Assessment of Wildlife Usage on an Active Restoration Site

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ABSTRACT

This study explores the difficulties of managing an ongoing riparian restoration site that has an active elk population. Land managers are often faced with the obstacle of repairing years of damage, prohibitive costs, as well as wildlife heavily browsing on newly transplanted vegetation. Because elk are large herbivores that reside in herds that move across large swaths of habitat, they require substantial amounts of food and landscapes can quickly become damaged. We compared the vegetation and wildlife usage between two adjacent sites in Covington, WA to examine and collect data on an infrequently studied part of the restoration process: wildlife usage. This study showed that elk and other wildlife were found more often in the active restoration area. Invasive vegetation also is a deciding factor to where wildlife frequents in higher prevalence. Limited studies on the effect of ungulates on restoration sites over time are a limiting factor for many land managers, so our intent is to collect data to inform interested parties and support higher successes in restoration involving wildlife.

INTRODUCTION

Assessing how wildlife utilizes a landscape undergoing active restoration management within the rural-urban interface has been under-studied and rarely monitored. This research is to gain insight and perspective on restoration activities and practices of how elk and other wildlife have been utilizing a site undergoing active restoration management. We seek to learn more about identifying what type of wildlife occupies the site, what type of habitat structures already exist, if they are being used, and to identify what ecological functions are present or degraded. We chose two areas of interest (AOI) to survey and monitor to assess whether an active restoration site with elk on the landscape will be used differently or if there will be no difference between a restored or unrestored habitat.

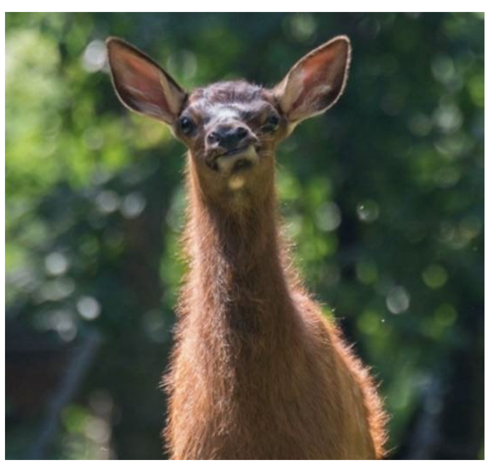
SPECIES BACKGROUND

Elk are found throughout Washington with two different subspecies, the Roosevelt elk (*Cervus canadensis roosevelti*), found on the coastal ranges in the Olympic Peninsula to Southwest Washington, and the western slopes of the Cascade Range and the Rocky Mountain elk (*Cervus canadensis nelsoni*) who are found in the mountain ranges and shrub steppes of Eastern Washington (WDFW, n.d.). Our study is focused on Roosevelt elk, as they are the only species known to use the AOI. Elk are light brown in the winter and turn reddish tan in the summer with buff-colored haunches. Antlers grow during the spring and summer and shed their antlers anywhere from February to May. Adult elk weigh 600-800 pounds and are 4.5-5 feet high at the shoulder and can eat an average of three pounds of food per day per 100 pounds of body weight.

According to the Washington Department of Fish and Wildlife, elk in the spring and summer graze on grasses, sedges, and flowering plants. In the fall they start to browse sprouts and branches of shrubs, trees and even conifers when food becomes limited. Elk use canopy forests as cover when the weather is extreme, to avoid hunters, or when they are harassed. The most suitable habitat for elk is productive grasslands, meadows, or clearcuts interspersed with closed canopy forests. Our AOI has many of the elk's nutritional needs accessible year-round, however it has limited closed canopy forest land.

Elk are social animals living in herds for most of the year. Cow-calf herds are led by older experienced cows and may include adolescent bulls. During the mating season in early fall, adult and young adult bulls will temporarily join cow herds. Larger bulls will try to gather harems of cows and defend against competing bulls. There can be harems from 3-4 to 20-25 cows. Bulls will socially dominate the cows, but the herd is still led by the older lead cows. Mating occurs in the fall, with cows giving birth to a single calf in May or early June. The timing of the birth is important to calf survival by being late enough that the risk of cold, inclement weather has passed, but early enough to give the calves time to grow before the next winter. Cows will feed their calves for up to nine months. Newborn calves weigh around 35 pounds when born, and by the winter calves can weigh anywhere from 225-250 pounds as shown in Figure 1(WDFW, n.d.).

Figure 1



Note. A newborn elk calf was born at Queens Zoo, in New York City (Larsen, 2015).

Elk have a superb sense of smell, excellent hearing, and can run up to thirty-five mph. However, most elk start to physically decline by age 16 and a 20-year-old wild cow elk is considered old. Automobiles, predation, hunting and habitat loss, the latter being our study's focus, all have taken their toll on elk populations. The impacts of wild ungulates like elk on riparian restoration are often ignored and remain largely unstudied, despite examples where wild ungulates have altered riparian woody species structure and composition (Averett et al., 2017). Knowledge of elk response in our AOI will provide the land managers with insight on how to manage restoration with a known elk herd.

