Suggested actions for the City of Albuquerque, Open Space Division to take regarding hazard reduction & forest rehabilitation of the forest burned adjacent to Bosque School May 2022

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Fire Event

In the early evening of Wednesday 25 May 2022 a wildland fire was reported burning on the west side of the Rio Grande south of Montaño Bridge and just east of the Bosque School campus, in Albuquerque, NM. All told, the fire eventually burned about 30 acres of bosque, including areas where it jumped to an island and jumped again to the east bank of the Rio Grande. The comments contained in this document are specific to the fire where it burned on the west side of the river and included roughly 20 some acres (Fig. 1). Albuquerque Fire and Rescue was the lead agency for this incident.

The fire burned in, mostly, heavy fuels, where an interlocking canopy of Rio Grande Cottonwood covered an understory of mostly exotic trees and bushes as well as a heavy buildup of down and dead woody material. Fire severity across almost all of the fire was "severe." The north-eastern corner of the fire intruded into the Bosque Ecosystem Monitoring Program's (BEMP) south east portion of its Savannah BEMP site. However, the fire was mostly centered in and burned in an area known colloquially as the "Deep Dark Woods." The fire burned for several days and it took about a week for firefighters to declare the fire out.

Fig. 1. "Deep Dark Woods," 2 weeks post May 2022 fire, viewed east to west, Coors Blvd. at top of photo. (Photo courtesy of Livingston MacLake)

Fire Site Context

The Savannah BEMP site and the adjacent Deep Dark Woods are particularly well known to us as we have used them as primary ecological and wildlife study sites for more than 20 consecutive years. Prior to the fire we have regularly monitored these areas for a range of environmental characteristics and documented use of those locations by vertebrate species.

Although we have known the risk of catastrophic fire within the Deep Dark Woods has been very high, we have simultaneously documented the area as a primary habitat for vertebrates including nesting song birds and raptors, denning and feeding areas for a range of mammals, including bobcat, javelina, raccoon, and the largest density of porcupine in the Albuquerque bosque.

The Savannah BEMP site is mostly open with relatively large islands of bulldozed and piled forest debris outside of its monitored section, but within the Savannah site's overall boundaries. The Savannah BEMP site has been monitored for the full suite of BEMP parameters for over 20 years. Additionally, various wildlife studies conducted by the Black Institute/Goodman Project at Bosque School have documented an abundance of wildlife activity. The Savannah site's burned area also includes a winter Bald Eagle roosting tree that has been used consecutively for at least 23 years.

Prior to the May 2022 fire, the Deep Dark Woods fuel load in 2015 was measured at over 100 tons per acre (BEMP unpublished data) (Fig. 2). As a comparison (Fig. 3), in over 100 fuel load assessments at 13 different Albuquerque area BEMP sites, and across more than a decade, less than 25% of those assessments exceeded the catastrophic fire threshold of 12 or more tons per acre with none going above 30 tons per acre (BEMP, 2022).

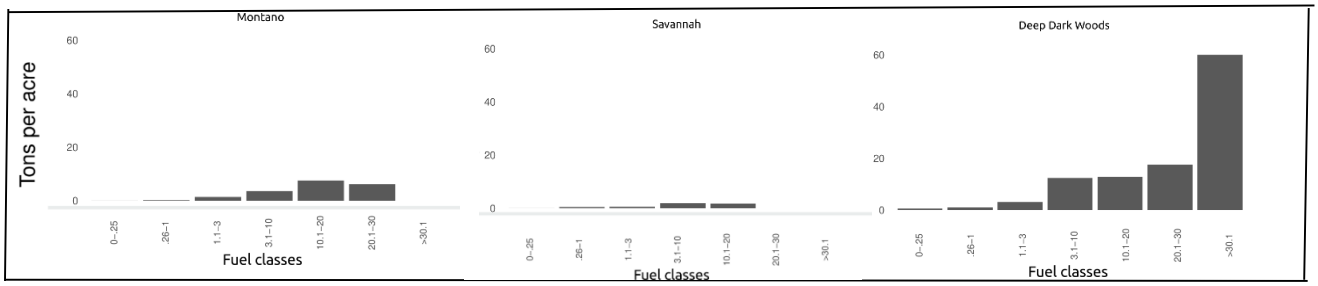

Fig. 2. Fuel loads south and within 0.75km of Montaño Bridge, at three locations, north to south pre May 2022 fire (courtesy of BEMP)

