Forum Article

Your Fire Management Career—Make It Count!

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ABSTRACT

This paper is an expansion of the thoughts I presented in the closing plenary at the 4th International Fire Ecology and Management Conference in Savannah, Georgia, USA. After ruminating over several days of oral presentations and posters and chatting with attendees, I concluded: 1) scientists are still wrestling with the same fundamental problems they have been for decades, 2) managers are increasingly skeptical of the proliferation of models because they don't provide reliable predictions in a timely fashion, and 3) competitors for airspace in which to release combustion products have become much more adept at convincing regulators to tighten the screws on prescribed fire instead of on their industries. Yet the general mood of the attendees and overall conference atmosphere was highly positive. Perhaps this was because the attendees agree with me that healthy ecosystems are the key to our long-term survival on planet Earth—a planet that has been shaped by fire for millennia and that continues to require periodic fire to maintain healthy ecosystems, thus making prescribed fire the "Ecological Imperative." Because fire managers have the high ground, I continue to be optimistic that, if we can stifle our self-serving tendencies, be factual, and not exaggerate the benefits nor gloss over the deleterious ramifications of prescribed fire, we can educate the general public and turn them into vocal advocates for the judicious use of fire. My primary objective in this paper is to share some concepts that guided me throughout my career with the hope that they will motivate you to improve your *modus operandi* and inspire you to expand your fire management outreach activities.

Keywords: ethics, fire management career, prescribed fire

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INTRODUCTION

I believe my extensive and varied work history qualifies me to speak out on fire management issues. I have spent over 50 years in fire management, starting out on a shot crew in southern California, eventually going back to school for another degree, and then heading to the Southeast where, for the next four decades, I examined the complexities of fire, occasionally creating snippets of knowledge that increased our understanding of this natural force. I had the good fortune to ply my trade over a broad geographic, political, and social spectrum that helped me develop a keen nose for charlatanism, particularly when it comes to people who call themselves fire scientists because of a diploma on their office wall. There are, of course, many good ones out there, but there are others who tend to pontificate on a vast array of fire management problems and needs without ever suggesting a workable so-

lution or, worse yet, who produce 'black-box' model solutions that they haven't field-validated and that are based on their own inadequate understanding of the fundamentals of fire behavior. I am also an old person and, according to a seventeenth century writer,

> *Old people like to give advice as consolation for the fact that they can no longer set bad examples.*

I like to believe that I set a good example because of the thousands of fires I have been involved with over my career. Numerous interesting moments come to mind, however, as well as a few overachievements, but I have had only one fire escape onto another owner's land, and that was the result of a spot fire over 1 km away. Ironically, I had asked the state fire control agency for assistance with the burn.

I attribute whatever success I have achieved to a fairly simple work philosophy: 1) try to do what is ecologically and environmentally right; 2) treat others as you would like to be treated, which includes both giving and being receptive to constructive criticism; and 3) being truthful and following through on what you say you will do even when circumstances change, making delivery of the promised action difficult. I also have an idiosyncrasy that some say results in an abrasive personality, but that does occasionally result in an improved line of attack: I typically mention the potential downside of any suggested plan of action and throw out alternatives, even if half-baked; my objective being to strive for the best, albeit one usually has to settle for less because of the political and physical realities of the situation.

My advice to fire managers is straight-forward and simple: stop procrastinating, stop making excuses, stop waiting for someone else to make decisions for you, be proactive, get off your derrieres, and do some burning. But, use common sense, employ fire judiciously, and pay attention to Norm Christensen's (2009) 10 standard fire management orders (Appendix). Unfortunately, this message has remained pretty much unchanged for more than a century while the task of returning fire to ecosystems has become increasingly difficult and complex as the fire-free interval lengthens on so much of the landscape. The first published articles I am aware of that warn of the consequences of attempted fire exclusion are by southerners Stephen Blocker (1875) and Ellen Long (1889). As the profession of forestry emerged over the next several decades, many early foresters echoed these concerns, including Gifford Pinchot (1899), the first Chief of the Forest Service. These early advocates of the intentional use of fire have been followed by an ever-expanding number of naturalists who have described the benefits of periodic fire and who actually spent their lives in the field and knew what they were talking about (See Weaver 1955; Komarek 1962, 1963, 1964; Garland 1988; Alexander 2009*a*, 2009*b*; Greer 2009).

I believe that the current ecological nightmare that we are mired in is due to people problems rather than to technological holdups. In my experience, the reluctance of managers to use fire typically involves one of the following personnel or management problems: marginal competence, self-serving agenda, complacency or satisfaction with the status quo, no cookbook to follow, other priorities with a lower risk factor (also known as higher personal comfort factor), a supervisor who hinders rather than facilitates fire use, or just not understanding and appreciating that fire is the "Ecological Imperative," a term coined by Frank Cole (a legendary positive force behind the scenes as well as in the trenches). In addition, the inability to get a permit, fear of litigation in the instance of an escape, and smoke management regulations play a part in their reluctance.

Our ancestors knew how to live with fire and make it work for them—why can't we? The only answer I can come up with is that rural people in the past had to depend upon their fire knowledge to survive, while today's majority population of urbanites and rurbanites (urban and suburban-oriented people living in

rural areas) have been misled by Smokey Bear, the news media, and their own urban fire experiences into believing all fires are destructive. Even if these misinformed individuals have an open mind, when they turn to the professionals for answers, they are apt to get half-truths and dream-world scenarios rather than meaningful information. Too many of our colleagues are more concerned about their careers than about the ecosystems that they are charged with sustaining. Just look around; most appropriated dollars to federal land management agencies are now spent on wildfire suppression and, as Steven Pyne has noted, fire control is what is out of control.

