Alternative Invasive Species Management:

Manual Russian Olive Seedling Removal on the San Juan

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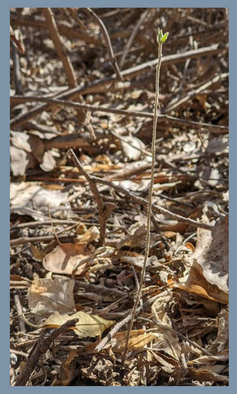
Introduction

In partnership with the Bureau of Land Management (BLM) and Utah Conservation Corps (UCC), Canyon Country Youth Corps (CCYC) has worked since 2017 at the Gold Mine Site in southeastern Utah along the San Juan river. The project's primary goal has been to remove woody invasive species, particularly Russian olive (*Elaeagnus angustifolia*) within and adjacent to all side channel habitats so as to restore natural hydrologic processes. The project stakeholders would like to see native plants such as Fremont cottonwood (*Populus fremontii*), New Mexico privet (*Forestiera neomexicana*) and coyote willow (*Salix exigua*) regain their dominance in the area to improve habitat opportunities for the yellow billed cuckoo (*Coccyzus americanus*) and southwest willow flycatcher (*Empidonax traillii extimus*), and to promote river side channels for spawning native fish like the razorback sucker (*Xyrauchen texanus*). Initial work focused on chemical treatment of mature *E. angustifolia*. However, *E. angustifolia* 's density at the site and its resistance to selective herbicides means that treatment radically transforms the space and potentially impacts vulnerable native species. Moreover, chainsaw work for low-stump treatment can only occur outside of bird nesting season. In 2020, the COVID-19 pandemic stalled scheduled treatment until nesting had already begun. Hoping to continue work in some way, stakeholders at the BLM and CCYC turned their attention to *E. angustifolia* seedlings emerging under the canopy opened by previous stump cut and frill treatments. Without documented precedent, the crew sought to test whether hand pulling of *E. angustifolia* seedlings could be an effective, chemical-free treatment.



Methods

Treatment
The manual removal of *E. angustifolia* seedlings involves pulling the tree out of the soil by hand, including as much of its taproot as possible. The taproot of *E. angustifolia* seedlings measures as many inches or more than the plant's above-ground height. For trees under 10", this requires no specialty equipment. Some participants reported a preference for hand picks to loosen the soil surrounding the seedling, or a shovel to remove multiple plants in areas where seedling density is greater than 20 per square foot. Other participants opted to remove each plant by firmly grasping the base of its stem by hand, wiggling the seedling to loosen the soil, and pulling upwards with controlled strength to remove the plant. This method has the advantage of leaving soil more intact, reducing the possibility of replanting *E. angustifolia* seeds that typically exist in abundance in the same areas as the seedlings. Once removed, *E. angustifolia* seedlings were bagged and removed from the site for disposal to eliminate the chance of rerooting in the soil before fully desiccating.

This method stands in contrast to the treatments for mature *E. angustifolia* employed at this site, namely frilling and low-stump treatment. Both methods have been used since the beginning of Canyon Country Youth Corps's collaboration with the Bureau of Land Management (BLM) at the Gold Mine Site, and are described here to illustrate the condition of the site and each of the plots. Frilling, colloquially referred to as "hack and squirt," is a chemical treatment that uses either a hatchet or handsaw to make lateral, downward cuts into the vascular tissue beneath a tree's bark. A concentrated herbicide is then applied, by dropper or handheld squeeze bottle, into the incision. The herbicide travels through the vascular system to a tree's roots to kill the plant. This treatment is most effective in fall, as a tree directs nutrients to its root system. Low stump treatment uses a chainsaw to level a tree to a stump, as low to the ground as possible. The living tissue on the stump is immediately treated with a concentrated herbicide solution (*USFS Field Guide for Managing Russian Olive in the Southwest. USDA.gov. June 2017*). Both frilling and low-stumping are documented, effective treatments, though frilling allows continued nesting and habitat for wildlife in the dead, but standing tree. Low stumping of each mature tree drastically changes the terrain in the area of dense *E. angustifolia* trees. Low-stump treatment also requires more equipment, logistics and a chainsaw-trained crew.

Observations of hand-pulling at the Gold Mine site were segmented by season. Initial treatment took place between May and July 2020. The crews returned in September in October 2020, and made informal observations of the treatment's success. In the crew's return to the Gold Mine Site in 2021, methodology was formalized to test the efficacy of hand-pulling. To test this hypothesis, the crew established three 5ft by 5ft test plots to monitor resprout activity from March to October 2021. Each plot was marked with pin flags and flagging tape. These plots were selected to study the conditions of *E. angustifolia* regrowth in distinct regions of the site, to better understand how *E. angustifolia* resprouts in the years following various treatments to mature and seedling trees.

Methods, cont.

Site Selection
Plot 1 was selected for its position just north of the boundary of the summer 2020 hand-pulling treatment area. The plot was approximately 30ft south of a large wash zone. The mature *E. angustifolia* trees in this area had been treated by frilling between 2018-2019. The resulting defoliation of the canopy promoted the germination of fallen *E. angustifolia* seeds. Seedlings were present in July 2020, but schedule limitations prevented the crews from addressing the entire area that season.

