# Compartment 07 Prescribed Burn Escape

# Facilitated Learning Analysis

**National Forests in North Carolina**
**Croatan National Forest**
**Croatan Ranger District**

**July 2012**

# Contents

*"The Facilitated Learning Analysis process helps us to maximize learning opportunities presented by unintended outcomes or near miss events. The intent is to improve performance by generating individual, unit, and organizational learning that capitalizes on shared experience—blaming is replaced by learning."*

**Facilitated Learning Analysis**
**Implementation Guide**
**August 2012**

# 1. Introduction

On June 16, 2012, the Croatan National Forest of the National Forests in North Carolina (NFsNC) experienced an escaped prescribed fire from the Compartment 07 Prescribed Fire. The resulting wildfire was named the Dad Fire on June 17th, 2012. In order to identify and share the lessons learned from this incident with other land managers the Forest decided to conduct a Facilitated Learning Analysis (FLA). The Croatan National Forest invited a FLA team to work in partnership with those involved in the Compartment 07 Prescribed Burn to identify the factors that led to the escape. The FLA process was comprised of:

- An onsite evaluation of the physical factors impacting this event
- An analysis of the environmental factors impacting this event
- An open dialogue with the prescribed fire participants to better understand the human factors involved in this event.

All of the participants involved with the prescribed fire and the ensuing escape were committed to engaging in proactive land management, which carries with it the inherent risk of unintended outcomes.

The following report is offered as an opportunity to continue the Safety Journey dialogue so the Forest Service can build on progress already made, transforming the agency from a mentality focused on assigning blame, towards the ideal of sharing experiences and lessons learned in order to promote the development of a high reliability organization.

### A. Description of the Event and the Outcome

The Compartment 07 Prescribed Burn conducted on June 14, 2012, was implemented as part of an ongoing effort to recover endangered species, improve wildlife habitat, and restore natural plant and animal communities on the Croatan Ranger District of the Croatan National Forest.

**Facilitated Learning Analysis History and Intent**

In 2006, in an effort to help encourage a learning and a safety culture within the wildland fire community, the Forest Service Risk Management Council introduced a learning- focused approach into the accident investigation process. In 2007, the Council formalized this concept with two new safety analysis processes: The "Facilitated Learning Analysis" (FLA) and the "Accident Prevention Analysis" (APA). Since then, numerous FLAs and APAs have been conducted throughout the country on incidents that range from vehicle and equipment burnovers to entrapments and shelter deployments.

When used as intended, the APA and FLA will promote a learning culture and support organizational and individual performance, leadership, accountability, and responsibility. Concurrently, the FLA and APA analyses also serve to support program goals for developing a fundamentally sound and doctrine-based organizational safety culture.

The implementation guides for conducting both an FLA and an APA are available on the Wildland Fire Lessons Learned Center's website.

The goal of the prescribed burn was to alter general forest conditions in order to approach meeting four key objectives in the Croatan Land and Resource Management Plan:

1. Recover Red-cockaded Woodpecker (RCW) populations through a variety of management methods such as prescribed burning and timber harvesting.
2. Restore natural community types (such as longleaf pine) using the ecological classification system to guide restoration efforts.
3. Sustain a Fire Management Program that provides for the health and safety of employees and public while minimizing the risk for wildfire and ensuring the optimum use of fire as a management tool.
4. Use prescribed fire to restore the structure and composition of longleaf and mixed pine stands, prepare seedbeds for longleaf pine restoration, control competing pine species, and improve existing longleaf pine stands.

A briefing was conducted prior to ignition on the morning of June 14, 2012, during which the Burn Boss reinforced the goal of utilizing the burn to meet resource objectives. Following this briefing, the firing team conducted a test fire at 1109 hours under the direction of the Burn Boss, who determined that observed fire behavior met conditions required to achieve desired resource objectives.

Ignition continued throughout the day with successful results. No control or smoke management issues were noted during the ignition. Firing was completed around 1518 hours.

The post fire evaluation indicated that understory vegetation consumption averaged 40% within the compartment, with more complete combustion observed on the ridges than the Pocosin (freshwater wetland). Holding forces patrolled the fire post-ignition and allowed it to continue to burn without mop-up in order to achieve a primary resource objective of reducing surface fuel loading.

