

Challenges to Educating the Next Generation of Wildland Fire Professionals in the United States

Leda N. Kobziar, Monique E. Rocca, Christopher A. Dicus, Chad Hoffman, Neil Sugihara, Andrea E. Thode, J. Morgan Varner, and Penelope Morgan

ABSTRACT

Over the last 20 years, the duties of US fire professionals have become more complex and risk laden because of fuel load accumulation, climate change, and the increasing wildland–urban interface. Incorporation of fire use and ecological principles into fire management policies has further expanded the range of expertise and knowledge required of fire professionals. The educational and training systems that produce these professionals, however, have been slow to organize an updated and coordinated approach to preparing future practitioners. Consequently, aspiring fire professionals face numerous challenges related to scheduling conflicts, limited higher education programs in fire science, lack of coordination between fire training and higher education entities, and the overall difficulty of obtaining education and training without sacrificing experience. Here, we address these and other challenges with potential solutions and outline the first steps toward their implementation. We organize the necessary aspects of professional fire preparation into a representative model: a fire professional development triangle comprised of education, training, and experience. For each of these aspects, we suggest changes that can be made by employers, educators, and nongovernmental organizations to provide a more streamlined mechanism for preparing the next generation of wildland fire professionals in the United States.

Keywords: fire management, fire ecology, education, training, firefighter

The past 20 years have been characterized by major developments in fire science, management, and education in the United States (Stephens and

Ruth 2005, Stephens and Sugihara 2006). Both wildland firefighting and fire management have shifted from supportive, ancillary roles (Greeley 1951) to positions of primary

emphasis in many US land-management programs (Hiers et al. 2003). At the same time, in the US federal and state agencies that employ the majority of fire professionals, much of the workforce is at or nearing retirement age. Loss of the most experienced personnel is creating an increased demand for newly educated, trained, and experienced fire professionals, who are challenged by the growing complexity of fire management in the context of global environmental change, increasing wildland–urban interface (WUI), smoke impacts on human health, and other issues. Synchronous large fires have caused mass evacuations of residential areas, leading experts to ponder how fire's ecological imperative will be balanced with the protection of people and their property. The costs of fire management are high and increasing, making the effective education of future fire professionals critical.

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Recently, these developments have been accompanied by a proliferation of fire management vacancies and career opportunities, setting the stage for an evaluation of the educational systems that help prepare future fire professionals.

In this article, we, as the Education Committee of the Association for Fire Ecology (AFE), draw on over 65 years of collective experience as fire educators to assess the challenges that future fire professionals face. We have also conducted numerous informal interviews with fire management professionals from both USDA and US Department of the Interior (USDI) agencies; moderated panel discussions at International Association of Wildland Fire and AFE conferences; and solicited both written and oral feedback from aspiring and current fire professionals and students. Based on these discussions and our direct experiences, we offer our perspectives on improving existing and future preparatory systems designed to meet the evolving needs of fire professionals. The objectives of this article are to

- Describe and assess the current context for fire professional development in the United States.
- Identify shortcomings with the current fire professional development paradigm.
- Explore potential solutions to the challenges we identify.
- Offer promising directions for innovation in preparing fire professionals.

We propose a new system that is predicated on cooperation between higher education providers and the various agencies and nongovernmental organizations (NGO) engaged in training wildland fire professionals as they gain experience. The question, "How would we prepare the next generation of fire professionals if we were to start from scratch?" compels us to explore innovative solutions to the current challenges.

Fire management is in transition from an era dominated by fire suppression to one where fire use and suppression are equally viable resource management options (Stephens and Ruth 2005). Over the last few decades, fire has been increasingly incorporated into land-management programs as a component of ecosystem restoration and/or maintenance, for fuels management, and for protection against the deleterious effects of wildfires on human and biological communities (Kilgore 1974, Parsons et al. 1986, van Wagtenonk 1991, Western Governor's Association 2001, Hiers et al. 2003). Fire man-

agement has become a designed combination of fire suppression and fire utilization, based on increased understanding of fire behavior and fire ecology (Sanderson 1974, USDA-USDI 1995, USDI 2001). Accordingly, the science on which sound fire management is based has grown in breadth and diversity, even as federal land managers are legally mandated to practice science-based management.