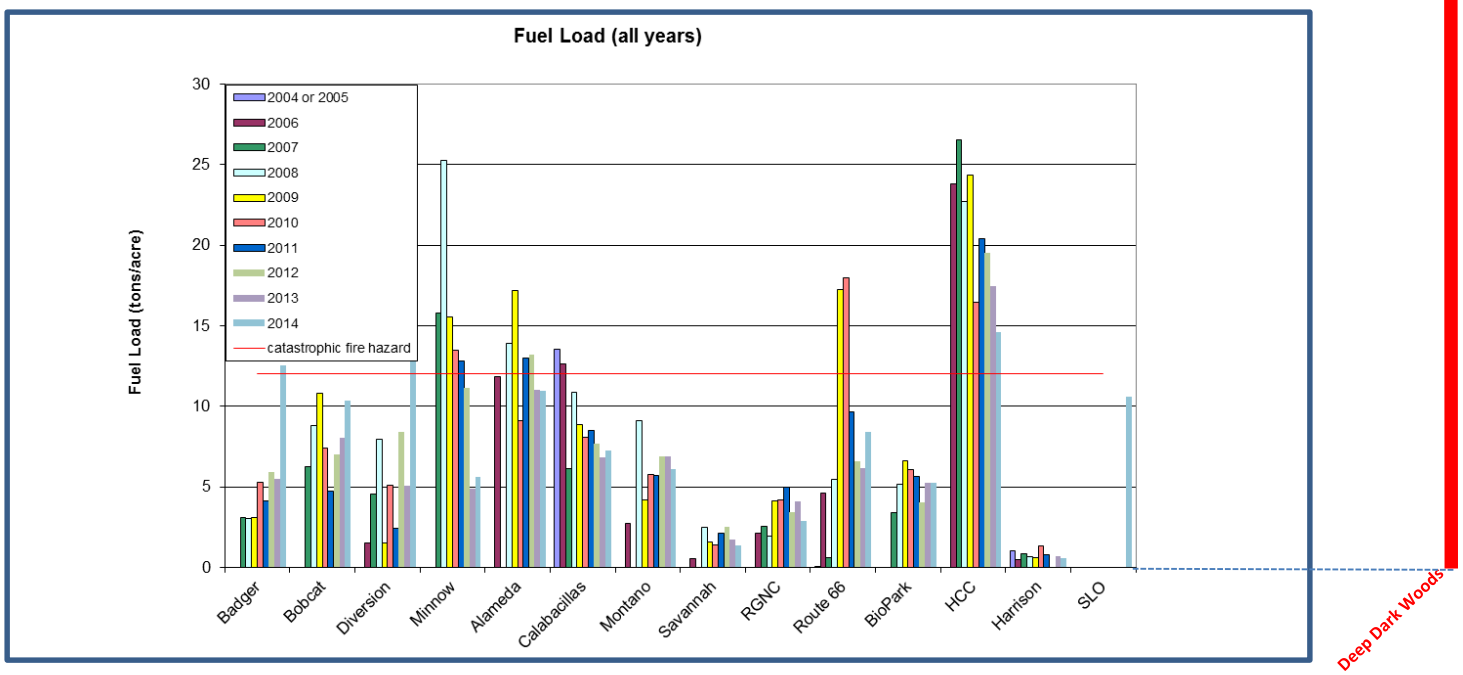

Fig. 3. Wildland fire fuel loads at the 14 Albuquerque BEMP sites from north to south (accessed at https://bemp.org/data-sets/)
(The "Deep Dark Woods" is not a BEMP site, so it is not depicted in the graph, but the red line on the right margin is to scale with the 14 Albuquerque BEMP sites in Figure 3 and shows the > than 100 tons per acre of fuel load in the "Deep Dark Woods" prior to the May 2022 fire.)

The fuel load had only grown since 2015 within the Deep Dark Woods where and when it was generally very difficult to see someone who was less than 50 feet away because of the thick vegetation and especially the down and dead woody material (Fig. 4). The current gallery cottonwood forest of the Rio Grande is senescing and many of those trees are self-pruning large limbs and dying (Fig. 5). We know that in recent years (2016-2018) the northern Albuquerque BEMP sites averaged greater than 2,000 grams per square meter per year of wood fall onto what already existed (BEMP, 2020). Furthermore, without flooding, Ellis et al. (1997) estimated that woody material in a regularly flooded bosque has a decomposition half-life rate of about 10 years compared to over 200 years for un-flooded bosque.