At 1600 hours, an After Action Review (AAR) was conducted for the resources assigned to the prescribed burn. The Burn Boss noted it was “just a typical burn day”. Following the AAR, resources were released for the day.

A reconnaissance flight was conducted at the end of the day. Aerial observations indicated all control lines were holding and no other issues were noted.

# 2. Sequence of Events

The Compartment 07 prescribed burn project was on the Croatan National Forest Program of Work for Fiscal Year 2012 (FY 2012). Funding to support the burn's implementation was provided by the Forest Service's Southern Region, which includes the Croatan National Forest, as part of an effort to accomplish an additional 10,000 prescribed burn acres in FY 2012. The Croatan Ranger District is well known for its ability to safely, effectively, and efficiently accomplish a substantial number of prescribed burn acres for ecological benefit and hazard reduction. With approved plans ready to be carried out, conducting burns in this location was a logical choice.

Table 1 displays the chronology of significant events derived from interviews of key personnel and unit logs.

**Table 1. – Chronology of Significant Events**

| Date | Time | Event |
|---|---|---|
| 06/14/12 | 0645 | On site weather recorded |
| | 0708 | Spot weather forecast completed for Compartment 07 prescribed burn |
| | 0800 | Compartment 07 Go/No-Go checklist completed by Burn Boss |
| | 0900 | Briefing for Compartment 07 prescribed burn |
| | 1030 | All resources on Compartment 07 prescribed burn (Little Road) |
| | 1100 | On site weather recorded |
| | 1109 | Started test fire |
| | 1300 | On site weather recorded |
| | 1500 | On site weather recorded |
| | 1518 | Aerial ignition completed helicopter 1HX |
| | 1600 | AAR completed |
| | 1615 | Helicopter 1HX completes post-burn reconnaissance of prescribed burn |
| 06/15/12 | 0900 | Compartment 07 prescribed burn checked by engines 31 and 32 |
| | 1040 | Resources arrive on Compartment 43 prescribed burn |
| | 1114 | Test fire OK, burn proceeding |
| | 1500 | Completed Compartment 43 burn |
| | 1530 | Compartment 07 prescribed burn checked by helicopter 1HX |
| 6/16/12 | 0730 | On site weather recorded for Brown Road prescribed burn |
| | 0744 | Spot weather forecast completed for Brown Road prescribed burn |
| | 0830 | Compartment 07 prescribed burn checked by engine 32 |
| | 1042 | All resources have arrived on Brown Road prescribed burn |
| | 1100 | On site weather recorded for Brown Road prescribed burn |
| | 1305 | Compartment 07 prescribed burn checked by helicopter 1HX |
| | 1330 | On site weather recorded for Brown Road prescribed burn |
| | 1445 | On site weather recorded for Brown Road prescribed burn |
| | 1430-1500 | Significant wind event effects fire behavior on Brown Road prescribed burn |
| | 1500 | Helicopter 1HX detects a fire south of Little Road, in Sheep Ridge Wilderness (thought to be a wildfire), estimated at 50 - 75 acres |
| | 1515 | Fire in wilderness reported to coordination center |

| | | |
|---|---|---|
| | 1600 | Burn Boss and District Fire Management Officer (DFMO) do a helicopter reconnaissance of fire |
| | 1800 | Fire GPS acres at 235 |
| | 1900 | DFMO briefed District Ranger |
| | 2030 | DFMO and District Ranger discuss safety concerns about night operations in the wilderness and made decision to wait until morning to reevaluate the need for suppression actions. |
| | 2030 | District Ranger, DFMO and Burn Boss discuss the possibility that fire is an escape from Compartment 07 prescribed burn conducted on 06/14/2012 |
| 06/17/12 | 0730 | District Ranger contacts Forest Supervisor and advised of a possible escape from a prescribed burn |
| | 0800 | District Ranger, DFMO, and Burn Boss take a reconnaissance flight over fire: fire is now 2800 acres |
| | 1000 | Verified that fire is an escaped prescribed burn from the Compartment 07 burn: it was converted to a wildfire and a Type 3 team requested |

