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REINTRODUCTION OF FIRE INTO FIRE-DEPENDENT ECOSYSTEMS: SOME SOUTHERN EXAMPLES

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ABSTRACT

Natural resource problems associated with, or resulting from, attempted fire exclusion are challenging managers across the United States. Critical issues range from epidemic insect and disease conditions to species extirpations. Southern burners continue to demonstrate that seemingly insurmountable constraints can be overcome through commitment and cooperation, and result in implementation of successful fire programs. Four diverse examples of case histories which support this assertion are discussed: 1) the reintroduction of fire after a half-century of exclusion, 2) a high-intensity stand-replacement fire, 3) burning in the aftermath of a major hurricane, and 4) burning within a residential subdivision. These examples are used to show that forest management problems in the South can be very similar to those faced elsewhere. We believe the approaches used in these examples can also be used elsewhere with equal effectiveness.

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INTRODUCTION

The ramifications of attempted fire exclusion in fire-adapted ecosystems continue to be discussed (e.g., Daniel and Ferguson 1991, Mutch 1994, Sapsis and Martin 1994, Williams 1995), while natures' corrective responses, perhaps exemplified by the 1988 Greater Yellowstone Basin fires, continue to take place on the ground, often with very undesirable consequences. Many reasons are given for our collective reluctance or apparent inability to restore fire to ecosystems that require it. Some have a ring of truth about them, but far too many are simply excuses for not doing a necessary job. Managers will never have all the information, funding, or staff they would like. Yet, numerous examples exist throughout the United States where committed individuals have overcome such obstacles, worked with the public, and initiated viable fire management programs. Perhaps the long tradition of fire use and expertise in the South explains why southern resource managers appear to be much more willing to not only verbalize the necessity of fire, but to actually select and use fire as a land management method of choice.

Significantly more acreage is underburned (i.e., prescribed burning under a forest canopy) in the South than in all other regions of North America combined. Management goals, areas of emphasis, and preferred strategies to achieve these goals keep changing in the South, as they do elsewhere. Within the last two decades, the focus on backing fires during the dormant season for hazard reduction has expanded to now include aerial ignition, burning during the growing season, smoke management, and threatened and endangered species concerns. Although regional differences in the obstacles to implementation exist, there are also many similarities. For example, Federal statutes and regulations should provide the same guidelines. We

believe the expertise associated with viable fire programs should be readily transferable to help minimize both the frustration level and mistakes of managers who want to initiate prescribed burn programs in difficult situations.

This paper briefly summarizes four examples where either the reintroduction or continued use of fire was the only practical remedy to correct an untenable situation or reverse an undesirable trend. They involve: 1) the reintroduction of fire after 45 years of exclusion; 2) a high-intensity stand-replacement fire; 3) burning in the aftermath of a major hurricane; and 4) burning within a residential subdivision. In each case the safest decision from a manager's career standpoint would have been not to burn. However, the best decision from an ecosystem health standpoint was to burn.

Factors common to the examples are: 1) all prescribed fires took place at the urban-wildland interface; 2) managers defined the problem in detail, and thought through the ramifications of various alternative solutions, including the consequences of not using fire; 3) the help of all stakeholders, including those with divergent viewpoints, was actively solicited to reach a workable solution; 4) a decision was reached to use fire without having all the answers; and 5) the general public was approached for input and support; citizens' concerns were addressed, and costs, risks, and potential outcomes (both desirable and undesirable) were fully discussed.

REVERSING 45 YEARS OF FIRE EXCLUSION: FLOMATON, ALABAMA

The first example involves the reintroduction of fire into one of the five known remaining virgin stands of longleaf pine (*Pinus palustris*). This 65-acre (26.3-hectare) stand in southern Alabama, known as the Flomaton Natural Area is currently owned by Champion International Corporation. It contains numerous longleaf that exceed 100 feet (30 meters) in height, 2 feet (0.6 meter) in diameter at breast height, and that are more than 200 years old (Meldahl et al. 1995). The stand is split by a 4-lane U.S. highway and surrounded by homes and an oil well. The stand was regularly underburned until the early 1950's when the Society of American Foresters designated it the E.A. Hauss Old Growth Longleaf Natural Area. Fire has since been excluded, allowing forest-floor fuel loading to exceed 16.5 tons per acre (36.6 tonnes per hectare) excluding branchwood. The herbaceous groundcover visible in a 1952 aerial photograph has been replaced by a hardwood midstory and a dense understory of vines and shrubs. A description of the flora can be found in Meldahl et al. (1995).