In light of the changing scope of fire management, the needs for professional staffing have rapidly expanded, outgrowing our current educational capacity and increasing demands for training. The types of education and training needed for future fire professionals have also evolved. In support of fire suppression, fire education has long focused primarily on fire as a physical process, on weather and fuel interactions, and on how to most effectively control fires (Gemmer 1979, 1980). With the increased recognition of fire's role in sustaining ecosystems and mitigating future wildfire risks, focus has expanded to include fire ecology and ways to use fire as one of many applied biodiversity conservation and ecosystem restoration tools. Furthermore, fire management is increasingly technology intensive, so that fire professionals must be adept at interpreting and applying the results of analyses based on remote sensing, geographic information systems (GIS), and models to support decisions. They must learn to evaluate which of many available tools is best suited for the task at hand.

Just as graduates need to be able to apply GIS, remote sensing, fire behavior models, and other technology (Zhao et al. 2005), they need to be adept at balancing social, economic, political, and ecological considerations (Sample et al. 1999). Such "broad and deep education" (Fisher 1996) could be well complemented with skills learned on-the-job through training and experience. For example, Gemmer (1980) proposed that university fire curricula be complemented by internships and by training courses through the National Wildfire Coordinating Group (NWCG). Others have called for educational changes to address the broad demands of forestry (Fisher 1996, Sample et al. 1999) and rangeland management (Kreuter 2001) professionals.

In this article, we focus on those professionals involved in wildland fire, including fire education, prevention, management, ecology, fuels management, and natural resources management. Fire professionals may

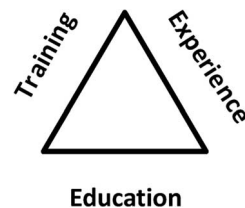


Figure 1. The fire professional development triangle depends on integrating training, education, and experience to provide the background for achieving effective fire science and management.

specialize in fire behavior, effects, or management; ecosystem restoration and maintenance, fire suppression, and other tasks, (e.g., federal policy compliance). Fire professionals work in all five of the US federal land-management agencies, as well as in a vast network of fire-related positions with other federal, state, and local agencies; private contractors; and NGOs, including tribal lands management. Although individual job descriptions vary widely, future fire professionals must understand the multiple facets of fire's ecological role, be able to forecast and evaluate fire behavior and effects, and have direct experience with fire's impact in multiple ecosystems (Interagency Fire Program Management [IFPM] 2008). To stay current, this new generation of fire professionals must continuously incorporate new knowledge of fire ecology, fire behavior, and social sciences to tackle the multifaceted issues they will face.

To be effective, fire professionals therefore need training, experience, and education, all crucial parts of the fire professional development triangle (Figure 1). Working fire professionals need training to develop and maintain specific skills, knowledge, and competencies for operating equipment, managing personnel, administering complex fire management programs, and other job requirements. Training prepares the fire professional for standard fire use and research procedures, promotes safety awareness, and builds specific leadership and technical skills. Education couples an understanding of the behavior and ecology of fire with the ability to think and communicate creatively and critically, interpret complex information, and solve problems across multiple disciplines along various temporal and spatial scales. Experience continually expands and refines both education and training. To make sound decisions, fire professionals must reflect and draw on a breadth of experience with multiple fire events in di-

Table 1. A sampling of universities and colleges with fire science programs in the United States (2008); included are those institutions that offer at least one certificate or degree in fire science and/or host an active chapter of the Student Association for Fire Ecology.