An aging and dying cottonwood forest, the accumulation of decades of down and dead woody material dried out during a drought (one that is as significant as any in 1,000 years), and the intrusion of an exotic and invasive woody tree understory all contributed to creating a fire load that was more than three times that of any other measured area in the Albuquerque bosque. Once this fuel load caught fire, severity was as much as any fire seen in the bosque in the last thirty years, by one of us (Shaw) as a wildland firefighter and/or bosque educator/researcher.

Fig. 4. 2015 Bosque students assessing fuel load in Deep Dark Wood

Fig. 5. Winter 2021-22 Deep Dark Wood abundant/recently-dead trees

Preliminary Assessment of Cottonwood Survival within Deep Dark Wood fire of May 2022
On 9 June 2022, roughly two weeks post-fire we surveyed the burned area's cottonwood trees. Not counting the trees dropped by sawyers during the firefighting operations or trees that were standing and dead before the fire, we counted every cottonwood tree that was likely alive in early May of 2022 **(n=438)** within the fire as delineated by the dozer line created to contain the fire. We crudely classified trees into one of two categories: "Still Alive/Possibly Still Alive" or "Obviously Dead or Likely Dead" (Fig. 6).

We found 62.1% (n=272) of trees within the burn area were dead or likely dead. Many trees had lost all or large sections of their bark, had browned and burned leaves, and had extreme burning around their root balls.

We used a relatively arbitrary metric of roughly 10% or more of a tree's circumference having intact outer bark and likely protected cambium to classify it as still alive or possibly alive. Our value of 37.9% (n=166) of still alive or possibly alive, is almost certainly an overly optimistic survival figure as Stuever (1997) documented that in severe fire intensity areas cottonwoods experience 100% mortality. Most of the area inside the Deep Dark Wood fire line experienced severe fire intensity (Fig. 7). This is further supported by Ellis (2001) that two years post fire there was no cottonwood survival in a study site without regular flooding compared to very low survival in a site with regular flooding.

We did not catalog trees other than cottonwoods in our preliminary assessment. There were some stands of NM Olive/Privet that might have survived and perhaps some Gooding's/Black Willow that also might have survived. There is little doubt that some exotic woody stemmed plants survived since we saw new Tree of Heaven and Salt Cedar/Tamarisk sprouts emerging through the ash.

Two weeks post fire, ash remained regularly 10-15cm deep or greater with no unburned vegetative ground cover exposed. Many of the burned trees appear to have lost much or all of the integrity of their bark (Fig. 8) as well as the integrity of their root systems. **The actual number of dead trees likely far exceeds the 272 we initially classified as such**.