During the summer of 1992, a low-intensity, high-severity wildfire crept across 5 acres (2.02 hectares) of this tract before being extinguished by the nocturnal rise in relative humidity. Because of dry conditions, most of the 5+ inch (12.5 centimeters) deep forest floor was consumed, killing overstory feeder roots that had colonized the duff layer during the previous 40 years of fire exclusion. Younger, vigorous trees were able to reestablish their fine-root systems quickly, but old-growth longleaf were not able to do so fast enough, and subsequently died.

Mortality caused by the 1992 wildfire focused attention upon the probable consequences of the next wildfire, especially if it were to burn under conditions with more wind when control would be more difficult. Another fire was considered probable because roadside parks were located on both sides of the highway where it passed through the stand. Because of such concerns, Champion convened an on-site discussion of potential alternative solutions. Champion wanted to perpetuate this tract as a functioning example of an old-growth longleaf pine ecosystem which meant frequent low-intensity fire would have to be reintroduced. Other options such as removal of the midstory and hardwood brush by mechanical or manual methods, herbicides, and/or mowing could visually mimic the short-term results of fire but would not fulfill many essential ecosystem processes.

Representatives of eight organizations took part in this discussion of the Flomaton tract. There was general agreement that the ecosystem could not maintain its integrity without close-interval fire, but no clear consensus emerged on whether fire could be safely reintroduced. Champion's legal department had strong reservations about the use of fire because of the adjacent homes and heavily traveled highway. However, Champion had designated this area one of their "Special Places in the Forest," and local Champion foresters were resolute in their desire to return the area into a functioning longleaf pine-bunchgrass ecosystem. Their persistence, together with the continued interest of individuals within seven of the eight organizations involved in the original discussions, led to a Memorandum of Agreement currently under the auspices of Auburn University School of Forestry. The Southern Research Station of the U.S. Department of Agriculture, Forest Service took responsibility for writing a burn plan and conducting the first series of prescribed fires in conjunction with the Alabama Forestry Commission.

The burn prescription called for ignition when the duff layer would be too wet to burn, but when brisk, persistent winds would push a moderate-intensity headfire through the dense tangle of vines, understory brush, and needle-drape to skim off the top layer of litter and begin the process of hazard reduction and ecosystem restoration. Two prescriptions were developed to mitigate smoke concerns. One utilizing prefrontal winds which would move the smoke in a north to northeasterly direction and one utilizing west to northwesterly post-frontal winds. The stand north of the highway was divided into eight blocks separated by soft lines and burned on one of two days, three months apart in 1995. Complete coverage was not an objective, although more than 80% of the area was treated. A second burn was applied to all blocks using the same procedure in 1996. Fire continues to be excluded from the stand south of the highway until fire effects on the north side become clear. These initial

fires opened up the stand and quickened forest floor decomposition without causing any longleaf pine mortality. The midstory component has since been manually removed to speed up the restoration process and the site burned again in June 1997. The stand has regained much of its pristine appearance. Short-interval growing season burns are planned for the foreseeable future to continue the healing process.

HIGH-INTENSITY STAND-REPLACEMENT FIRE: OCALA, FLORIDA

During the spring of 1935, the lightning-caused "Big Scrub Fire" raced across 35,000 acres (14,170 hectares) on the Ocala National Forest in 4 hours, the fastest spreading wildfire documented in the history of the U.S. Department of Agriculture, Forest Service. This fire occurred in the sand pine (*Pinus clausa var. clausa*)–scrub oak (*Quercus sp.*) ecosystem, which is characterized by an overstory dominated by sand pine and an understory of various evergreen oaks. The thin bark of sand pine provides little protection from fire; however, the cones of this tree are serotinous, making perpetuation of sand pine dependent on stand-replacement fires. This plant community is restricted to xeric sand ridges in central Florida and contains numerous plant and animal species that are listed as threatened or endangered.

The Ocala National Forest is now an urban forest because of its proximity to Orlando, one of the nation's fastest growing population centers. Instead of relegating the future of this forest type to chance wildfires, the Ocala staff decided to mimic the historical fire regime and conduct a stand-replacement crown fire. They successfully mitigated socio-political concerns such as fire escape, private property inholdings, smoke-related public health, and visibility reduction by involving the public during the early planning stages. The ecological necessity of fire in this vegetative type and the ramifications of planned ignitions compared to a policy of fire exclusion were stressed. The staff convinced local government officials of the need for such fires, and kept them informed of progress. Partnerships were formed to help achieve research and monitoring objectives. Interested citizens were bused to the site the day of the burn where they watched the whole show from pre-ignition briefing to mop-up.

