

Pack Creek Fire Restoration in the Pinyon-Juniper Forest: 2024 Progress Report

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Project Summary

In June 2021, the Pack Creek Fire burned over 9,000 acres in the La Sal Mountains outside of Moab, UT, devastating the local community and creating an immediate need for restoration action on the burned landscape. Preliminary restoration efforts performed by the US Forest Service (USFS) in conjunction with a local non-profit organization, Rim-to-Rim Restoration, focused on lower elevation pinyon-juniper forests, with native plant seeding conducted in the Fall of 2021. However, before the 2021 fire, the USFS thinned several areas of Manti-La Sal pinyon-juniper woodlands within the Pack Creek Fire scar, which was suspected to have implications for the trajectory of post-fire recovery. This project asked if and how pre-fire forest thinning and post-fire seeding altered the timing and trajectory of pinyon-juniper understory recovery following the Pack Creek Fire.

Funds from the Canyonland Natural History Association (CNHA) 2023 Discovery Pool helped cover the costs of fieldwork, including field technician time and transportation, salary support for Principal Investigator (PI), Rebecca Finger-Higgins, and logistical costs associated with revisiting plots established in the 2023 growing season by the USFS to help track pinyon-juniper forest understory recovery and potential differences in soil stability. Fieldwork occurred from June 12-16, 2023, and was led by Rebecca Finger-Higgins and assisted by three technicians including two Utah State University (USU) undergraduate interns, and an ecologist with Rim-to-Rim Restoration. Key findings from this study suggest that the pre-fire thinning treatments (and the associated post-fire seeding by the USFS of rangeland grass species) are impacting the recovery of post-fire sites within the Pack Creek Fire, and that hand seeding appears to be most successful in the non-thinned areas. These findings have brought us to a new line of inquiry with the USFS Manti La Sal Wildlife Biologist, Barb Smith, to explore the impacts of pre-fire thinning treatments in other, non-burned areas of the forest. Additionally, through the Discovery Pool Grant program, PI Rebecca Finger-Higgins has communicated consistently with local Moab land management agencies, including the Bureau of Land Management (BLM), which will help bolster science-based management in the greater area. Finally, the Discovery Pool Grant program has also connected our research team to other scientists in the region, such as Jason Kirks and Jonny Jew (Moab BLM), Mallory Sandoval Lambert (USU), and Joel Berger (Colorado State University), and encouraged further collaboration and outreach activities to promote the science excellence of the greater Moab area.

Methods overview and 2023 accomplishments

Site Establishment

Site selection and establishment of our hand-seeding and crossed erosion control study were completed in the summer of 2022 before receiving funding from CNHA. Candidate sites were selected from locations that were previously randomly selected for post-fire vegetation and soil survey fieldwork that occurred in the fall of 2021. For the seeding trial, a total of 10 pinyon-juniper forest sites were selected, with 5 of those sites located within areas that had undergone pre-fire thinning (chained), and 5 sites that had not (control). Within each site, four plots were established: a control plot, a seeded plot, a plot with an erosion control rock wall, and a plot with both seeding and an erosion control rock wall. Each plot was 1.5 m by 1.5 m and marked with a rebar stake to allow for revisitation. Plots were established in a line, separated by 1 m between plots and in areas that had less than a 5° slope.

After plots were established at a site, each plot was raked to provide a consistent level of surface disturbance regardless of seeding treatment. For the two plots that were designated to be seeded, ~45 g of seed was scattered across the plot area before raking. For the erosion control plots approximately bread loaf-sized rocks were collected from the surrounding area to create a small wall. The wall was created to test whether some seeds could be protected from surface erosion by creating microtopography across the landscape. Once all treatments were in place, the field crew documented the location with photographs and GPS points.