National Interagency Fire Center (NIFC) statistics (http://www.nifc.gov/fire_info/prescribed_fires.htm) show that both the number of prescribed fires and area treated finally took a big jump in 2009. Let's hope that year was not an anomaly. I recognize that NIFC can only collate the numbers it receives, but the true 2009 statistics are actually much more impressive as the state of Florida alone burned over 1 million ha in 2009 (<http://www.fosterfollynews.com/news/2010Sept27RECORDBREAKINGPRESCRIBEDBURNINGSEASON.php>), more than the total that NIFC posted for all ownerships. What factors allow Floridians to treat more acreage than all federal agencies combined? Reasons include the following: 1) all natural resource bureau chiefs advocate the use of prescription fire; 2) the Florida Division of Forestry (the agency responsible for fire management in Florida) encourages private landowners to use prescribed fire and provides assistance; 3) Floridians believe in the appropriate intentional use of fire—Florida was the first state to pass prescribed fire legislation (Brenner and Wade 1992); 4) the state promotes burner certification and offers both an online short course and 1-week intensive training sessions (more than 10 000 people have graduated since these courses began in 1988); and 5) numerous consultants offer prescribed fire services. A brief (1- to 2-page) written plan is a requirement to execute a burn as a Certified Burner in Florida; whereas, in contrast, Forest Service fire managers in particular spend an exorbitant amount of effort having to over-plan for every imaginable contingency and then often have to defend the plans in court before they can put fire on the ground. We will never have all the answers we desire, nor be able to prove that executing a burn will not harm some individuals of a species of special concern, even though those species more than likely became imperiled as a result of prolonged fire exclusion. During my career, one would proceed slowly to 'walk the talk' and practice what is now called 'adaptive management.' Field experience was the sure-fire (no pun intended) way to create and affirm fire knowledge on an operational scale. Nowadays, however, it seems as though much of the progress comes from the private sector where creative experimentation is not stymied (Figure 1).

Previous federal leaders must shoulder much of the blame for putting land managers in their current predicament, for they ignored the facts until an enraged public finally demanded change. Anyone who thinks the fallacy of fire exclusion was turned on like a light bulb in the minds of natural resource leaders after the 1988 Yellowstone fires needs to switch to some other mind-altering drug. In my view, what happened was that people saw that America's 'Crown Jewel' had not been destroyed as predicted by the pundits. As they watched these ecosystems emerge like the Phoenix from the ashes in a rejuvenated and healthier state, they first realized that their natural resource leaders did not know what they were talking about, and then as they learned that these leaders had consistently ignored the warnings of their own fire scientists and on-the-ground land managers, as well as non-governmental organizations whom they trusted, such as The Nature Conservancy, they realized they had been hoodwinked. No wonder the public now doubts federal fire managers who tell them that the fire exclusion policy was a

Figure 1. John McGuire (Westervelt Ecological Services) igniting fire backing downhill through cogon grass, an exceedingly flammable invasive non-native plant.

well-meaning endeavor with unfortunate side-effects, and that they really can be trusted to oversee our nation's ecosystems. To restore public confidence, I believe the next step is to make initiating and maintaining appropriate fire regimes on all federal lands the highest priority; it is the only long-term solution to reduce the effects of nature's inevitable attempts to restore balance to fire-adapted ecosystems. There are overwhelming societal and landscape benefits to planned ignitions that address human safety and health issues compared to the only alternative—the inevitable random combination of a receptive fuel bed, weather, and an ignition source that are much more likely to produce a diametric effect (Figure 2).

PROBLEM AREAS AND RESEARCH NEEDS

Fire management leaders collectively agreed on the solution by specifically including the use of fire in federal policy (Douglas *et al*. 2001) a decade ago, but precious little progress has been made on the ground, although the 2009 figures mentioned above suggest implementation is finally gaining momentum. I spent considerable time putting together a list of problem areas and research needs for my Savannah talk, but kept coming back to a presentation by Dave Cleaves in 2003. I present his outline below:

Figure 2. The appropriate use of prescribed fire will reduce destructive wildfires such as this one that swept through Palm Coast, Florida, USA, in 1985, destroying hundreds of homes.

Wildland Fire Problem

Physical aspects

- Large fires are increasing
- Fuels are accumulating
- Urban intermix is expanding
- Global change impacts are uncertain
- Use of prescribed fire is not gaining momentum fast enough
- Fire management is more expensive

Social and Political Aspects

- Public is slow to recognize fire as a positive ecological force (which I [DDW] think is because the government kept telling them the opposite for almost a century)
- Complex value tradeoffs
  - Prescribed fire smoke vs. wildfire smoke
  - Escaped prescribed fire risk vs. catastrophic fire loss
  - Mechanical fuels treatment vs. wildlife habitat and water quality

Research Needs

Ecosystem effect of fire

- Understanding fire regimes
- Interactions with other ecological processes
- Impacts on vegetation, soil, hydrology, animal habitat, and atmosphere
- Effects on human environment
- Carbon storage and cycling and productivity

Fire behavior

- Weather and fire severity prediction
- Mapping fuel structure and composition
- Modeling fire characteristics—physical and empirical
- Landscape scale prediction and modeling

Fire management challenges

- Allocation of fire management resources
- Evaluation of polices and strategies
- Financial modeling of fire systems
- Human factors in safety and decision making
- Social perceptions, costs, and benefits
- Global implications of fire management policies