Institution (State)	Academic major	Degree seeking UG option/concentration	Nondegree seeking UG certificate	No. fire-specific continuing/distance/short courses ^a	No. semester fire-specific courses, UG	No. semester fire-specific courses, G
California Polytechnic State University (CA)	N	Y	N	3	8	1
Clark University (MA)	N	N	N	0	1	1
Colorado State University (CO)	N	Y	Y ^b	4 ^b	4	2
Duke University (NC)	N	N	N	0	0	1
Humboldt State University (CA)	N	Y	Y	6	6	2
Louisiana State University (LA)	N	N	N	0	1	0
Mississippi State University (MS)	N	N	N	2	2	0
Northern Arizona University (AZ)	N	Y	Y	3	3	1
Ohio State University (OH)	N	N	N	0	1	0
Oklahoma State University (OK)	N	Y	N	0	3	2
Oregon State University (OR)	N	Y	N	1	3	2
Stephen F. Austin St. University (TX)	N	N	N	0	1	1
Texas Tech University (TX)	N	N	N	0	2	2
University of California–Berkeley (CA)	N	N	N	0	1	1
University of California–Davis (CA)	N	N	N	0	1	0
University of Oregon (OR)	N	N	N	0	1	1
University of Florida (FL)	N	N	N	1	2	2
University of Idaho (ID)	Y	Y	Y	8	6	1
University of Montana (MT)	N	N	N	0	1	1
University of Nevada–Reno (NV)	N	N	N	0	1	0
University of Washington (WA)	N	N	N	0	1	1
Utah State University (UT)	N	N	N	1	1	0

^aNumber of fire-specific courses” denotes courses with “fire” in the title. Table completed to the best of our knowledge as of February 2009.

^aThis column includes both special offerings and regular university courses that are offered in an alternative format (condensed, online, and so on) in effort to target midcareer professionals. Content may be identical to courses in the next two columns. This does not include NWCWG courses offered through cooperation with the educational institutions.

^bTechnical Fire Management, offered through the Washington Institute, credit through Colorado State University during 1985–2008.

UG, undergraduate; G, = graduate; N, no; Y, yes.

verse fire environments. Ideally, these elements will be part of life-long learning and integrated effectively. Their relative importance will vary depending on job responsibilities and stage of career.

Current Capacity of US Fire Education

Only a handful of the country’s thousands of universities and 2-year and 4-year institutions provide substantial educational opportunities in wildland fire management and fire ecology. Fire management and ecology education has historically been concentrated in land-grant universities and technical community colleges, particularly those with forestry and range management programs, and is concentrated in the western United States where large fires are legend (Table 1). Furthermore, programs whose graduates are employed primarily by public agencies have had greater involvement in providing fire education.

Programs of study leading toward a fire-related BS degree range from stand-alone academic majors, options, and focus areas within related majors, to academic minors and certificates (Table 1). Even in academia, coursework emphases can differ between regions based on the cultural history of burn-

ing, management history, and the focus of the department within which fire is taught. Traditionally, schools in the southern United States have focused more on prescribed fire use than western schools, which have emphasized fire behavior and science and other fire-related subjects. Within the 4-year schools with stand-alone majors and options (Table 1), all are located in land-grant schools (9 of 73 nontribal land-grant schools across the United States) or those with established natural resource education programs (6 of an estimated 80 schools with such programs). The linkage to natural resource-focused institutions, although geographically limiting, provides ancillary coursework and access to supporting faculty who, while not fire specialists per se, may have worked extensively on issues related to fire. Without a focus on natural resources, colleges and universities with environmental or biological science programs may be less likely to offer fire-related education.

Recently, increasing student interest has compelled academic institutions to expand the number and variety of academic courses and programs available to educate fire professionals. At the university level, at least five institutions have formalized new wildland fire options/concentrations/majors

over the last 10 years (Table 1). Some have developed new courses and options in wildland fire sciences to capture the growing demographic of students with interests in wildland fire. Graduate fire science education at the MS and PhD levels has also grown, in part because of the relative stability of fire research funding associated with the USDA/USDI Joint Fire Science Program. As an indicator of increasing interest in fire sciences, the Student Association for Fire Ecology (SAFE), founded in 1998, has expanded to an internationally recognized entity with over 90 members and 13 official chapters at universities and community colleges across the country (B. Watson, pers. comm. SAFE, May 15, 2009).

In addition to traditional semester-based courses, a number of universities have developed short courses, online or distance-education courses, and other programs to help accommodate acting fire professionals who seek courses for academic credit. Several institutions have employed campus-based courses in an accelerated format that typically spans a few days to weeks rather than a typical 10-week quarter or 15-week semester. Additionally, these courses are often linked to extensive pre- or postcampus work that is facilitated by communication

among students and with the instructor via the Internet.