There were also technical hurdles to a successful burn including development of a prescription for a "controlled" crown fire. Virtually all fires in sand pine are crown fires. Surface fires tend to creep and are easily extinguished. But live sand pine needles are extremely volatile so after short periods of spring or summer drought, these stands become very flammable. Using this local knowledge and the BEHAVE Fire Behavior Predictions System (National Wildfire Coordinating Group 1992), the Ocala staff determined that live woody fuel moisture and windspeed would be the dominant factors in producing a fire intense enough to consume the canopy. The BEHAVE system showed they could hold windspeed to a manageable level (from a fire control standpoint) and still develop the needed intensity by working with live woody fuel moisture.

The real test came when the Ocala National Forest personnel put their prescription to the test. A well-defined column quickly developed, drift smoke containing live embers was observed 6 miles (9.6 kilometers) downwind, but no spotting occurred. Immediately after the fire it was obvious that BEHAVE had accurately predicted fire behavior, thereby ensuring the burn was confined to its intended area, a seedbed prepared, and the cones opened. More specific information on the fuels, fire behavior, and planning aspects of this fire can be found in Custer and Thorsen (1996), and Outcalt (*this volume*).

UNDERBURNING IN THE AFTERMATH OF HURRICANE HUGO: CHARLESTON, SOUTH CAROLINA

The 250,000-acre (101,000-hectares) Francis Marion National Forest (FMNF) contains about 175,000 acres (71,000 hectares) classified as pine type. Longleaf pine was the historical dominant, but much of the area had converted to loblolly pine (*Pinus taeda*) because of harvest practices and the relatively long 5- to 6-year prescribed-fire-return interval. In spite of the fact that the forest is located within 20 miles (32 hectares) of Charleston and is traversed by two major highways (one of them the coastal route between the Northeast and Florida), over 35,000 acres (14,200 hectares) per year had been burned for several decades, primarily with dormant season fires. These fires typically consumed 2–3 tons (2.2–3.3 tonnes) of fuel, kept the hardwood brush in check, and reduced the damage potential of wildfires which were common.

The Francis Marion National Forest changed dramatically on September 22, 1989. When the sun rose, over 70% of the merchantable overstory was on the ground and Hurricane Hugo was churning its way inland. Clearing just the 615-mile (980-kilometers) forest-road system took 4 months. During the next 2 years, over 15 million dollars were spent, primarily on fire prevention and suppression (see Saveland and Wade 1991 for an overview of fire management ramifications). South Carolina implemented the most concentrated fire prevention program ever attempted called "GIMME 12," which asked landowners, including the Francis Marion National Forest, to suspend all outdoor burning for 1 year.

By the end of this "fire-free" year, the FMNF staff recognized not only that fire exclusion was the wrong approach, but that prescribed fire was, in fact, the ONLY practical long-term solution. They proceeded to switch this worst nightmare into a great opportunity. In the months before Hugo, forest personnel had been wrestling with ways to increase the acreage devoted to the longleaf pine ecosystem, perhaps North America's most endangered major ecosystem. Longleaf pine and

much of its associated groundcover are strongly shade intolerant. By rewriting the Forest Plan and utilizing closer interval growing season burns, the FMNF staff put their longleaf restoration plans into action. The new Forest Plan specifically designates the use of fire on 112,000 acres (45,200 hectares) for ecosystem restoration and for threatened and endangered species habitat. The major snag (if you will excuse the pun) to full implementation of this plan has been smoke management.

This challenge is being addressed by aggressively soliciting involvement of the local community in the decision-making process. In fact, the new Forest Plan is truly a joint effort that involved the public from the very beginning. Emphasis was placed on restoration of the longleaf pine ecosystem and its threatened and endangered species which can only thrive long-term under a chronic low-intensity fire regime. FMNF staff are currently burning about 30,000 acres (12,100 hectares) per year, most of it on a 2-year return interval, and adding additional acreage as opportunities arise. Aerial ignition has turned out to be the best smoke management tool at the disposal of the FMNF staff allowing them to develop a convection column that gets the smoke up and out in a timely manner. Results of these biennial burns look very promising. The eventual goal is 50,000 acres (20,200 hectares) with about 20% of it burned during the growing season.