*"It just caught everyone by surprise, when they said it [Compartment 07] got out. Especially two days later, I was just real surprised."*

# 3. Conditions

**A. General**

Located northeast of the Sheep Ridge Wilderness on the Croatan Ranger District of the Croatan National Forest, the planned 1567-acre Compartment 07 burn unit is bordered by South Little Road to the southwest and Catfish Lake Road to the north (fig. 1). To the south the unit is bordered by plow line that ties into a drainage and on the East is Bryce's Creek. Previously treated fuels existed to the south and east of the unit adjacent to private lands. Untreated fuels existed directly north, west, and south of the burn unit with scattered active Red-Cockaded Woodpecker (RCW) trees. Area fuels were primarily classified as Southern Rough, fuel model seven (FM7). The Compartment 07 burn unit was one of three planned burn units in the area, with one located immediately north and northwest of the unit across Catfish Lake Road, and the second located southwest of the Sheep Ridge Wilderness.

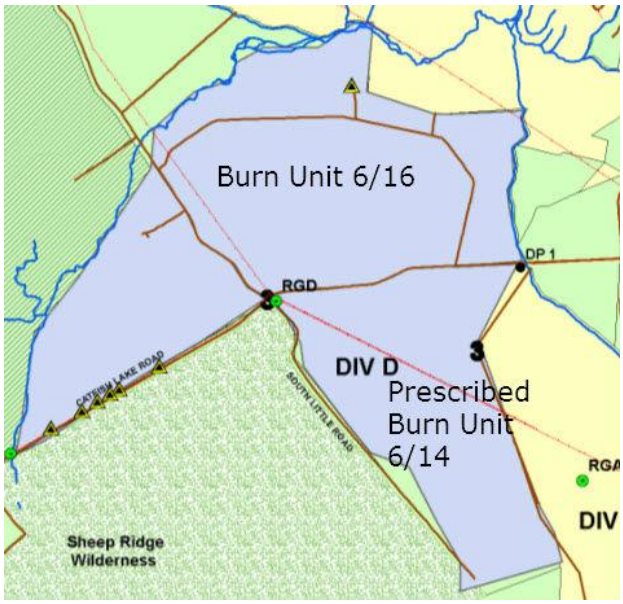



**Figure 1. Croatan Planned Prescribed Burn Units**

Fuels in the planned prescribed burn units consisted of an understory of herbaceous and woody surface material along with mixed shrubs including wire grass, fern, hardwood sprouts, gallberry, reed, greenbrier, fetterbush, huckleberry, leaf/pine needle litter, wax myrtle, titi, and bay. Overstory fuels included mixed hardwood, shrub, loblolly pine, pond pine, and longleaf pine (fig. 2).