2023 Field Work

Fieldwork occurred June 12-23, 2023 (Fig. 1). At each site, all four plots were surveyed in the same manner to ensure data collection consistency. Photographs were also taken during fieldwork, both at the site and plot scale. Additionally, data was collected for species inventory, cover, and abundance using cover class estimates, and soil aggregate stability. CNHA funding covered the cost of the technician time (USU interns), transportation costs to the study sites, and salary support for Rebecca Finger-Higgins for study planning, training, data analysis, and outreach. Additionally, during fieldwork, Barb Smith (USFS) and Jonny Jew (Moab BLM)



Figure 1: USU interns Amanda Kloz (left) and Keslee Green (center) and Rim to Rim Ecologist Gavin Belfry (right) help with 2023 field work in the Pack Creek Fire Scar

joined the sampling efforts to help inform land managers about our ongoing work.

Outreach

In addition to fieldwork, in early July 2023, eight student interns participating in the Native American Tribes Upholding Restoration and Education (NATURE) Program toured the Pack Creek Fire scar. NATURE is a collaborative effort between the Nature Conservancy's Canyonlands Research Center and USU. It is a 7-week internship program created to empower Native college students in and around the Colorado Plateau to lead in the fields of natural resource management, sustainability, and environmental science. Interns hiked to various locations within the scar to better understand some of the complexities of wildland fire recovery, restoration, and dynamics. Site visits were facilitated by co-principal investigators and collaborators, USU Assistant Professor Brooke Osborne, Utah Valley Assistant Professor Tara B. Bishop, and USFS Hydrologist Daniel Lay (Fig. 2).



Figure 2: USFS Hydrologist Daniel Lay (far right) teaches a group of NATURE interns about the impacts of the Pack Creek Fire on regional hydrology and erosion in the Pack Creek Fire near the site of the fire's origin

In Fall of 2023, Dr. Finger-Higgins was interviewed for a Science Moab Podcast featuring the CNHA-funded work and presented her research at the Moab Information Center during a public lecture. The Science Moab podcast was released on Oct. 17, 2023, and the Moab Information Center presentation was on Sept. 28, 2023.

Results

Key findings from our fieldwork indicate that hand seeding treatments are more effective in control (i.e., unchained) versus previously chained plots (Fig. 3). On average, we found ~ twice as many seeded individuals (mean 43.2 ± 6.7 standard error) in the controlled, seeded plots compared with the chained, seeded pots (mean 20.3 ± 6.7 ; Fig. 3A). The erosion control walls did not significantly impact the efficacy of hand seeding in either the control or chained plots and did not appear to significantly alter overall plant cover, so they were excluded from further analysis. For total plant cover, we did not observe significant differences between the control or chained plots (Fig. 3B), in either native or non-native/invasive plant cover. However, it should be noted that non-native perennial grasses were only observed in the previously chain plots as these areas were often seeded with non-native grasses immediately following chaining activities to presumably improve rangeland conditions. In the control, non-chained plots, we also found that soil stability was often higher, as tested by field slake tests. This indicates that the soils in the control plots will likely be less prone to water erosion than the adjacent chained plots. Combined, our findings suggest that seeding treatments are likely to be more effective in native plant regeneration in areas of the Pack Creek Fire that did not previously experience chaining and non-native perennial grass seeding, which could also be linked to faster soil stabilization following wildfire.

Additionally, by the end of the summer of 2024, Dr. Finger-Higgins compiled a species list and plant guide of the Pack Creek Fire scar and distributed it to project partners including Barb Smith, Kara Dohrenwend (director of Rim-to-Rim Restoration), and Jonny Jew and Jason Kirks of the BLM-Moab.

Future Directions

Thanks to funding from CNHA, findings from the first year of the seeding trial study have led to several follow-up questions that we look forward to pursuing in 2024. Our initial results suggest