There is not only a growing academic interest in fire science; recent updates to interagency fire management job descriptions and qualification standards have produced a new group of experienced fire professionals in need of fire-relevant university level education. Following the tragic firefighter fatalities of Colorado's South Canyon Fire of 1994, an interagency task group was assembled to investigate how training and education could better prepare fire management professionals for the complexity of their professions. The resulting *Interagency Fire Program Management Qualification Standards and Guide* (IFPM 2008) defined 14 fire management positions with minimum qualification standards. Six of these 14 positions, primarily mid- to upper-level fire management positions (GS-09 and above), were classified into the federal government's GS-0401 "General Natural Resources Management and Biological Sciences Series." Although the details and application of this change from a technical series to a professional series is still being refined, it adds a minimum educational requirement of either (a) an undergraduate degree in biological sciences, natural resources, or related fields, or (b) a combination of education and experience that includes at least 24 credit hours of coursework in related fields. These qualification standards apply to new employees, those desiring promotion, and individuals who held impacted positions before reclassification. Consequently, demand for academic courses and programs to help this group of fire managers meet the GS-0401 standards has been and is expected to remain high.

Academic programs involved in meeting the educational demands of current and potential GS-0401 professionals include those institutions listed in Table 1. Many aspiring fire professionals gain education, training, and experience in cooperative internship or trainee programs such as the Student Career Experience Program (SCEP) and Student Temporary Employment Program (STEP) (USOPM 2009). These programs provide students with work experience with an agency while they attend school. Although the STEP program is short-term, SCEP students may be noncompetitively converted to career, term, or career-conditional appointments if a position is available after graduation.

The Challenges

A historical deficiency of coordination and communication among universities and agencies has inadvertently resulted in barriers that prevent simultaneous access to all three legs of the professional development triangle. Traditionally, higher education institutions exclusively provided the educational component, while federal, state, and local agencies, as well as The Nature Conservancy and 2-year technical colleges, dominated training and experience opportunities. Traditional students find it difficult to attain training or extensive experience from agencies, and existing agency personnel often can not readily participate in higher education without significant time away from work. Discussions with fire professionals across the United States suggest that the integration of education, training, and experience in programs developing fire professionals is challenged by the lack of a common vision and a coordinated approach.

Academic calendars regularly overlap with seasonal employment for prescribed burning and wildfire suppression, making it difficult for students seeking experience and for fire practitioners seeking education (Figure 2). Agencies may be hesitant to hire traditional semester schedule-bound students for seasonal fire crews because of, in part, student's late arrival and early termination, jeopardizing crew cohesion and safety. This challenge may even be exacerbated by climate change, which is predicted to further extend the western US wildfire season (Westerling et al. 2006) into academic calendars. Even if academic calendars and fire seasons did not overlap, there appears to be an inherent discrepancy between educational goals and the requirements necessary for entry-level agency positions. Higher education is largely intended to prepare graduates for management positions, but graduates can not achieve higher ranks, or even obtain many permanent entry-level positions, without agency-sponsored training and appropriate fire experience (Figure 2). Such experience provides the essential background from which critical fire management decisions can be made, and no amount of education can compensate for what experience bestows. However, training and experience often appear more important than education to students trying to secure both seasonal and permanent employment early in their careers.

Although many higher education pro-

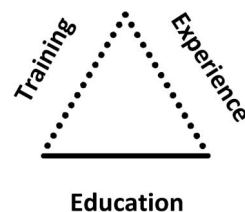


Figure 2. Education acquired, but experience and/or training a challenge.

viders have attempted to respond to this challenge by incorporating training and experience within the context of academic programs, the NWCG does not recognize university courses as meeting their specific training qualifications unless taught by an approved instructor. Few available instructors meet both university and NWCG requirements. Universities typically require lead instructors to hold a PhD, but acting professionals without a higher-level degree can give lectures and assist in teaching university courses. Even with such a team effort, it is unclear how to verify NWCG credit even if a university course explicitly covers NWCG-sanctioned material (using standard published guidelines, presentations, and exams). University courses often embellish the standard material with additional analysis, public speaking and writing assignments, and assessments of critical thinking. For example, in some universities, students plan, present, and execute a number of training-oriented tasks during prescribed burns. However, most often, students can not count these experiences toward meeting the qualifications required for postentry-level positions in agencies, because an NWCG-trained and agency-employed representative must administer the training.