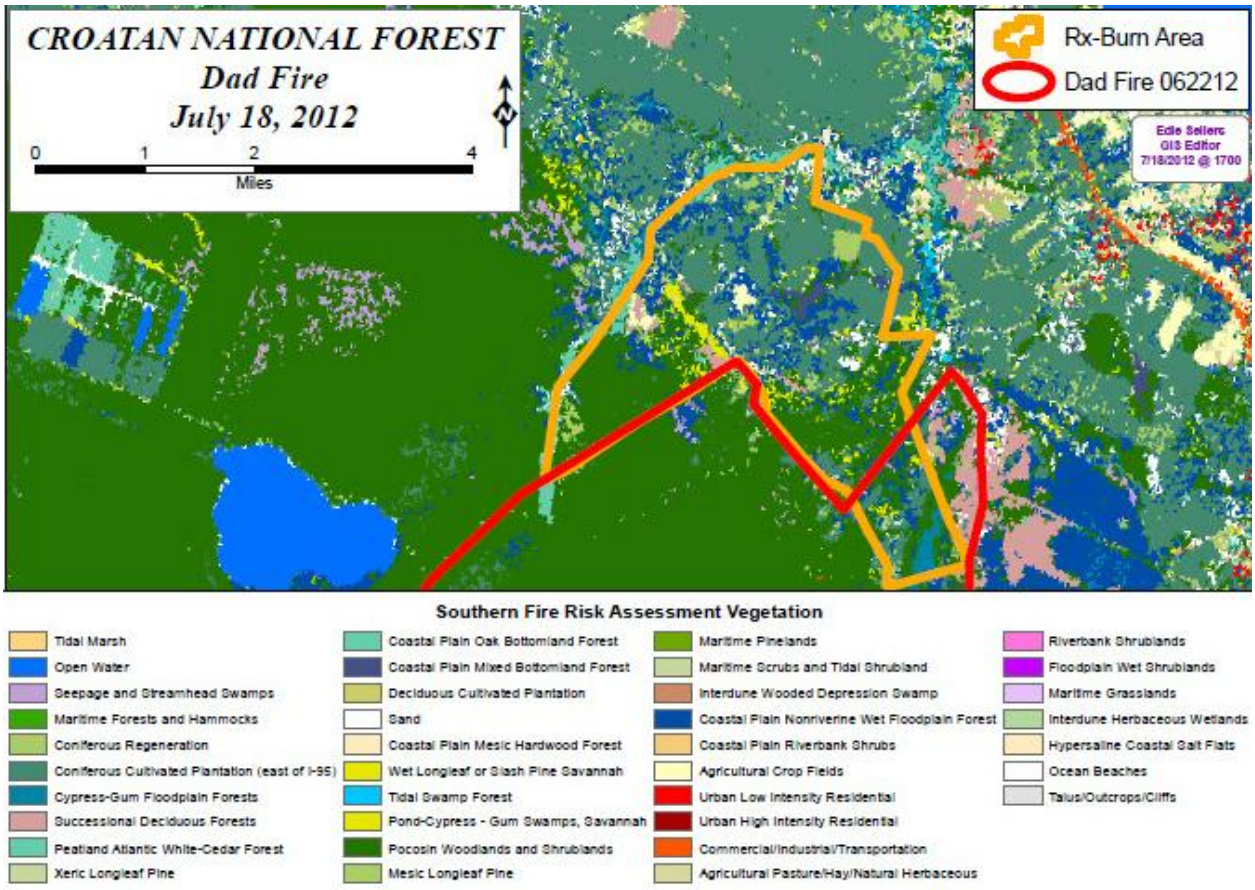



**Figure 2. Prescribed Burn Vegetation Types**

### B. Seasonal Severity

Indices calculated in FireFamily Plus were generally unremarkable. The 1000 hour fuel moisture (1000 hr.) was found to be at the 90th percentile, but still within the range of normal practice. The Energy Release Component (ERC), Burning Index (BI), and the Keetch Byram Drought Index (KBDI) were all very near the mean values for June 14.

**Table 1. NFDRS Indicies**

| NFDRS Outputs | 6/14 WIMS Calculated Values | 6/16 WIMS Calculated Values | Mean | 90th Percentile |
|---|---|---|---|---|
| ERC | 33 | 39 | 30 | 47 |
| BI | 39 | 45 | 46 | 86 |
| KBDI | 215 | 235 | 299 | 490 |
| 1000 hr. | 18 | 18 | 20 | 18 |

**C. Burn Day Weather**

A spot weather forecast for the Compartment 07 burn was issued on June 14, 2012, at 0708 hours by the National Weather Service's Newport/Morehead City office. The forecast called for temperatures near 71°F at the time of ignition with a humidity of 66%. Temperatures were forecast to increase to 77°F in the afternoon with a minimum humidity of 69%. North winds were forecast throughout the day with wind speeds of 7-9 mph in the morning predicted to increase to 10 mph in the afternoon.

Onsite weather observations began at 0645 hours on the day of the burn. Table 2 summarizes the weather observations during the ignition phase of the project. Observed burn day weather conditions were well within the prescription window defined in the burn plan.