Plot 2 was identified to represent areas one year after mature tree treatment. The mature *E. angustifolia* in this area were frilled in September 2020, the remaining snags comprised the canopy of this plot. The canopy had opened as a result of leaf senescence in treated *E. angustifolia* trees, dropping seeds on the plotted area and its surroundings. The plot was of particular interest for its proximity to a side channel. The plot was placed 2ft away from the bank where the channel flowed during flood events. The mature *E. angustifolia* trees in the area were treated in September of 2020.

Plot 3 was selected to represent the area surrounding it that received chemical treatment during or before 2019, manual seedling removal in June of 2020, and machine mastication of treated snags in March of 2021. In selecting this site for a plot, the CCYC crew aimed to test the effect of mulching and full sun exposure on *E. angustifolia* regrowth. Unlike previous plots, this plot was designated 10ft off of the main San Juan river corridor.

Results

On March 29 2021 CCYC crew members hand-pulled 728 seedlings from Plot 1. The plot contained no other plant species, so it was left empty apart from residual *E. angustifolia* seeds from treated trees in the plot's canopy. Seedlings surrounding the plot were also removed but not counted. On August 30 2021, two newly emerged *E. angustifolia* seedlings were observed and hand-pulled. No other vegetation was present. On October 11, 2021, no new vegetation, including *E. angustifolia* seedlings were observed, though *E. angustifolia* seeds continued to litter the plot.

At Plot 2, *E. angustifolia* seeds littered the ground. The crew observed some grass growing in the plot on March 31 2021, but no *E. angustifolia* sprouts. On August 30 2021, six perennials were observed, all of which were identified as Russian knapweed (*Rhaponticum repens*). Sparse grasses were also observed but whose species could not be confirmed due to growth stage. After sustained heavy rains, on October 11, 2021, three of the *r. repens* plants remained, and two mushrooms of the Cavalier (*Melanoleuca*) genus were observed in the plot.

While designating Plot 3 on April 1 2021, the crew counted zero *E. angustifolia* sprouts or seedlings. The plot had the greatest increase in vegetation over the course of six months. On August 30 2021, seven western goldenrod (*Euthamia occidentalis*) plants were observed, three of which were over 3ft in height. One *r. repens* plant was also observed. A single tamarisk (*tamarix*) seedling grew just outside the plot's border, its branches hanging into the plotted area. The neighboring river bank, bare in March, was now blanketed with coyote willow (*Salix exigua*). Evidence of feral horses was also observed, in the form of feces and broken flagging tape. On final observation on October 11 2021, the *e. occidentalis* had bloomed, but otherwise the composition of the plot remained consistent with the August observations.

Conclusion

Hand-pulling seedlings proved to effectively end the cycle of regrowth for *E. angustifolia*, and can serve as a model for community involvement in land stewardship and a starting point for restoring native species to the landscape.

In Plot 1, hand-pulling resulted in .27% regrowth rate in one season. Whether pulling plants individually or digging them at them with hand tools and shovels, observers saw success. The hand-pulling method was effective even when the taproot broke during its extraction. Further research should be pursued to learn how many inches of taproot is enough for an *E. angustifolia* seedling to survive, or alternatively, how many inches below the soil's surface must a break occur to ensure the taproot does not resprout. Conditions at Plot 1 invite the question of how to proceed after thoroughly disturbing an area through invasive species removal. In the case of Plot 1, while the season ended with no *E. angustifolia* seedlings in the plot, there were no observable native plant species either. Invasive species, such as *R. repens*, thrive in disturbed terrain. A plan to seed the area with native species including Rocky Mountain beeplant (*Cleome serrulata*), sunflower (*Helianthus*), varieties of wheatgrass (*Thinopyrum*), penstemon (*Penstemon*), coneflower (*Echinacea*), is already underway, though it will take several years of study to determine the efficacy of seeding native flora at Gold Mine Site.

More research is needed to better understand under which conditions *E. angustifolia* seedling monocultures emerge in the years following mature plant treatment. Despite having a similar canopy composition to Plot 1, no *E. angustifolia* seedlings emerged in the year following chemical treatment. Plot 3 was unique in canopy and ground composition, making it difficult to draw conclusions without more study. For future study, the microtopography of select locations on the Gold Mine Site should be categorized before selecting plots. Ideally, future tests will establish multiple plots representing each identified variable to increase the statistical significance of results.

Although limited in scope, the results of the Gold Mine Site survey show a promising path for involving the public in combating *E. angustifolia* regrowth. In less than 15 minutes, a member of the BLM or corps staff could provide a group of volunteers an overview of the *E. angustifolia* problem on the San Juan river and demonstrate the hand-pulling treatment. A group of 20 could eliminate tens of thousands of seedlings with a few hours of work. Engaging volunteers has the added benefit of empowering members of the community to be stewards of and advocates for the land.

Credits/Acknowledgements

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