis of rigorous cost-containment procedures. These conditions suggest university administrators need to be persuaded of the importance of forestry education programs and that partnerships between educational programs and the client groups they serve need to be strengthened. Competition for bright students and competent faculties will increase in the years ahead.

- Accreditation of formal professional education programs increasingly will reach out in scope as a mechanism to promote higher standards for formal professional education. However, accreditation actions will face difficult issues, such as assignment of responsibility for accreditation, accreditation across broader natural resource interests (timber, wildlife, water, recreation, environmental studies), expanding the array of competency standards (technical versus managerial skills) used to judge program conditions, and accreditation of graduate education programs (programs beyond the first professional degree).

- Continuing professional education is becoming increasingly important to forest sustainability. Notable in this respect is employers' (public and private) increasing assumption of responsibility for continuing education activities (in some areas, surpassing that assumed by all other providers combined); growth in collaborative institutional and program arrangements (especially between universities and employers) for providing continuing education; and increases in continuing education being a prerequisite for professional and related registration, certification, and licensing.

- Continuing professional education as a system is increasingly beleaguered by fundamental concerns over the intent of continuing education programs (especially updating professionals' knowledge generally versus improving professional technical competency), and institutional governance and responsibility for continuing education programs over long periods of time (assignment of responsibility and leadership, mission and strategic planning, acquiring and allocating resources, program monitoring and evaluation, avoidance of destructive organizational competition).

- Formal educational institutions as a source of resource professional to be engaged in the sustainable management of forests will increase in number and diversity. The range of disciplines and resource specialities required for the sustainable management of forests will draw talent from an increasing variety of formal educational programs (conservation biology, environmental studies, landscape architecture, archeology), in addition to those traditionally accredited as formal forestry education programs.

- Knowledge bases required to address forest sustainability and conservation is increasingly being hindered by severe declines in research capacity. Federal research organizations have especially suffered declines in full-time equivalent researchers, especially those focused on research involving entomology and plant pathology, chemist and soil scientists, and forest product technologies.

Information Adequacy

Specification

Information about maintaining human resource skills across relevant disciplines has been the focus of attention for various public and private organizations over the years. In 1999, the National Association of State foresters (1999) sought a better understanding of State forestry agency information concerning the subject. The association reported only two States with an abundant amount of information concerning professional and related education and nine with sufficient information about such activities (three reported little information). Somewhat troubling was that 34 States reported having no information concerning educational activities required to maintain the human resource skills needed for forest sustainability. As for the quality of information, 3 States reported it was excellent, 10 adequate, and 1 reported poor quality information (National Association of State Foresters 1999).

The Society of American Foresters, Society of Wood Science Technology, and the Food and Agriculture Educational Information System (FAEIS) are major sources of information about professional and related education programs important to forest sustainability. As for information about continuing education programs focused on resource professionals, technicians, and timber harvesters, no know sources of comprehensive information about such programs has been established. Similarly, information about formal and continuing education programs involving other resource fields (for example, wildlife and recreation) or professionally forest-related programs (for example, law, political science, conservation biology, environmental conservation) has also not been gathered and synthesized in a comprehensive sense. Where such does exist, the information is not always comprehensive (usually case study in

nature) nor capable of being aggregated and usefully summarized. Furthermore, the available information often lacks a concerted focus on education as an important element to maintaining human skills across disciplines. In a more specific sense, information voids of the following types are common:

- *Measurement Information* — Information about which variables and how they should be measured so as to accurately portray conditions involving education efforts to maintain human resource skills has not been adequately addressed (What conditions should be measured and subsequently compiled [for example, characteristics of students, needs of employers, quality of faculties, relevance of subjects, levels of investment]? Given the multitude and great variety of institutions engaged in skill maintenance, what measures could accommodate such variability? What conditions to be measured are the best indicators of accomplishing having human skills needed to accomplish standards of sustainable forest management? How often are these variables to be measured? Are there special measurement needs associated with different types of education activity [formal professional, continuing education]? What information would most clearly identify trends?).

- *Extent of Activity information* – Information about formal and related education activities has been assembled in an often uncoordinated way, the result of which is information that depicts only current conditions, and often lacks local, regional, and national consistency. The diversity and types of institutions offering education makes information gathering difficult, although the Food and Agriculture Educational Information System (FAEIS) is certainly a step in the right direction. (What are the magnitude and type of skill maintaining programs at various geographic levels and by various educational organizations? How are these conditions changed over time [if at all]? Are there differences in the substance [basic, specialized, continuing education] of skill maintaining offerings among different educational institutions [why, why not]? What is the status of local government educational programs [conservation education programs of community colleges, small liberal-arts colleges]? Are compilations as currently carried out useful for guiding policy and program direction? Is there a need to expand centralized reporting systems for educational programs enforcement [for example, Food and Agriculture Educational Information System (FAEIS)]?).

- *Responsible Organization Information* — Information about what organizations are actively engaged in skill maintaining educational activities has not been assembled except in a very modest way. Such is especially so for continuing education activities (What public and private organizations are engaged in activities that maintain human skills across resource disciplines? What authority assigns them responsibility and is such authority being accurately interpreted? Do some organizations have an advantage in providing educational opportunities? What are these institutional advantages? Do different public organizations engaging in educational initiatives have similar or differing goals and objectives that foster or hinder the maintenance of resource-oriented skills? What roles do private

organizations play in skill maintenance prompts such involvement [avoid government regulation]? Are there organizational patterns in the public and private sector that, if known and publicized, would enhance overall maintenance of human skills across relevant disciplines?).