Since initiation of the new Forest Plan, the FMNF is having increasing difficulty maintaining even the current acreage level because of smoke management considerations. The 1,000-hour fuels produced by Hugo (downed logs and snags) have decayed to the point where they now ignite under almost any burn prescription and are extremely difficult to extinguish. There is no feasible way to extinguish even a fraction of these residual fires on an operational burn. Residual smoke is trapped by the low-level inversion that forms in this part of the coastal plain on most nights. In addition, much of the FMNF is close enough to the coast to be affected by tidal influences and sea and land breezes. Thus, at night, residual drift smoke is held close to the ground, follows cold air drainage down waterways, and responds to abrupt reversals in wind direction.

Smoke management contingency planning is now the most time-consuming part of the prescribed burn planning effort. A residual smoke hazard risk assessment procedure was developed by their fire manager and is part of every plan (Twomey, no date). Two crews of sawyers are kept busy felling snags around the periphery of planned burns to reduce spotting potential and smoke problems. A 2-mile (3.2-kilometer) buffer strip is left unburned along all paved roads. Smoke signs are placed on all roads prior to ignition and remain until the smoke hazard is gone. In addition to routine calls to adjacent property owners, rural fire departments, emergency medical services, and law enforcement, the burn manager calls the local County Highway Department to position detour signs on high-risk roads and the local County Department of Education to alert school bus drivers of possible detours and early morning smoke problems. In the vicinity of a planned burn, messages on door-hangers are left on all homes. Residents with respiratory problems are evacuated as necessary. A Smoke Patrol Boss is part of the organizational structure of all burns. Smoke patrols with cell phones operate from dusk to dawn.

Local folks are very understanding and appreciate this forewarning. However, city-dwellers who have moved to the urban-wildland interface see no reason to put up with such minor inconveniences, let alone to have their homes subjected to smoke for several nights. Many of these people left the city because they wanted clean air and are simply not interested in the ecological benefits of prescribed fire if it means they will be affected by smoke. Educating these new arrivals will require continual effort.

Employee stress has also emerged as a major concern, both from risking personal liability as well as from creating situations that are potentially dangerous to human health. But, at least for the time being, local forest staff and the overall community continue to be fully committed to the use of prescribed fire. The future of this program is, however, still in grave doubt. During fiscal year (FY) 1995, major highways were shut down four times and two minor vehicle collisions occurred. Eleven highway closures took place during FY 1996, and nine in FY 1997 along with another minor accident. On at least one fire, nighttime residual smoke conditions did not warrant road closures until 5 days after the burn. Even though wildfires during this same time period have resulted in many more vehicle accidents, agency and municipal administrators have trouble accepting such statistics as a norm. See Myers and Van Lear (*this volume*) for another perspective of post Hugo fire management opportunities and problems.

BURNING FOR HAZARD REDUCTION AT THE URBAN-WILDLAND INTERFACE: NORTHPORT, FLORIDA

During the first half of the 20th century, much of the pine flatwoods of southwest Florida were burned every winter to "green up" the forage for cattle. Since 1959 when the city of North Port was incorporated, this practice has been excluded on 76 square miles (197 square kilometers) of this wooded rangeland. The area was subdivided into 0.25-acre (0.1-hectare) house lots and sold worldwide. Homes have been built on only about 5% of the 90,000 lots. Most of the remaining lots are owned by absentee landowners and are thus not maintained. Without frequent fire, the herbaceous understory is replaced with an understory dominated by volatile species such as saw palmetto (*Serenoa repens*), gallberry (*Ilex glabra*), and wax myrtle (*Myrica cerifera*) that are very dangerous to burn due to their volatility. Wildland fuel loads continue to accumulate, and wildfire suppression is increasingly difficult and dangerous.

As a result of this deteriorating fire suppression situation, the North Port Vegetation Modification and

Fuel Load Reduction Study was undertaken in 1987 to determine current fuel loadings, to compare fuel reduction alternatives, and to recommend a course of action. This study concluded the only practical solution was to use prescribed fire (Voltolina et al., no date).