Once students have completed their undergraduate or graduate education in a fire-related subject, they must compete for available jobs. In many cases, the only available entry-level fire management positions are in firefighting, and lack educational requirements. Although critical thinking is an immediate benefit, in many cases the first promotion potential derived from education occurs in midlevel fire management positions, which may take more than 10 years of employment to reach. This scarcity of entry-level professional fire positions limits the potential of fire agencies to provide employment for students who complete higher education degrees.

Most fire organizations have traditionally hired young firefighters with little or no experience or university-level education.

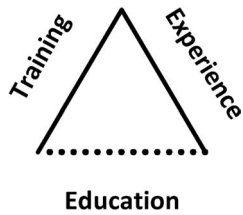


Figure 3. Training and experience achieved, but education is a challenge.

These individuals accumulate knowledge and expertise through experience, as they advance in their careers and gain training along the way (Figure 3). However, federal agencies have recently recognized the necessity of a broader educational base for many of their key fire management positions. The conversion of these positions to the GS-0401 Professional Series necessitates successful completion of a degree or 24 semester hours of higher education coursework. Many current employees holding these positions have obtained the required coursework via creative combinations of on-campus classes, online courses, and university short courses. Although the effort required to fulfill these education requirements is significant, the rewards equal the challenge; employees can maintain their current positions and gain the potential to advance into other professional series positions.

However, some midcareer professionals, although motivated toward self-improvement, may not pursue these educational opportunities because of a lack of agency support for both time and costs incurred, particularly if they are not currently in but aspire to GS-0401 positions. Regrettably, many senior-level federal employees have expressed frustration and demoralization, and even plan to retire early rather than meet the requirements of the GS-0401 series. Unless those who aspire to GS-0401 positions continue to find access to and support for educational opportunities, the vacuum in qualified employees will increase as employees who obtained the GS-0401 educational requirements retire in coming years (Figure 3).

In addition, fire professionals with extensive experience and training who are pursuing higher education for the first time or who are continuing in a new field of study often run into barriers. In particular, many individuals are either unprepared for the nature of university coursework or have not been exposed to the prerequisite biology, ecology, math, and communication skills needed to be successful in upper-division ac-

ademic courses. Thus, students who already lack the support and/or time to return to school must also consider the possibility that they will need to take remedial coursework or spend extra time studying prerequisite materials to succeed in upper-level classes.

Adding to this challenge is the paucity of educational programs tailored to current and future needs of the fire profession. Unfortunately, with ever-tightening budgets, lack of financial resources will likely frustrate efforts to start new programs or expand existing ones, even with faculty desire and a large student demand. Although the IFPM recognizes the value of higher education, there is no joint agency-academic consensus as to what constitutes sufficient academic standards for a fire professional. Without such an accreditation process, students are left without a clear pathway that would guarantee their preparation for professional fire positions and are thus less likely to pursue fire education. Unlike forestry and range science, which have academic accreditation standards dating to 1935, (administered by the Society of American Foresters and Society for Range Management, respectively), fire ecology and management are recently emerging fields that lack a single, overriding organization to develop such standards. In an attempt to start addressing this need, the AFE has recently proposed a fire ecologist/fire professional certification program. The program is designed to foster a sound academic framework that encompasses the needs of diverse subdisciplines and geographic regions.

In addition to 4-year programs focused on wildland fire, a host of 2-year wildland fire programs at community colleges focus on technical education and training more than higher-order learning skills. Individuals who have received training through a 2-year technical degree program also face obstacles in obtaining experience due to the overlap between the academic calendar and seasonal employment opportunities (Figure 4). After degree acquisition, however, these individuals possess the required training to compete for entry-level and seasonal employment, giving them an advantage over students completing nontechnical degrees. The 2-year degree students are thus (at least initially) better qualified to obtain fire employment where experience can be gained. Still, the 2 years devoted to education are at the expense of gaining experience in fire, and without a 4-year education degree students

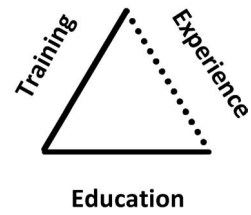


Figure 4. Training and some education obtained, while gaining experience is a challenge.

run the risk of not qualifying for certain professional series positions.