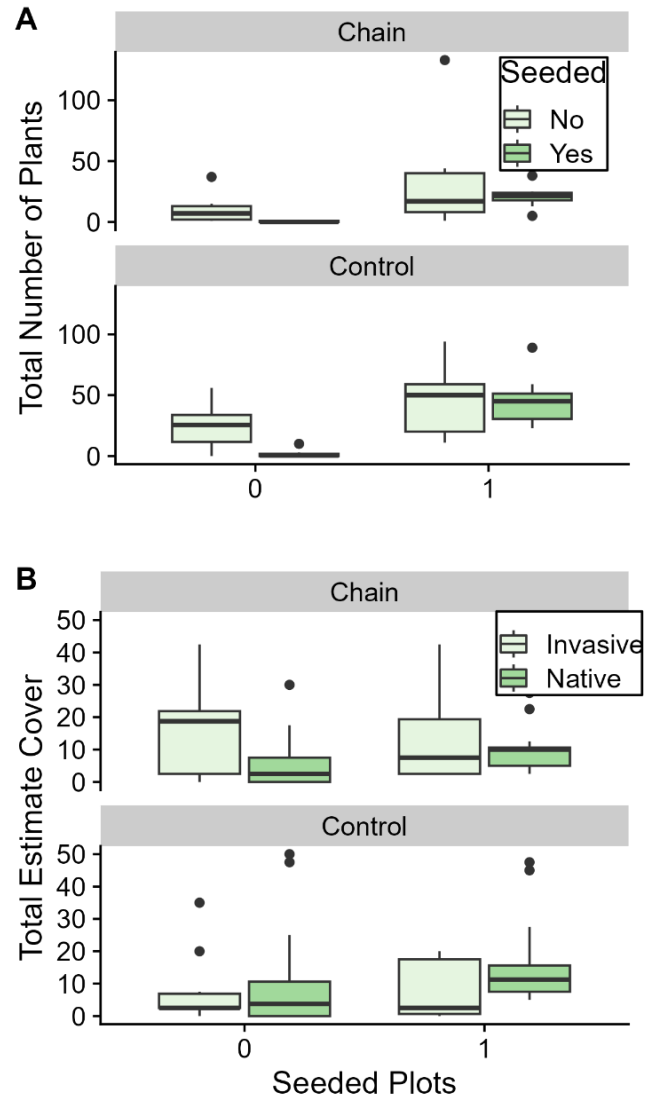


Figure 3: Summary statistics of (A) the total number of individual plants observed in hand seeded (1) and non-seeded plots (0) in previously chained and control plots, and (B) the total estimated cover on native and invasive plants in chain and control treatments. Boxplots indicate the median value of each treatment condition (solid middle line) bound by the first and third quartile.

that pre-fire thinning treatments conducted by land management agencies, such as the USFS and BLM, can directly impact the recovery of these ecosystems following wildfires. In the Pack Creek Fire, our findings suggest that this ecosystem may not be able to fully recover to a pre-fire native pinyon-juniper reference state in areas that were previously chained due to lower native recruitment and an increase in soil erosion potential. Additionally, the reductions in soil stability in the previously chained areas could be exacerbating the chronic flooding that has occurred in the Pack Creek drainage following the 2021 fire. Based on these findings, our research will now primarily focus on the recovery of different understory communities within the Pack Creek Fire to monitor potential ecosystem-state transitions that might occur in this ecosystem. To accomplish this goal, using CNHA 2024 Discovery Pool funds, we will be revisiting 18 monitoring plots that were established in the fall of 2021 to track ongoing nature regeneration that is occurring in the region.

Additionally, guided by interest from USFS manager Barb Smith, we will be expanding our scope of work to pinyon-juniper thinning treatments across the region, exploring other areas that have received fuel reduction treatments in the greater Moab region to better understand the impacts of these land management decisions. This summer, we will visit several other sites that have received similar chaining treatment to those burned in the 2021 Pack Creek Fire to help understand the dynamics of the affected ecosystems. This work will be supported by CNHA funds received from the 2024 Discovery Pool and will assist with undergraduate research training led by Dr. Tara B. Bishop at Utah Valley University and Dr. Brooke Osborne at USU-Moab.

Finally, being a part of the CNHA Discovery Pool has connected our research team with other exciting research being done in the area. Due to connections made through the Discover Pool process, in her role as acting chair of the Southwest Chapter of the Ecological Society of America, Dr. Finger-Higgins has invited Mallory Sandoval Lambert and Joel Berger to participate in this year's Annual Ecological Society of America Conference being held in Long Beach City, CA on August 4-9th, 2024. Lambert and Berger will both be presenting on CNHA funding projects to discuss "Surviving stress in the Southwest". This will help bolster regional science at a national level and help promote Moab as a regional science hotspot.