Florida has enacted several statutes to facilitate prescribed burning within its borders (see Wade and Brenner1995 for an overview). North Port elected to proceed under the Hawkins Bill which empowers the Florida Division of Forestry to use prescribed fire to reduce hazardous fuel accumulations on private property under certain conditions unless the landowner objects in writing (Wade and Brenner 1995, Wade and Long 1979). First, the North Port Fire Rescue District staff recruited local and state agencies to help implement the study recommendations. Armed with this report and a unified government voice, they solicited public support through one-on-one contacts, slide talks to organized groups, news articles, fire education days, and actual on-site test burns to demonstrate that they could do the job safely. Interestingly, after the second or third demonstration burn, many homeowners asked for their property to be used as a test site. Fire planners kept the county commissioners and city council members updated on development and implementation of fire plans. When the planners thought the timing was right, they presented their plan and method of accountability to the city council for approval. To help sell this new idea to the council, they used visual aids that the council was already familiar with, such as road and traffic projection maps.

With the approval of the council, the plan was set in motion following the provisions of the Hawkins Bill. Concurrently, the fire district and local Florida Division of Forestry staff selected the first sites and wrote prescribed fire plans for each planned burn. A fairly narrow range of burning parameters was selected for each fire to help ensure that fuel reduction objectives would be met but not exceeded. Pre- and post-burn news articles appear in the local paper and a public information officer is on site during all burns to answer questions from both the public and the press which are always invited. Elected officials and other interested people are kept informed both verbally and in writing.

North Port implemented the Incident Command System for all potential disasters and all city departments were trained in prescription and wildland fire concepts. The burns are used as training drills with other city departments and cooperating fire-suppression organizations. These drills help defray the cost of the burns while also accomplishing something useful. Fire planners utilize twice the resources anticipated from a safety standpoint to try to get everyone involved and to assure that they can respond quickly if burn plans begin to unravel.

North Port fire planners recognize the importance of doing a job right the first time because it is unlikely they would get a second chance. To reduce the risk of an undesirable outcome as they progress to more dangerous, complex burns, every fire is documented and evaluated.

CONCLUSION

In the four examples given, southern forest managers determined that their respective areas faced more potential damage if they attempted to exclude fire than they did with the intentional use of fire. With adequate planning and community cooperation, they instituted successful prescribed burn programs that are being fine-tuned as results become available. The authors believe that many of the same constraints exist in other regions of the U.S. and could be overcome with equal success by following the approaches described above.

LITERATURE CITED

Custer, G., and J. Thorsen. 1996. Stand replacement burn in the Ocala National Forest—a success. Fire Management Notes 56:7–12.

Daniel, T.C., and I.S. Ferguson (eds.). 1991. Integrating research on hazards in fire-prone environments: reconciling biological and human values in the wildland/urban interface. United States Man and the Biosphere Program. Washington, DC.

Meldahl, R.S., J.S. Kush, W.D. Boyer, and C. Oberholster. 1995. Composition of a virgin, old-growth longleaf pine stand. Proceedings of the Biennial Southern Silvicultural Research Conference 8:569–572.

Mutch, R.W. 1994. Forest health and productivity: fire interactions. Pages 101–106 *in* Proceedings of the 1993 Society of American Foresters National Convention. Society of American Foresters. Bethesda, Maryland.

National Wildfire Coordinating Group. 1992. Fire behavior field reference guide. PMS 436-4 or NFES 2224. National Interagency Fire Center, Boise, ID.

Sapsis, D.B., and R.E. Martin. 1994. Fire, the landscape, and diversity: A theoretical framework for managing wildlands. Pages 270–278 *in* Proceedings of the Conference on Fire and Forest Meteorology 12:270–278.

Saveland, J.M., and D.D. Wade. 1991. Fire management ramifications of hurricane Hugo. Proceedings of the Conference on Fire and Forest Meteorology 11:124–131.

Twomey, B. no date. Managing smoke risk on the Francis Marion. Mimeographed Report. Francis Marion National Forest Supervisor's Office.

Voltolina, D., A. Mitchell and P. Kaskey. no date. North Port vegetation modification and fuel reduction study. Unpublished report on file, Florida Division of Forestry, Bradenton.

Wade, D., and J. Brenner. 1995. Florida's solution to liability issues. Pages 131–138 *in* D.R. Weise and R.E. Martin (technical coordinators). Proceedings of the Biswell symposium: fire issues and solutions in urban interface and wildland ecosystems. General Technical Report PSW-158, U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Berkeley, CA.

Wade, D., and M. Long. 1979. New legislation aids hazard reduction burning in Florida. Journal of Forestry 77:725–726.

Williams, J. 1995. The role of fire in ecosystem management. Pages 139–140 *in* D.R. Weise and R.E. Martin (technical coordinators). Proceedings of the Biswell symposium: fire issues and solutions in urban interface and wildland ecosystems. General Technical Report PSW-158, U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. Berkeley, CA.