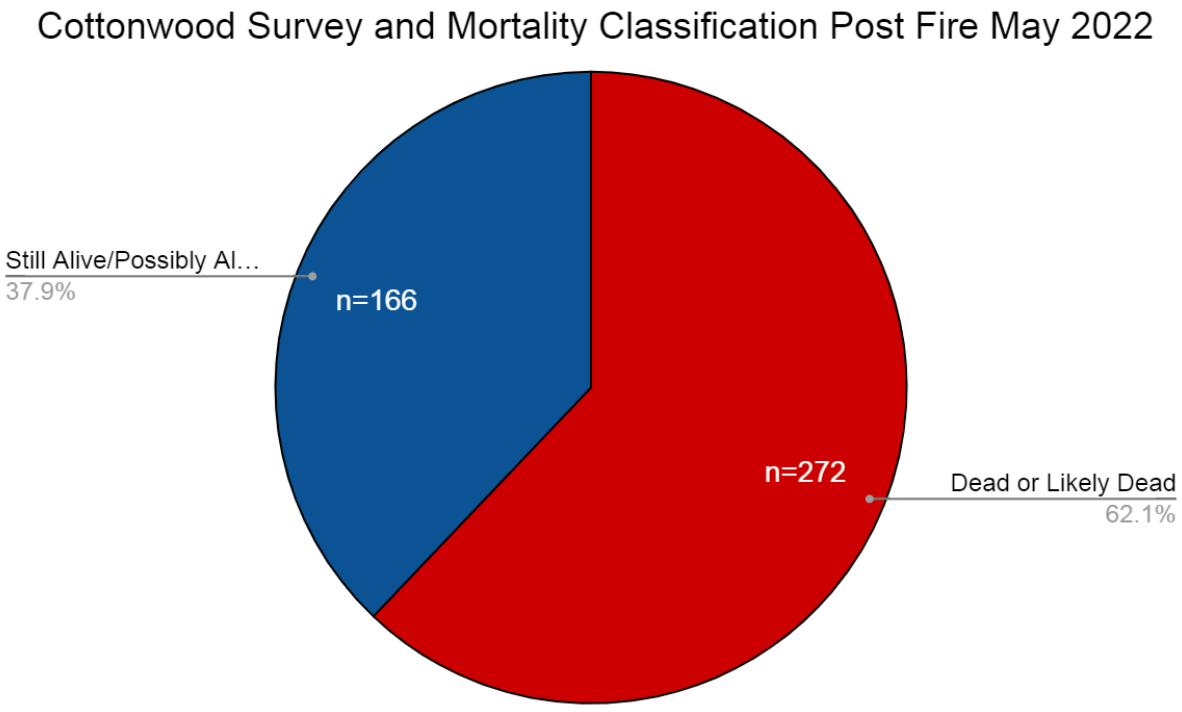

Fig. 6, Preliminary rough estimate of Cottonwood survival, with a likely significant overestimate of trees that might still survive.

Fig. 7. Representative area of severe fire
(Photo courtesy of Livingston MacLake)

Fig. 8. Typical cottonwood we classified as "Dead/Likely Dead"
(Photo courtesy of Livingston MacLake)

Some Recommendations Regarding Hazard Mitigation and Forest Rehabilitation

Most likely, the cottonwood trees within much of the Deep Dark Woods fire site are dead. There is the possibility that stump/root sprouts might emerge from some of the burned cottonwoods, however, because of the fire severity and the near complete combustion of most surface fuels, the fire's impact in killing tree tissue (roots) below ground was most probably very high. Therefore, the primary path forward should consider that most of the cottonwoods within the fire line are dead or will be shortly. There are a number of cottonwoods, especially around the edges of the fire, that seem to have survived and they should be considered differently.

Most Immediate Concern

Because of the near total combustion of down and dead woody material it should be assumed that tree mortality was mostly complete for several hundred trees. Since the fire's intensity likely killed below ground tree tissue (roots), those several hundred trees are an extreme hazard to the public. The likelihood of trees falling with wind is very high, and even without it many of the burned trees could easily fall.

Recommendation 1. Immediate concern. Signage should be placed around the fire site closing the area to the public and warning of the extreme danger of trees falling. Signage should also be placed at least at the three closest access points to the fire (Andalusia Park, Bosque School culvert Bridge, and Pueblo Montaño Park) as soon as possible warning the public to stay out of the fire area because of high personal risk.

Near Term Recommendations

Recommendation 2. Secure funding for rehabilitation. Have funding include capacity to support not only physical rehabilitation of the area but also monitoring and community (citizen) science efforts regarding the burn site and the success or not of rehabilitation work. Specifically, this should include funding for BEMP, since they have had thousands of students monitoring in what is now the burned area and will be able to continue to engage students in the field in that area. In addition, they have a strong data set of pre-fire conditions. Likewise, their science staff can make more detailed restoration suggestions based on their bosque ecosystem expertise.

Recommendation 3. As soon as possible, cut down, and remove from the bosque as many dead trees as possible. There should be minimal if any chipping of wood to be left on site. This effort must include the removal of down and dead material or we will end back up with a high fuel load. Chipped wood does not reduce fire risk, it just increases the

amount of woody surface area to burn and moves fuels from a more vertical configuration to a horizontal one. A top goal is to saw, cut up, and haul out of the bosque dead cottonwoods.

Recommendation 4. Prepare for early autumn herbicide application of re-emerging exotic and invasive trees in the burn area particularly Tree of Heaven and Russian Olive followed by chain saw removal of treated exotic and invasive trees. This would be an excellent work project for State Forestry's Inmate Work Crew.

Right now, the biggest and most immediate need is to address the safety of the public in a very heavily used bosque area. That means signage and education to keep people from walking under dead and precarious cottonwoods. There is still plenty of unburned, and much safer bosque habitat nearby (Fig. 9).

And to reduce that hazard getting standing dead trees cut down as soon as possible. Requesting a waiver from the US Fish and Wildlife Service to start cutting down dead and hazardous trees very soon for public safety reasons with pre-site assessment of any nesting birds, particularly animals listed on the Endangered/Threatened lists.

QUICK SUMMARY

This was an incredibly hot fire that killed hundreds of cottonwood trees. Standing dead cottonwoods are a major safety issue(Fig. 10). . Educate the public and restrict access. Support BEMP leading student monitoring and research. Cut dead cottonwood and remove from bosque. Have a plan to reduce the inevitable surge of exotic tree species that are emerging already. Most other concerns can wait.

Fig. 9. Unburned bosque adjacent to the fire site

Fig. 10 Burned and unburned bosque

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