Additionally, challenges exist for technical degree students who wish to transfer into traditional 4-year programs to qualify for higher-level and GS-0401 positions. Students often lack the prerequisite courses required to continue studies in fire science or fire ecology. For example, a graduate from a 2-year wildland fire program may not have taken basic biology, chemistry, or physics classes required in a 4-year program. Typically, 2-year programs provide students with some basic educational skills, but emphasize fire-specific training activities. Technical degrees may not prepare students to transfer and complete 4-year degrees in only 2 additional years of study, potentially increasing the length of time over which education is traded for experience.

Overcoming the Challenges

The current structure of fire professional development programs makes it difficult for students to simultaneously achieve education, training, and on-the-ground experience. The current approach to gaining job qualifications is frustrating to aspiring and established fire professionals alike, who often find themselves with a lopsided “fire professional development triangle,” with the weakest component impacting their ability to compete for jobs. We believe that this problem is so pervasive that it may soon limit the ability of our profession to respond innovatively and effectively to growing fire and fuels problems in the United States. New models for fire professional development are needed to integrate the three sides of the triangle, as well as restructure the professional development process. We describe our vision for a streamlined, integrated program, and recommend practical implementation steps to overcome the three challenges. Our aim is to ensure that wildland fire career building is more accessible, efficient, and effective over the long-term.

The Perfect Triangle: Our Vision for a Successful Professional Development System

The ideal system for preparing the next generation of fire professionals would integrate and/or provide in parallel education, training, and experience. Such a system would share characteristics with educational models used in other professions such as law, business, and medicine, where coursework is offered in conjunction with summer job experiences, training courses, and extensive internships. We suggest that a diversity of programs with different configurations ranging from 2-year technical programs through graduate programs be available to ensure that various career pathways are well paved.

Incorporating training and experience together with traditional coursework will likely necessitate a longer time commitment (i.e., an integrated program equivalent to a Bachelor's degree may take 5–6 years to complete). For such increased lengths of programs to be palatable, a systemwide commitment to valuing the education, training, and experience obtained is essential. For example, graduates will qualify for positions commensurate with their integrated education and will have an advantage in competing against those who have not acquired the same degree of education. Therefore, the training, education, and experience components of these programs must be adequate to fulfill or exceed the IFPM-derived education and experience requirements of the target positions.

We propose that the first step toward resolving the challenges with the present systems of fire education is to foster open dialogue between the agencies that hire fire professionals, the developers, and instructors of NWCG training programs, and the higher education providers that represent degree programs. Improved communication will, undoubtedly, lead to innovative and mutually beneficial approaches to educating the next generation of fire professionals. Such coordination will have several important consequences: a mutual understanding and respect for what agency training programs and academic classes offer, with an appreciation of who is best equipped to provide each; a collaborative atmosphere revolving around a shared mission, as everyone works toward a common goal; and restructured educational systems that reduce redundancy and make education more accessible to both aspiring and midcareer fire professionals.

An important element of streamlining

the professional development process includes the coordination of course content between universities and the NWCG. This coordination would result in increased access to NWCG training courses for aspiring fire professionals and increased access to university courses for midlevel fire professionals. By developing mechanisms by which agency instructors and university professors could coteach selected courses, (such that students have the ability to receive both NWCG certificates and university credit), neither the students nor employers would have to pay twice (in time and/or money) for course content. Some universities already pair with agency instructors to make this possible, and student, agency, and academic response has been overwhelmingly positive. We emphasize, however, that we are not viewing NWCG courses and university courses as equivalent or substitutable. For credit in both academic and NWCG systems, students must be proficient and meet the goals of both entities.

Although we support streamlining the ways education and training courses are offered, we contend that agencies have a greater need and capacity to create and administer training courses, while universities are the more appropriate proprietors of academic tutelage. Where the content and goals of training and academic courses diverge, universities should take the lead in designing and teaching additional fire-related courses that have a true educational component (i.e., not pure training courses). Agencies should administer and teach the courses that involve specific skills needed to perform their jobs, such as safety and practical skills, and coordination between universities and agencies can ensure that students have opportunities to pursue both.