Research challenges

- Research capacity
- Research skill mixes to match future needs
- Technology development and transfer cycle
- Research scale of analysis
- Role of fire in land management planning
- Tools and data for all ownerships—local to global

I suspect that most folks would agree that the above list provides a good roadmap, although much of it is a succinct synthesis of previous roadmaps stretching back at least half a century. This reinforces my belief that the lack of progress as measured by trends in the areas treated with prescribed fire (the 2009 NIFC stats not withstanding) is due to people problems, but what are they? Are we only marginally competent? Are we self serving? Are we less than proactive? Whatever the answer, I reiterate that we need to take action and make introducing and maintaining appropriate fire regimes our highest priority. Doing so is, however, much easier said than done, mainly because most of the hurdles are personnel related rather than technological. We know what we need to do and pretty much how to proceed (Figure 3), yet over the past 10 years we have just begun to ramp up the area treated with intentional fire, with a few striking exceptions including several national forests, national wildlife refuges, and Department of Defense

Figure 3. Aerial burn along the wildland urban interface conducted by the St. Johns River Water Management District near Palatka, Florida, USA, 2007. Photo by Maria Zondervan.

installations. State agencies that do an admirable job include Blackwater State Forest, and the Saint Johns River Water Management District, both in Florida. The Eglin Air Force Base fire management team treats over 40 500 ha (100 000 acres) a year, which is about one fourth of the Eglin landscape (talk about making an impact!). If you want to look back on your career and be able to say, "I made a difference," you need to be passionate and willing to make personal sacrifices to get the job done (Figure 4). And this is not the same as looking back and saying, "I had a successful career."

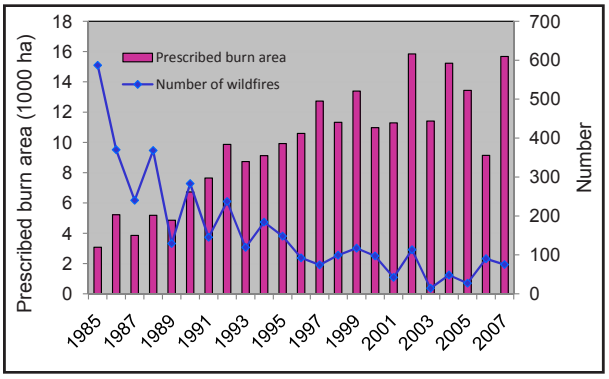

Figure 4. As prescribed fire use increased on Ft. Benning, Georgia, USA, the number of wildfires dramatically decreased.

Herbert Stoddard (1962), an early advocate of prescribed fire (who, by the way, never finished high school but who founded Tall Timbers Research Station and, along with Aldo Leopold, founded the profession of Wildlife Management), stated, "Fire may well be compared to a two-edged sword which requires judgment, care, and experience to properly handle..." I have heard that the proper application of fire is 20 % science and 80 % art; I don't know about the ratio, but I do know that you really do have to know what you are doing, and that requires a lot of time observing fire behavior and fire effects. If you are actively engaged at the field level, you will continually encounter situations that are new to you; but if you have a good understanding of fire behavior fundamentals, you can wing it, learn from your missteps, and practice adaptive management. At least many of us older folks had that latitude during our careers. My career spanned the transition from the current situation back to the closing days of the era of strong-willed field-savvy leaders who were given the overarching resource management goal, were unencumbered by a plethora of regulations and statutes, and who were expected to make decisions and accomplish that goal. It seems to me that today's fire management leaders talk about empowering their employees, but never open the barn door, and deal harshly with anyone caught slipping out the back door to get the job done. Two quotes worth internalizing are: "Wisdom is the measure of the impact of experience on innate intellect," by Ferrol Sams (1984), and, "We are drowning in information and starving for wisdom," by E.O. Wilson (1998).

MANAGEMENT STYLES

Fire management personnel are a cross-section of the general population, so although we might like to think that our profession attracts folks a cut above the general population because of the altruistic nature of our mission,

we still have our share of bad apples and self promoters. If we are to expose and marginalize them, we must first discover what makes them tick. For example, some managers put their careers and personal agenda first, and what is good for the ecosystem and environment a distant second. These self-serving, myopic prima donnas make virtually every decision based on the "how will it further my career" litmus test. When dealing with such narcissists, make sure that they understand that the ecosystem(s) they are responsible for are out of kilter, and if no attempt is made to rectify the situation, they will be held responsible, thereby retarding their chances for advancement. Convince them that letting you husband the ecosystems within their jurisdiction will make them look good. Tell them unequivocally that you will take responsibility for failure, but that you will be happy to share your successes with them; you won't have to think twice about how best to handle the latter, because they will be clamoring to take all the credit. I've had more than one supervisor tell me, "Hell No," to a research request; I typically responded with words such as, "If one doesn't do anything, they can only escape blame for further deterioration of the situation at hand if no potential solutions were offered, and my notes will show that I offered one." One of my supervisors took particular umbrage with my above response, accusing me of threatening him with blackmail when I asked for permission to start cooperative work with John Muraro of the Canadian Forest Service to test aerial ignition in southern forests in the early 1970s. Sometimes you have to bide your time, but keep throwing out seeds as you never know when one will germinate and take hold. In the above example, I was vindicated about 10 years later when Dane Roten with the North Carolina Forest Service came back from a trip to Australia and asked my research unit to determine the feasibility of using aerial ignition in southern pines.