**Table 2. Burn Day On-Site Weather Observations 06/14/12**

| Time | Dry Bulb (°F) | Wet Bulb | Relative Humidity (%) | Wind Speed (mph) | Wind Direction | Comments |
|---|---|---|---|---|---|---|
| 0645 | 65 | 61 | 80 | 2-4 | N | S. Little Rd Spot |
| 1100 | 75 | 68 | 70 | 5-7 | N | Gusts 9-10 Test fire |
| 1300 | 78 | 68 | 60 | 6-9 | N | Gusts 9-12 Fire burning in spots, good on ridges |
| 1500 | 78 | 68 | 63 | 7-10 | NW | Gusts 9-15 Fire burning off Catfish Lake Road in places |

Wind speed gradually increased over the course of the day. By late morning, on-site observations noted wind gusting up to 9-10 mph. By 1500 hours, gusts had increased in velocity to 9-15 mph. Additional prescribed burns were implemented on the following two days.

On June 15, the burn unit southwest of the Sheep Ridge Wilderness was carried out (fig. 1). On June 16, the burn unit immediately northwest of Catfish Lake Road was ignited (fig. 1). A spot weather forecast was issued at 0744 hours for this unit, described as the Brown Road unit, by the National Weather Service Newport/Morehead City office. The forecast called for temperatures near 73°F at the time of ignition with a humidity of 62%. Temperatures were forecast to increase to 79°F in the afternoon with a minimum humidity of 49%. Northeast winds were forecast throughout the day with wind speeds of 7-8 mph in the morning predicted to increase to 10-16 mph in the afternoon.

On-site weather observations began at 0730 hours on June 16 for the Brown Road burn. Table 3 summarizes the weather observations during the ignition phase of the project. Observed burn day weather conditions were well within the prescription window defined in the burn plan.

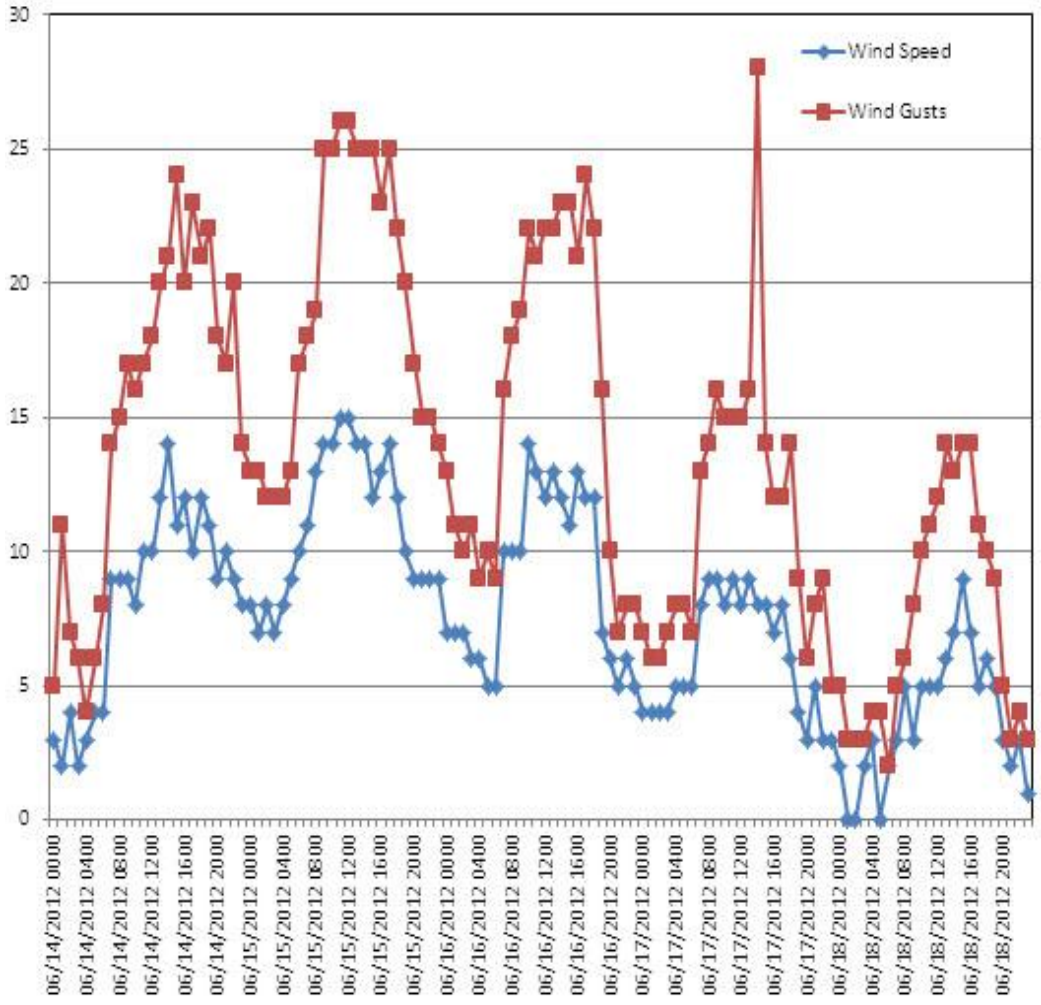
**Table 3. Brown Road Burn Day On-Site Weather Observations 06/16/12**