- *Coordination information* – Information about coordination of activities important to maintenance of human skills has not been assembled (What are current patterns of coordination [including requirements and incentives for coordination]? Do program conflicts exist between the various entities engaged in education focused on the maintenance of relevant human skills? How might they be productively resolved? Do existing coordination efforts encourage coordination across relevant forest resource disciplines? Do they ensure that the cumulative results of local, State, and regionally undertaken education will lead to outcomes consistent with national requirements for maintaining human skills [and vice versa]? Do they allow incorporation of ad hoc educational activities [special continuing education needs] occurring at various times and undertaken by various levels and types of educational institutions? Are different education offerings comparable [for example, conservation biology, environmental conservation]? How are comparable offerings determined and by whom?).

- *Procedure and Specification information* – Information about how standards for human skill capacity are developed and implemented has not been generally assembled (Is there a broad agreed-to framework within which public and private administrators of educational programs seek to develop and implement programs relevant to maintaining human skills important to forest sustainability [for example, SAF Accreditation Standards, timber harvester continuing education standards]? How are such frameworks, including specific standards, developed and implemented? Do national educational standards allow for regional and subregional development of speciality education programs focused on maintaining certain resource skills?).

- *Scope of Skill Maintaining Information* — Information about educational initiatives required for maintaining human skills often focuses only on certain forest benefits, failing to comprehensively describe activities skill maintaining activities across the range of benefits provided by forests (What capacity exists for maintaining human skills across the range of values associated with forests [timber, water, wildlife, recreation]? What approaches have been successfully used to encourage development and application of skill maintaining activities focused on this broader range of benefits? Are different resource-oriented institutions [university department, private continuing education programs] complementary or competitive in this respect?).

- *Investment and Incentive Information* – Information about resources devoted to the maintenance of human skill across relevant disciplines has not been assembled except in some very limited cases (What is the magnitude of investment

in various relevant educational activities [continuing education, formal professional educations], especially continuing education? Are political and administrative processes for allocating resources to these activities effective and sufficient? Are there fiscal incentives for encouraging the development of skills across relevant disciplines?).

- *Effectiveness information* — Information about the effectiveness of various approaches to maintaining human skills across disciplines has not been compiled except in a limited number of cases (Are there legal or administrative requirements to determine efficiency and effectiveness of different ways of carrying out skill-enhancing programs? What are appropriate measures of success? What opinions do stakeholders and interest groups have of these programs?).

- *Monitoring information* — Information about the monitoring of programs designed to maintain human skill relevant to forest sustainability has not been assembled (Are their legal or administrative requirements to monitor the results of educational activities of various types? Who is [should be?] responsible for gathering and analyzing such information? Is the information from monitoring activities being used to adapt educational programs to changing circumstances? Is the information being collected and analyzed in useful ways? What are requirements for employment in forest resource programs? Are educational programs meeting these requirements?).

Recommendations

Indicator 55 suggests the need to develop and maintain the institutional capacity necessary to ensure the wide range of human resource skills required to meet expectations for the sustainable management of forest resources. There is a host of information needs (many described directly above) which must be addressed to better understand the institutional conditions involving processes that lead to such a goal. In order to suitably deal with them, the following actions would seem appropriate.

- *Comprehensive Periodic Reviews* – Conduct periodic and comprehensive reviews of current authorities and institutions which give direction and commit resources necessary for maintaining human resource skills important to forest sustainability. These reviews should include information regarding the providers of educational efforts, the content of educational offerings, coordination activities between providers, and information regarding program effectiveness and appropriateness. This information should be gathered and synthesized regarding both private and public efforts.

- *Responsibility for Conducting Reviews* - Assign responsibility for conducting reviews of educational efforts to a specific unit located within a Federal agency, a

college or university, or other nonprofit organization. This responsibility should be assigned to an organization that has a proven track record in addressing the complexities of education and human resource development within the forest resource arena. Examples are the Society of American Foresters, National Association of Professional Schools and Colleges (NAPFSC), and administrators of the Food and Agriculture Educational Information System (FAEIS).

- *Devote Resources to the Reviews* – Invest in the review sufficient resources as are necessary to provide the type and quantity of information necessary to dramatically improve understanding of current abilities to provide and analyze human resource skill development regarding sustainable forestry.

Indicator Appropriateness

Indicator Definition

There are a number of definition and scope problems regarding Indicator 55. The far-reaching scope of the descriptor “human resource skills” poses problems for determination of the scope of information gathering as does the elusiveness of “relevant disciplines.” Human resource skills may be viewed from the perspective of various sectors (for example, professionals, timber harvesters, technicians), functions (for example, administrator, researcher, educator), disciplines (for example, economics, ecology, statistics) and resource orientations (for example, timber, water, recreation, recreation).

The indicator speaks to “across relevant disciplines,” which seems to imply information about integration and interdisciplinary activities. Problematic is whether the focus should be on “across disciplines,” “across resource orientations,” or “across social and biological dimensions.” The specification of “relevant” disciplines is also an issue for attempts to focus information gathering activities.

Continuing education seems to be implied by the indicator, yet common perceptions might lead to an incomplete assessment of continuing education, if a focus were only on the continuing education activities of institutions providing formal education (employers are major providers of continuing education).

The indicator might better be specified as institutional capacity to “. . . *develop and maintain professional and related human skills across relevant disciplines and resource orientations.*”

Cross-Cutting Conditions

There are many crosscutting conditions involving Indicator 55. Most notably, there seems to be extensive overlap with Indicator 53, especially regarding extension programs and “make available forest related information.” Other indicators which have some crosscutting issues include Indicator 39 (level of expenditure on research and development, and education), 44 (direct and indirect employment in the forest sector), 45 (average wage rates and injury rates), 46 (viability and adaptability to changing economic conditions), 56 (infrastructure), 57 (enforcement), 59 (trade policies), 63 (development of scientific understanding), 64 (costs and benefits), and 65 (new technologies).

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