A recent issue brought to my attention is that some agency bureaucrats have suggested that their fire management staff get their own supplemental insurance to cover on-the-job fire activities, but don't fall for this attempt to spread their liability; your employer is responsible for training and protecting you from personal liability when you are carrying out assigned duties. If they don't think their coverage is adequate, or if you worry about your agency backing you if a bad outcome occurs (and based on events over the past decade or two, federal fire staff might well harbor such worries), ask that they pay for supplemental insurance if they want fire management to be part of your duties. You really should not worry about being held personally liable as long as your actions are covered by written documents such as your job description and an approved burn plan and, providing you are not negligent, you are covered by the doctrine of *respondeat superior,* which states that your actions are imputed to the corporate or agency entity as long as you are acting within your scope of responsibility and authority, and providing you do not commit a willful or wanton act to injure another (van der Smissen 1990). Put your plan(s) in writing and include a section describing how all who have to approve your written plan can help facilitate implementation; then discretely make sure that that document, along with their responses (if any), gets circulated to a person or two up the line who can take appropriate action to correct any bottleneck that occurs—they understand that getting more fire on the ground will also make them look good.

I recognize that few upper-level bureaucrats and technocrats get to their positions by being altruistic; it is, however, a trait I believe everyone should more fully embrace. When you come across someone you think is honest, fair, and effective in carrying out the responsibilities of their position, you would do well to focus on the reasons you believe that person is a good manager and leader, think about ways you can emulate their positive traits, chat with them, and internalize any tidbits they offer. Mike DeGrosky writes a column for *Wildfire* entitled "Thoughts on Leadership" that I enjoy

reading. One of his articles worth a good perusal lists 10 rules on personal communications for aspiring leaders (DeGrosky 2009).

At the other end of the scale are those folks who have no clue how to do whatever it is they are supposed to do; they spend most of their time covering their butts. In the old days when such an individual was identified, agencies often promoted them from an action-oriented job into a dead-end position with no line authority in an attempt to remove their deleterious effect on progress. If you sense this is happening to you, a frank discussion with your supervisors is in order, but you should be willing to take constructive criticism; it behooves all of us to continually work on self improvement. On the other side of the coin, I have known good scientists who were rewarded with a promotion into a management position where they failed miserably. Agencies have the authority to temporarily place a person in a position and they should exercise this authority more often to get a better handle on whether making the move permanent would be a win-win situation; allowing individuals to return to their previous position if it becomes apparent that the new move is not a good fit, can also be a win-win situation providing the 'domino effect' doesn't come into play

Federal and state agencies were, and I suspect still are, rife with individuals who were selected based on nepotism, ethnicity, or gender, and thus perform marginally at best through no fault of their own. Everyone should be measured with the same yardstick and promoted on performance and demonstrated ability. People are subjected to a true injustice when they are selected based on other criteria because the grapevine will never allow them the satisfaction of knowing that they were the best available person for the job. Moreover, placing them in a position before they are ready not only sets them up for failure, but also raises very relevant fire safety issues. Remember that, once an individual is placed in a position using the wrong criteria, it becomes extremely difficult to remove them.

The vast majority of us fall somewhere between these extremes; we may think we are doing the right thing, but occasionally we are not. Before we are receptive to suggested change, however, one has to get our attention, which can be difficult to do until our shortcomings are pointed out. The problem is that most of us don't like to be criticized and there are generally folks around who are all too happy to admonish us in an effort to keep the spotlight off themselves. One trait most of them have in common is that they advocate change on your part, so you need to be able to separate good advice from that that is not. The first thing I do when confronted with such a situation is to consider the source; if I trust or respect the individual as a critical thinker from a science standpoint (whether I like them or not is irrelevant), they have my immediate attention. However, if I don't know them, or am not aware of their pedigree, my guard goes up and I apply the appropriate filter. I ask myself what is in it for them if I give them a positive response, and factor that into my decision-making process.

Many of you will have the opportunity to take on new career challenges; perhaps some that you think you are ill prepared to transition into smoothly. Remember that someone recommended you for the job. However, if that job is not an obvious step up your career ladder, reflect on that person's motive; ask yourself whether the upward chain-of-command is happy with your performance, whether they might just be transferring you so they won't have to supervise you, or, worse case scenario, be setting you up for failure so they can terminate you. Next, make sure your family is behind you, and lastly ask what your options are if it turns out to be a bad move on your part. If you decide to take the challenge, listen to what your new staff and colleagues have to say, and read between the lines. Treat everyone equal and in the way you would like to be treated. Then surround yourself with folks smarter than yourself and, as my friend Johnny Stowe with the South Carolina Department of Natural Re-

sources would say, "Go at it wide open as a peanut hull."

RULES OF THUMB

Over the years I have adopted some rules of thumb to help guide my actions. I share these below, along with some examples of the hurdles you may face in your endeavor to leave ecosystems in a healthier state than you found them.

Rule 1: Do No Ecological or Environmental Harm.

Aldo Leopold (1947) gave natural resource managers a golden rule to go by: "A thing is right only when it tends to preserve the integrity and beauty of the community and the community includes the soil, waters, fauna, and flora, as well as people." This doesn't just mean doing the small stuff like not littering and picking up the occasional discarded bottle or aluminum can and tossing it in your vehicle for later recycling. One of the best ways to lead is by example. Little things like this send a message that you really do care about the environment, and don't consider yourself too important to stoop down and perhaps get your hands a bit dirty toting someone else's trash out. When folks see that you care, it tends to make them more receptive to your ideas.