| Time | Dry Bulb (°F) | Wet Bulb (°F) | Relative Humidity (%) | Wind Speed (mph) | Wind Direction | Comments |
|---|---|---|---|---|---|---|
| 0730 | 65 | 63 | 90 | Light | Var | Clear-spot wx |
| 1100 | 78 | 65 | 49 | 5-7 | NE | Fire b/c Catfish Lake Rd |
| 1330 | 81 | 65 | 42 | 5-7 | NE | Gusts 9-10 Middle little |
| 1445 | 81 | 64 | 38 | 7-10 | | Gusts 9-15 Brown Road fire heading off plow line |

After the final on-site weather observation was made for the Brown Road prescribed burn on June 16, 2012, a wind event reported to have lasted between 15-30 minutes was observed by multiple individuals on the fire. The Remote Automatic Weather Stations (RAWS) located at Croatan and New Bern captured at 1508 hours showed wind guests to 23 mph. National Weather Service center staff indicated that a change of 5 mph in actual wind speed from the spot forecast should trigger a call to the individual requesting the original spot weather forecast.

*"It was as if someone flipped a switch – it went from moderate to extreme when the wind event came up."*

**Table 4. Hourly wind speed gusts 6/14 through 6/18**



**D. Fire Behavior**

Fire behavior on the Compartment 07 prescribed burn, on June 14, 2012, was within prescription and met the burn plan goals and objectives. The Burn Boss, District Fire Management Officer, and the burn crew all agreed that observed fire behavior was normal, with no surprises. Some burn crew members indicated that they would have liked the burn to have been more complete, noting a couple of islands of unburned vegetation or "mosaic" areas. A prescribed burn conducted nearby the following day on June 15 had similar fire behavior and results.

*"We tried to burn the green pockets inside the line with aerial ignition multiple times but it would not burn."*

On June 16, the Brown Road prescribed burn was carried out immediately north of the Compartment 07 burn. Members of the burn crew all agreed that the burn was behaving very similarly to the burns implemented on the previous two days until 1430-1500 hours, when the wind speed suddenly increased for a 20-30 minute period.

*"Burn conditions changed rapidly from moderate to extreme with the wind event, which was short in duration with either fifteen to twenty minutes or twenty to thirty minutes in duration. The wind direction stayed the same during the event."*

This increased wind speed caused a drastic change in the fire behavior on the Brown Road prescribed burn, and may have caused a firebrand from the Compartment 07 burn to ignite south of Little Road.

The FLA team conducted a fire behavior analysis assessing the likelihood of a firebrand causing the escape during the wind event. Using known RAWS station data and rate of spread calculations from the first GPS mapping of the Dad Fire, the 20 foot wind speed was found to have likely exceeded 20 mph for some period of time. BehavePlus calculations revealed that maximum spotting distance during this time was over 1000 feet. All observed fuels and calculations are consistent with the possibility that a firebrand originating in one of the unburned islands north of Little Road could have caused the Compartment 07 escape on June 16.