Ideally, a student in a university program who aspires to a fire professional position would have the opportunity to earn both the academic qualifications and the fire experience needed to qualify for a position on completion. We suggest that, simply through better coordination and collaboration between university faculty and agency personnel, many of the scheduling conflicts we have identified could be overcome, resulting in novel partnerships that nurture students and provide coordinated opportunities for learning.

New prospects for facilitating experience for university students might include designating some positions on seasonal crews specifically for students, offering

trainee or intern positions for assisting with off-season management activities (e.g., planning and monitoring ongoing agency projects), or agencies inviting university students (courses, student organizations, or individual students) to participate in or observe prescribed burning and other management activities. Although many universities currently take advantage of the latter, it may be mutually beneficial to formalize these arrangements so that they are recognized as part of the future fire professional's accumulated experience and training. Alternately, students could take time off campus midway through their studies, after they have acquired a basic understanding of fire behavior and fire effects through their coursework, and spend a full season or longer working professionally in fire management.

If such traineeships were sanctioned as integral to the educational goals of the academic program, professors would adjust the academic calendar and curriculum to accommodate and reward such internship opportunities. Fire practitioners, in turn, would be formally mandated to mentor university students in the program. Participants would benefit from learning different aspects of fire management from their professors and from their typically more-experienced professional mentors.

For the special case of experienced fire professionals in need of academic credit, we propose that university coursework be considered an opportunity for growth. It should not be a duplication of training, but rather a mechanism by which professionals hone their critical thinking, analytical, writing, communications, and problem solving skills. We see many avenues to facilitate university education acquisition for experienced fire managers. Competitive leave or grant programs for undergraduate or graduate education would help agency employees take a "time out" from their careers to focus on academic classes. Alternative educational formats including distance learning courses and degrees, short course formats, and hybrids of these will make education more accessible and convenient for full-time fire professionals. These are already offered on some campuses (Table 1) and should be expanded.

Key Steps Toward Implementation

We suggest the following developments and actions to hasten the improvement of the current system. The initial and most critical component is the establishment of an

ongoing forum by which universities, agencies, and NGOs discuss common challenges, and the means to facilitate cooperation in achieving solutions to the challenges. The AFE Education Committee, Lessons Learned Center (an online discussion board resource), NWCG training committees, or a combined taskforce thereof would help organize this forum, which would guide and in some cases administer the following actions:

1. Establish shared standard expectations of future fire professionals between agencies and higher education providers. For example, the certification program developed by the AFE could serve as a springboard for discussions and potential strategies to achieve these standards. Such standards could guide the development and implementation of new BS programs, areas of emphasis, minors, or curricula in higher education to better meet the shared expectations of the desired future workforce.
2. Formalize agreements between higher education providers and agencies to bolster cooperation before, during, and after the education of future fire professionals. Develop and define viable career paths to ensure future fire professionals achieve experience, training, and education. Other opportunities for collaboration include agency input in course development, university access to training courses and experience opportunities, and mechanisms for career advising.
3. Enhance utilization and support for existing federal programs such as SCEP and STEP, designed to facilitate the transition from education to employment. This might also include enhanced opportunities for internships and traineeships that lead to permanent positions, financial incentives (e.g., fellowships awarded to graduates of fire programs) to encourage agencies to grant on-the-job experience to early career fire managers, and the establishment of a resume clearinghouse from which agencies can selectively recruit recent graduates of fire degree programs.

Conclusions

Universities and land-management agencies are partners in educating the fire professionals of the future. The professions

of fire ecology, science, and management are greatly expanding in scope, breadth, and application. We are at a critical point in the transition from an emphasis on fire suppression to widespread fire management and use, resulting in the rapid expansion of professional workforce needs. Our current workforce is aging and we must provide an updated system that can respond to future needs and complexities. It is essential that the education, training, and experience programs that produce the future workforce are developed in a logical, thoughtful, and coordinated manner. Professionals in fire currently have the opportunity and the responsibility to provide a workable system for future wildland fire professionals.

Given the multifarious challenges we face, we must work together toward meeting our common goals through a careful evaluation of the most effective distribution of responsibilities. We hope this article will inspire discussion and propel dialogue on this topic among the major organizations tasked with fire education and training. We recognize that there are numerous challenges, but, more importantly, see ample opportunities for improving our preparation of the future professional fire workforce.

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