Perhaps more important is the fact that we would have far fewer dangerous guidebooks and models published if this rule was faithfully adhered to. Models have become important management tools, but they present abundant opportunity to violate this rule of thumb. If I were in charge, I would require a preamble written in laymen's terms in every publication that unveils a new model, which would:

- Describe the specific geographic area(s) and array of conditions under which the model was developed and field tested.
- Describe the underlying assumptions, whether any were violated during field validation, and what that means from an operational standpoint.
- Provide the number and percentage of cases where the model did not yield an output value within 20% of the actual field value during field validation.
- Provide contact information for each co-author along with a pledge to give prompt and full attention to correcting problems in model use when used under conditions stated as being applicable.
- Document every request for help, the time frame of resolution, and complete user comments and contact information.
- Make timely successful resolution of identified user problems a major element in the lead author's annual performance rating.

Burn objectives would also be met more often because fewer burns would be conducted under marginal conditions

Models are one of my hot buttons, but I do recognize that they can be very useful when correctly used and when the developer has the knowledge necessary to recognize what makes real-world sense and what doesn't. I have seen way too many models that cobble various pieces of information together to produce a result that has dangerous real world consequences. Sullivan (2009*a*, 2009*b*, 2009*c*) surveyed models published during the period 1990 to 2007. Alexander (2009*b*) and Garland (1988) present good discussions on the abuse of models. Remember: Garbage In = Garbage Out; and just because a model appears logical at first blush doesn't necessarily mean it accurately or precisely follows scientific cause and effect. Models give predictions, not facts. As atmospheric scientist Gary Achtemeier has been known to say, "Models by definition are designed to fail." Having worked with him, I know that Achtemeier abhors failure, which is perhaps why his smoke models are some of the very few whose predictions I have come to

trust. When one of his models gives an unexpected outcome, I first reconsider why I expected a different result, whereas, when, for example, BEHAVE belches out a prediction that my experience suggests is ridiculous, I just smile and include the output in the document I am preparing as required by the agency. The most important thing to remember is that when model output does not jibe with what is taking place in the field, don't trust that model again until the reasons for failure have been identified and corrected. As long as I am on the subject of BEHAVE, Dick Rothermel often said that his rate of spread model was just a first approximation, for he knew better than anyone that he was an engineer with virtually no field experience and, although he watched many a laboratory fire, he recognized that one could not scale up directly to a wildland fire. Nonetheless, the Forest Service made use of his model mandatory, and frustrated fire managers have been dealing with the band-aids, "improvements," and add-ons that continue to spew forth. An excellent discussion of real-world problems associated with current fire models and the underlying reasons for the discrepancies can be found in Cruz and Alexander (2010).

Rule 2: Most Fire Scientists are Not Well Grounded in Fire Behavior Fundamentals.

How can they be when virtually none of their college professors are? I see this as the major reason why today's graduates are so ill prepared to smoothly transition into a professional fire management position. It is the rare individual who has a good grasp of the rudiments of fire behavior upon graduation—most graduates have never seen a unit being ignited nor watched a fire respond to changes in fuel, weather, topography, and ignition pattern over the course of a burn, let alone have someone describe to them what is going on and why. Students are instead taught how to use models, but with little critical thinking about how the output was derived or whether it makes sense. When talking to a fire scientist, assume he or she is not red carded and has spent very little time observing fire behavior on operational burns; and that includes folks who spend considerable time collecting pre- and post-burn samples. I am aware of only one current Forest Service fire scientist who served as a Fire Behavior Analyst (although later in his career he had to be rescued from a situation that would have likely resulted in his death because of his lack of fire behavior knowledge), and am not aware of a single current fire researcher who is a red-carded Prescribed Fire Burn Boss. And don't assume that just because someone has a Ph.D. that they have any practical knowledge. Having said this, I hasten to acknowledge that many top-notch fire and natural resource folks that I know have the terminal degree. The same criticism holds for college professors—few spend much time on fires attempting to figure out what drives their behavior, and fewer still have taken the time to become certified burners. There is a vast difference between 10 years of a person's first year of experience and actually having 10 years of experience. . Many of my colleagues have a fair amount of fire experience in a single fuel type under a small array of prescribed burn conditions, and thus know a lot less than they think they do (e.g.; many western fire experts are very surprised the first time they see the dramatic effects of live southern fuels on fire behavior) (Figure 5). To begin to understand fire behavior, one has to spend a lot of time on the interior (wrong) side of the fire line, experimenting with firing techniques and ignition patterns, and observing fire behavior under a broad range of weather and fuel conditions. It has been my experience that many scientists don't even bother to show up to observe the nuances of ignition pattern and fire behavior when their research areas are burned. Maybe I am a slow learner, but I rarely am on a fire where I don't learn something.

Figure 5. Several live southern species such as saw palmetto, gallberry, and wax myrtle depicted in this prescribed fire can act as fire accelerants.

Rule 3:
You May Be a Competent Scientist, but when Dealing with Natural Resource Managers in the Rural South, if You Over-Officiously Look, Dress, or Act Like One, You Will Have a Hard Sell ahead of You.