# 4. Lessons Learned as Shared by the FLA Participants

A. When we lit the Catfish Lake Road burn on Saturday the ignition pattern created a smoke screen and we could not see into Compartment 7. We might have noticed fire activity in Compartment 7 sooner if the area was not shielded by the smoke screen.
B. In terms of what constituted threshold indicators on this district/in this ecosystem, we historically look at Energy Release Component (ERC). I have considered an ERC of 41 as a trigger point for a look out situation, we would rather not have multiple indicators pushing the threshold but by itself it constitutes a "Look Out" situation. I need to reevaluate this and consider a lower threshold in relation to what happen with this escaped prescribed burn.
C. If we could have gotten something from the weather service, it might have made a difference. Usually they monitor and call us pretty quickly when there is evolving weather that might impact us. I may have relied too heavily on the NWS for notification two days after a prescribed burn.
D. The rules of how fire is managed in a wilderness area are not understood by the public. We need to work with the media to improve public awareness of how our policies on wilderness fire affect our treatment options.
E. Speed up the process for getting approval for prescribed burning in wilderness areas. We need to burn these areas as we did historically or smoke production from heavy fuel loads can potentially impact urban areas.

## 5. FLA Team Observation on Team Selection

The individuals that make up a Facilitated Learning Analysis (FLA) team substantially influence the impact and utility of the FLA process either positively or negatively through their interactions with those involved in the situation. This impact means that team members must be carefully considered in order to select individuals best prepared to participate in the FLA process for a specific situation, taking into account the event, location, and those involved. An understanding of the FLA philosophy and FLA experience should be a minimum qualification for selecting team members, but it is also important to consider other attributes prospective team members possess. In this case, three team members were qualified Prescribed Fire Burn Bosses, which positively impacted the FLA process. Union participation was a helpful part of the FLA team effort and the representative was fortunately one of the three burn boss qualified individuals. In addition, all team members had substantial wildland fire experience, which increased team credibility and assisted them in swiftly understanding what transpired during the prescribed burn event, helped them coalesce and function effectively as a team despite the fact it was the first time several of the individuals had worked together, and work efficiently under tight time schedules. Additionally, the team's fire experience helped to lower the anxiety level of those involved at the Ranger District and increased their willingness to openly participate and take ownership in the FLA process. Though the success of the FLA process does not depend on team members possessing wildfire experience, in participating in the FLA process for this particular event it was immensely helpful in assisting the team in quickly establishing credibility, building trust, developing support and ownership for the process. This resulted in the creation of Lessons learned that will be utilized and shared broadly by the District and throughout the Region and Nation.

# 6. Lessons Learned from Managers and Leadership

A. The Croatan Ranger District's relationship with the National Weather Service's Weather Forecast Office (WFO) is critical for obtaining weather forecasts and forecast updates. A clear line of communication between the WFO and the Burn Boss on the day of the burn ensures that updates/warnings may be communicated without delay. The Ranger District will continue its focus on maintaining this close working relationship and facilitating communications during prescribed burn operations. When changes in weather are observed during firing operations the District personnel should initiate a call to the WFO to understand the duration of any unpredicted event.

B. The preplanned actions were initiated as listed within the burn plan. Maintaining and utilizing communication protocols between the Croatan Ranger District and the Supervisor's Office are critical in ensuring required notifications are made and to determine whether any approvals are necessary.

C. Fire Danger helps the Burn Boss understand today's fuel conditions as compared to historical conditions. The National Forests in North Carolina (NFsNC) will participate with the District in reviewing the fire danger indices used by the Croatan Ranger District to ensure that the critical threshold is accurate.

D. The degree of public understanding related to wilderness and wilderness fires is mixed. The NFsNC will develop a communication plan aimed at enhancing public awareness of issues related to wilderness fires, describing policy and explaining how fire is managed in the wilderness.

E. Once the escape was confirmed, good decisions were made that provided a margin of safety prior to engaging the fire.

# 7. Commendable Actions

A. All District employees involved embraced the Facilitated Learning Analysis process and the learning that can be achieved by this process.

B. All prescribed burn preparation and plan execution policies and practices were followed during the prescribed fire operations and the wildfire.

C. Personnel working on the prescribed burns maintained situational awareness as weather conditions changed. This led to the quick discovery of the escaped prescribed burn.

D. The District's strong cooperative relationship with the National Weather Service was apparent.

E. The National Forests in North Carolina leadership fully supported the use of the FLA process in the spirit of lessons learned from this escaped prescribed fire.

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