Bill Beaufait was my mentor in graduate school. He strongly believed that American foresters should dress and act like their German counterparts if they wanted the same elevated status and respect, and he hammered this into me. He also convinced me to take a job at the Forest Service's Southern Forest Fire Laboratory in Macon, Georgia, because I could burn year-round in the South. I arrived at a fortuitous time because industry was rapidly expanding its use of fire and the Southern Region fire staff was conducting 3- to 4-day classroom and field training sessions at the request of many southern states. I saw this as an opportunity to learn about southern ecosystems, get to meet and interact with southern burners, and share my western fire experience and "book learning" with these folks, and thus got permission from my boss to become part of the training team. I thought my presentations and field exercises were OK, but most of the trainees kept me at arm's length until it dawned on me that they thought I was teaching down to them and considered myself better than them because of my dress code. My proper English and lack of a southern accent didn't help either. However, as soon as I began to dress and speak more like they did, they became much friendlier, and I suspect I learned more from them than they did from me. I might have been able to explain the science behind an observation, but they taught me the nuances of fire behavior in southern fuels, and were instrumental in building my fire behavior foundation—some of them may have had trouble reading and writing, but they knew fire behavior and how to anticipate changes in it. In the South, there are more than a few backwoods folks who have been burning the same tracts for decades (I know of one instance of more than 70 years—the last time I chatted with Sonny Stoddard, he was still burning in his bare feet and advocating, "life is too short to backfire"), who know intimately how fire behaves on that particular tract. One can learn a lot from them providing you ask the right questions, and listen. And you might be surprised how far the use of polite terms such as "Ma'am," "Sir," "Please," and "Thank You" will get you in rural areas. The take-home message here is to be aware of local customs and act accordingly, respecting and adhering to them, although I do draw the line at drinking tepid buttermilk on a hot summer day.

Rule 4:
Keep Focused on the Big Picture, but Pay Attention to Detail.

Soon after I arrived in the South, I asked my boss, Bob Cooper, for permission to attend the next Tall Timbers Fire Ecology Conference. At that time, the Forest Service was not happy with Tall Timbers Research Station because of station director Ed Komarek's outspo-

ken views on fire exclusion and Smokey Bear (although many of us thought he was "on target"). Cooper told me I could go if I was on the program, and somehow I convinced Ed to include me as a speaker. A major concern at the time was that even low-intensity fire would exacerbate erosion on Piedmont sites, but preliminary data from my research showed that this was not the case after summer burns, in part because of the rapid herbaceous response. I was feeling pretty full of myself after my first conference presentation in the South when Roy Komarek, also from Tall Timbers, came up to me and casually mentioned that the predominant plant species in the slides I used to show the rapid vegetative recovery on my summer burns was actually toxic to cattle. I thanked him profusely for educating me, and for doing so in private rather than from the auditorium floor, and then I asked him for any other suggestions to help me improve. My sincere appreciation for constructive criticism impressed Roy, and thus began a mutually productive relationship with Tall Timbers that continues to this day.

Rule 5:
Address Problems when First Recognized. Even Minor Ones are Likely to Metastasize.

Exposing wrongdoing or unethical behavior, first privately and then, if necessary, publicly, no matter how painful the short-term consequences, is invariably the right thing to do. An example you may come across in your career is data falsification. Sometimes the perpetrators get their just reward, but all too often the agency takes the easy way out with the expectation (hope) that the scientist involved will clean up his or her act. If you suspect such a situation, do your homework and then blow the whistle—there should be no place in your organization for data fabrication or intentional dishonesty. Be advised, however, that if you blow the whistle, the trail of misconduct may lead to unexpected individuals.

Rule 6:
Your Ethical Behavior Defines You as a Person.

When you intuitively and positively know something is the right thing to do, proceed, and then later, if necessary, ask for forgiveness. There is a gray area between ignoring agency policies and regulations to get the job done efficiently (or in some cases at all) and getting a reprimand in your file. If I thought the situation at hand was important, I generally went for it, and thus developed an interesting personnel file over my career. Upper management typically liked the results because they made them look good, but if my immediate supervisor was a 'by the book' person, or was looking for an opportunity for revenge, I had to be willing to face the consequences. Don't ever lie to try to extricate yourself from a situation, you will likely find yourself in a heap more trouble and you will have just ruined your reputation and lost your self-respect.

When writing up the results of someone else's work, or using data collected by others on study areas that you did not install, always acknowledge that fact and credit those who were instrumental in establishing or maintaining the study, both scientists and technical staff. For example, a young scientist stationed at Clemson used soils data from a long-term study area that he did not collect and did not acknowledge that fact, thereby giving the symposium audience the impression that he had collected the data; that young man doesn't know how lucky he was that the aggrieved person, who happened to be in the audience, chose to berate him in private rather than from the floor of the auditorium.

Another situation arises when the use of inappropriate statistics or incorrect analysis methodology results in unwarranted conclusions. One should always put his or her study conclusions to the common sense litmus test. If they defy logic, they are very likely wrong. Occasionally such pseudo-science gets past the review process and appears in print; when this

happens and the mistake(s) are pointed out to the authors, they need to publish a correction or retract the article. That same Clemson individual did not fare as well at another symposium, where he was publicly corrected for sloppy work that led him to a nonsensical conclusion. He never did retract the paper and thus lost the respect of many of his peers.

Marty Alexander, with the Canadian Forest Service, is in the throes of exposing another example of shoddy work. He wrote to the author of a stellar example of faulty thinking and misuse of models that led to a ridiculous conclusion, but was ignored. Marty assumed that other readers would also catch the technical and conceptual errors and inappropriate use of models, but the paper is rather complex and continues to be cited by other scientists who, hopefully, just focused on the conclusions without scrutinizing the body of the paper. Because the paper has far-reaching ecological consequences regarding jack pine and lodgepole pine, both economically important fire-maintained species with extensive ranges, Marty eventually took the time to write an objective point-by-point critique (a case study of modeling fire impacts in relation to forest fire behavior) that is currently going through the review process. Previous reviewers made Alexander out to be the bad guy for exposing the erroneous work, with one reviewer even rationalizing that the paper has only been cited 39 times. Authors used to be held responsible for what they wrote! Moreover, a critique such as Alexander's serves as an excellent tutorial and review of the fundamentals of fire behavior, use of models, and the scientific method.

Rule 7: Share Your Missteps as Well as Your Successes.

To quote Igor Stravinsky, "I have learned throughout my life… chiefly through my mistakes and pursuits of false assumptions, not by my exposure to founts of wisdom and knowledge." An important part of maturing professionally is to admit our mistakes so others can learn from them. Henry Ford once said, "failure is simply the opportunity to begin again more intelligently." Redford and Taber (2000) explained this concept well when they wrote:

> *Funders want to report only the successes of their grantees, so only successes are reported to them. Nothing ever goes wrong because no one ever says that anything has gone wrong. To read the record, conservation is an overwhelming success. But we all know this is absolutely not the case. Everywhere you look there are failures, half failures, and almost successes. But to discover these failures you have to find the implementers and take them out for a beer, or visit the site yourself. Heaven forbid if you should want to read about these experiences, because the cycle of success is carefully guarded—renewal of funding is contingent on success. Few have ever been rewarded for anything other than success. We in the conservation business have locked ourselves into a straitjacket of partial truths. Inside this straitjacket we will not achieve effective conservation because we will never learn. Learning requires experimentation, and experimentation sometimes means failure. When failure is not tolerated, learning will never take place. Time is short as we try to slow the juggernaut of biotic impoverishment. We cannot waste time trying things that others have tried and found wanting. But we cannot do otherwise unless we document our failures as well as our successes. We suggest that the long-term success of conservation depends on our willingness not only to admit our failures but to share them as well.*

I strongly urge you to join or form a prescribed fire council in your locality. You might be surprised at the amount of learning that takes place at such meetings. Fire councils offer an excellent forum for exchange of knowledge. They are perhaps the best way to keep prescribed burners up to date on new research results, emerging technology, training opportunities, and other fire-related issues within your locality and beyond. We now have an umbrella organization, The National Coalition of Fire Councils (http://www.prescribedfire.net/), which is a storehouse of information and help. All you have to do is ask. Another excellent website for sharing fire management experiences is http://www.wildfirelessons.net/Home.aspx

Rule 8: Take Time to Help Folks out— We All Need All We Can Get.

We all have colleagues who are a pleasure to work with; who are competent, creative, and industrious; who don't worry about the time or who gets the credit; who try to keep us from making fools of ourselves; and from whom we always learn. You too can develop such a reputation if you choose to do so.

Do not condone behavior such as 'it's not my place,' 'it's beyond my control,' 'I don't have time,' 'I don't know how,' or 'it's not politically correct.' But do take the time to work with such individuals to show them how they can be part of the solution rather than part of the problem. Distance yourself from researchers whose conclusions are compromised by preconceived ideas, by a professionally dishonest agenda, by potential funding sources, or who don't have the intestinal fortitude to issue retractions when the process they used to reach a conclusion is shown to be flawed.

We are all ignorant, just in different subjects and to varying degrees. Occasionally you will find yourself on a team with marginally competent colleagues; rather than ignoring them, try to them tasks that you think they can do well and guide them as necessary along the way; it will help them build self confidence and improve team performance.

Most of you will occasionally suffer under poor or self-serving leadership. When you find yourself in such a predicament, don't buckle; tell them what you expect from them as supervisors and support personnel and how they can facilitate accomplishment of your assigned tasks. Then do their jobs as well as yours if need be.

For most of my career, I found that my colleagues who were intellectually honest and hard working were recognized and appreciated for their efforts, and their failures not held against them. But, alas, over the last decade or so, I have observed a reversal. Agencies now appear slow to reward those who are at the forefront using fire in areas with unprecedented accumulations of fuel with few detailed guidelines, but are quick to point the finger of blame when things go wrong. Little wonder that agencies now have problems recruiting top-notch people to fill fire management positions. The lack of an obvious career ladder in fire management does not help either. But for those people who love the outdoors and want to make a difference, a career in fire management is an obvious choice. I would plunge in again without hesitation because the work is exciting, challenging, and very rewarding (even if not on a monetary basis) as you help secure the future of prescribed fire in ecosystem management.

CONCLUSIONS

When you chose fire management as a career, it should have been obvious that you weren't going to get rich, and that long hours, often under arduous and hazardous conditions, were going to be the norm. Avoid the trap of doing less because you believe you are currently doing more than your share. Others will notice your drop in productivity and that action won't help get the task at hand accomplished. You have to have faith that your supe-

riors will eventually recognize you for your extra effort and can-do attitude.

The task ahead is daunting and requires all of us to do more. We need to be more proactive and lead by example instead of making excuses for our inaction. Yours is not some union job where you can expect to get ahead by simply showing up, exuding personality, and being careful not to do more than your colleagues. You signed on to help manage our nation's natural resources and that means you have an awesome responsibility to future generations. As Alan Dozier (Forest Protection Chief, Georgia Forestry Commission) said in his welcoming remarks to the Savannah conference, "Lead, follow, or get out of the way."

I reckon I'll close now, with a statement from a few years back that I think bears repeating:

> *Ultimately it will be the public who decides whether intentional fire will be used to manage fire-adapted ecosystems. This is too important an issue to leave to others to come to grips with on their own. We all must be proactive in our outreach efforts to demonstrate to the public and our elected representatives that prescribed fire is the only practical (and rational) approach, and that given the latitude and legal protection to do so, fire managers have the will and skill to use fire in a safe and effective manner. The gauntlet has been laid before us; it is now up to all of us to rise to the challenges ahead and to take action which requires risk, rather than hide from the challenge and be limited to reacting. In our view, the cost of no action is simply too great!* Wade *et al*. (2006).

Thank you for the opportunity to share these thoughts that I have developed and found helpful over the course of my career.

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Appendix. Norm Christensen's (2009) 10 standard Rx fire orders from his plenary address at the 2008 Yellowstone Fire Conference.

1. *Know what it is you are trying to accomplish and why.* It is not sufficient to say that we are restoring fire itself. While fire is essential in many ecosystems, it is not the endpoint of management. Rather we manage fire—suppress it, restore it, and prescribe it—in order to conserve key things such as fuel conditions, natural and historic objects and wildlife, and key processes such as energy flows and element cycles. Our goals must be formulated in terms of these measures of forest sustainability.

2. *Set realistic goals.* We manage—we set fires, extinguish fires, and in various ways manage fuels—across a range of fire regimes. The fact that certain things are easy to do at one end of that range too often leads to hubris regarding what can be accomplished elsewhere. Prescribed fire is virtually an oxymoron in many fuels; forest restoration treatments of the kind that diminish wildfire risk in semiarid ponderosa pine stands are neither feasible nor effective in many other forest types.

3. *Manage the cycle—meaning the entire process of change—not just the fire.* Fire is just one moment, albeit a transformational moment, in a process of change. And, the nature of a fire, any fire, is determined only in part by conditions—weather, fuel moisture, etc. —unique to that moment. Much of fire behavior is a consequence of a century or more of ecosystem change preceding it. Furthermore, its behavior will influence the patterns of change that proceed from it over the decades and centuries that follow.

4. *Manage less for desired future condition and more for desired future change.* This order follows from the previous one. Change is constant and, as we have learned in several recent foreign conflicts, efforts to restore a particular condition with no thought about the change that will follow are likely to produce unhappy consequences. Across many parts of the West, we have embarked on a process of forest restoration to produce fire resistant structures. But, without a plan and the resources to manage that change that will inevitably follow this restoration, we will very soon return to high fire risk conditions.

5. *Variation and complexity matter—conserve them!* Perhaps the greatest ecological lesson of the 1988 Yellowstone fires was their remarkable variability and the equally remarkable diversity of recovery patterns and biological communities they produced. We now know for certain that the diversity of so many special places is a consequence not just of disturbance, but of variations in disturbance and the processes of change that they produce. For this reason, managers should avoid homogeneity in their practices.

6. *Eschew arbitrary boundaries—which means almost all boundaries.* This is, of course, a basic tenet of ecosystem management. The 1988 Yellowstone fires and other subsequent fire events have brought home the fact that the spatial extent of fire and of the many processes that are affected by fire have little relationship to boundaries of jurisdiction or ownership, or to the boundaries that we use to define social and cultural categories such as urban and wildland. This is particularly important where the scale of fire or any other process approaches or exceeds the scale of ownerships and jurisdictions.

7. *The world is changing—expect surprise and manage to accommodate it.* In its 2007 reports, the Nobel Laureate Intergovernmental Panel on Climate Change pleaded with world governments to take steps to mitigate greenhouse gas emissions and thereby slow global warming. Nevertheless, they warned that some warming and associated climate change is inevitable and that environmental managers should take steps to adapt to that inevitable change. Forests and related ecosystems must be a priority for such adaptation. Diversity and complexity provide a critical buffer for change. The loss of complexity and resilience in many of our forests is a matter of great concern, not just with respect to fire, but with regard to a great many natural and human-caused disturbances.

8. *Pay attention to history—but not too much attention.* The concept of historic range of variation has been a powerful addition to our understanding of fire in forests. But, the fire cycle is a very simplistic model of real-world change. Henry Chandler Cowles' wonderful depiction of succession as "change converging on change" is much closer to the truth. Yellowstone and other similar events have taught us that each disturbance cycle is different. This is an especially important lesson in our rapidly changing world. Changing climate may well redefine both the nature of future fires and the nature of the ecosystems they produce. Diminished air and water quality and the redistribution of species across Earth's surface are producing ecosystem change that has no historical precedent. I will repeat something that I said at the first biennial Yellowstone Fire Conference 18 years ago: Naturalness, defined as that that was before people mucked things up… naturalness is to ecosystem management as the frictionless plane or an ideal gas is to physics.

9. *Remember, you are mostly managing people.* There are so many aspects of this order that I could discuss, but I want to focus on the tenth fire fighting order—manage fire aggressively, providing for safety first. Fire management is not an academic matter; it has great consequences for human life and property. If nothing else has been learned on this matter in the past 20 years, it is that attempts to manage fire and fuels at landscape scales and across jurisdictional boundaries must have the engagement of all communities and stakeholders. The history of past forest use and perceptions about the actual intentions of forest managers—lock it up or log it—will be an inevitable subtext for community-based management.

10. *You only think you know what you're doing—be humble, manage adaptively.* This tenth order is, I think, an especially apt capstone to a week in which we have rehearsed in detail the wealth of new data and understanding that has come from experience and research in Yellowstone and elsewhere. We have no choice but to learn on the job—adaptive management is critical. We must ensure that our monitoring is directly relevant to goals and objectives (Order one), and that research is addressing our most pressing uncertainties. The world is changing, but uncertainty is an unacceptable excuse for inaction. Indeed, in a world of change, there is no such thing as inaction.