SITE AND WILDLIFE IMPACT BACKGROUND

There are few peer-reviewed studies on wildlife response to riparian restoration. Rarer still are articles that synthesize studies of restoration response across multiple taxa (Golet et al., 2008). Restoration practitioners can benefit from an increased understanding of how elk and mule deer impact stream recovery efforts (Averett et al., 2017). Our study was in a known wildlife corridor utilized by elk, and at the same time, an area with ongoing restoration starting in 2019. The restoration process included planting nursery-grown one-gallon potted trees and shrubs and being willow staked many times with limited success. One of the concerns for the restoration planting has been the herbivory and rubbing damage to the new plantings, caused by elk on the landscape. Looking forward, it is hard to prepare a plan for sites like this because there has been minimal published documentation of effectiveness beyond limited information on vegetation response (Golet et al., 2008). Restoration undertakings like this are becoming extensively used to repair the damaged riparian stream areas, such as our AOI, however, despite huge monetary investments to implement restoration projects, effective monitoring is rare (Bernhardt et al., 2005). This study had to design its own methods because when monitoring does take place, quantifiable success criteria have been rarely defined. Opportunities to improve restoration practices are thus being lost (Golet et al., 2008). Not only do we know little about how elk who reside or pass through the AOI use this area, we question whether it is a place where elk or the plantings are thriving. Our control AOI, which has not undergone any restoration activities, is also showing the effects of invasive plants. Highly competitive, invasive pasture grasses, such as timothy (*Phleum pratense*) and especially reed canary grass (*Phalaris arundinacea*), are a threat to riparian plantings because they compete for sunlight, water, and nutrients (Wall, 2011). The data from this study shows invasive plants that do not provide food for ungulates near an area freshly planted with young, native plants are not having high survivability.

When discussing post-disturbance ecosystems, research tends to infer that early seral conditions are undesirable and need to be restored to closed canopy conditions as quickly as possible. Emphasizing recovery as the management goal fails to acknowledge the essential ecological roles played by early successional ecosystems on forest sites (Swanson et al., 2011). These open edge habitats, although can be undesirable for salmon habitat in riparian areas, have in our study shown to have consistent elk usage. More generally, vegetation characteristics are studied, with the assumption that animal populations will recover once adequate habitats are established (Golet et al., 2008).

However, it is hard to make assumptions when most project records are found to be inadequate to extract even the most rudimentary information on project actions and outcomes, it is apparent that many opportunities to learn from successes and failures, and thus to improve future practice, are being lost [or rarely studied like elk usage] (Bernhardt et al., 2005). Our study's restoration area, like many others, has land managers doing their best by making educated decisions on the native plants to fill the area, but we wonder if these decisions are what is best for the local elk and/or whether the new plants can survive with a local elk population. For some taxa, it would be beneficial to expand on the initial surveys profiled in this paper to gain more information about how they interface with habitats along the river (Golet et al., 2008). Some research in other places have shown results suggesting that wild ungulate herbivory can impede riparian restoration along salmonid streams by suppressing woody plant establishment and recovery (Averett et al., 2017). Our restoration AOI is on its third planting, as the first two have not thrived because of the impact of invasive plant species and the effect of browsing and overall animal damage. This restoration area's ability to recover over time with the elk population's browse pressure depends on site-specific characteristics such as availability of palatable food, proximity to hiding cover and pressure from predators and hunters (Wall, 2011). Our site showed that many of the conifers were browsed and had critical rubbing damage from the ungulates using the area.

METHODS

Site Location

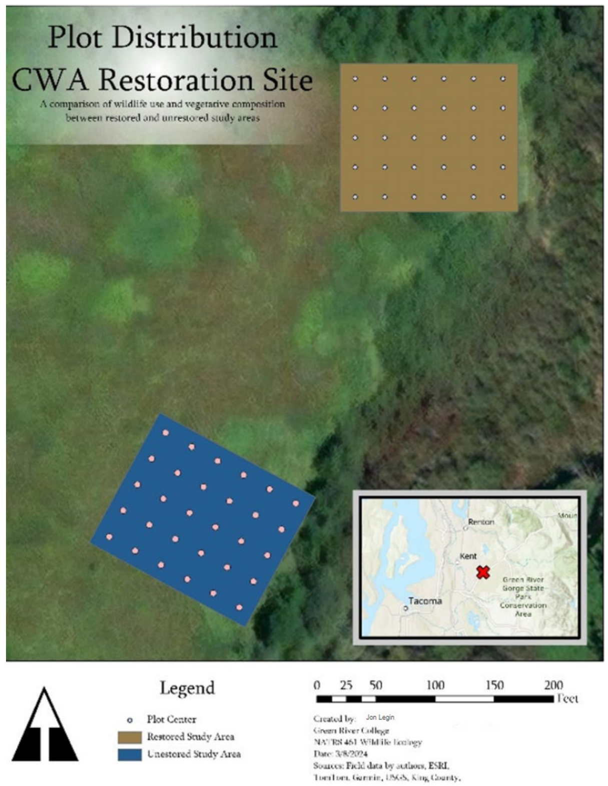
Our survey took place at the CWA restoration site, located at 47°21'01.4"N 122°08'00.2"W, in Covington, WA as shown in Figure 2. This survey took place February 25th-26th 2024, during the afternoon. The weather was cloudy/rainy both days, with temperatures between 43-46° F. Within this site we surveyed two AOI's where our plot sampling occurred. Each AOI has been overlaid with a 25' x 25' grid to determine plot centers for a total of 30 plots per AOI:

1. AOI 1: 150' x 125' grid / 18,750 square feet that is under current restoration, with newly planted native plants.
2. AOI 2: 150' x 125' grid/ 18,750 square feet is adjacent to AOI 1 and has not undergone any restoration. AOI 2 was the control for AOI 1.
3. Camera 1: 2/7-3/8/2024, 47°21'02"N 122°07'48"W (facing south) as seen in Figure 3.
4. Camera 2: 2/7-3/8/2024, 47°21'01"N 122°07'48"W (facing north) as seen in Figure 3.

Materials

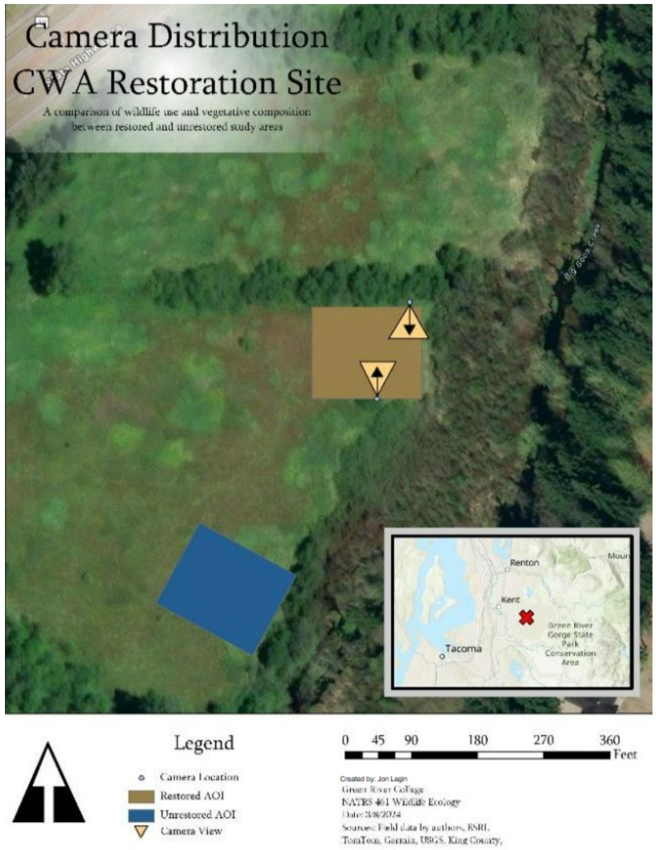
The tools used for this study were two game cameras (Campark, n.d.), (GardePro, n.d.). D-tape, GPS, 3x3 ft PVC pipe sampling square, plant identification book: *Flora of the Pacific Northwest: An Illustrated Manual, 2nd Edition* (Hitchcock et al., 2018), and field notebook.

Figure 2



Note. This map shows both AOI’s for the study in Covington, Washington.

Figure 3



Note. This map shows both AOI's for the study, and how the game cameras were placed, Game camera 1 is the Northernmost camera and camera 2 is the Southernmost camera.

Procedure

This study consisted of gathering 30 data points per AOI, 60 data points total for both AOI's. One plot on the grid surveyed equaled one data point. Attributes associated with each data point were documented in detail, however, will be related to the single data point they were collected at. A 150x125 ft. grid was mapped in each survey area. We used GPS to measure and flag the grid with a D-tape for consistency. A PVC 3x3 ft square was placed in each plot center and a 100% survey of the plot was taken. Attributes included: percent coverage of each species or family of plants, count number of scat, tracks, browse, game trails, rub, dead trees, and any pertaining notes. We sampled the vegetation to track survival and growth, to see how the habitat is being used and potential wildlife density. The attributes were noted in a field book, then transcribed into Excel.

Game cameras were also utilized as a supplement to our data points to see what wildlife (elk in particular) was occupying the AOI's. These data points were extra, and not part of the 60 grid points collected.

RESULTS

Table 1

Species (Common Name)	Restored AOI	Unrestored AOI
Reed Canary Grass	x	x
Scoulers Willow	x	x
Himalayan Blackberry	x	
Sitka Spruce	x	
Pacific Ninebark	x	
Black Cottonwood	x	
Oregon Ash	x	
Sedge	x	x
Forget me not	x	
Bulrush	x	x
Black Twinberry	x	
Red-Osier Dogwood	x	x
Native Grasses	x	x
Creeping Buttercup	x	x
Red Clover	x	
Peafruit Rose	x	
Western Water weed	x	
Curly Dock	x	x
Western Red Cedar	x	
Dandelion	x	x
Pacific Crabapple	x	
Trefoil	x	x
Black Hawthorn	x	
Big Leaf Maple	x	
Ribwort Plantain	x	
Common Vetch	x	
Red Alder		x
Bull thistle		x
Fringe willow herb		x
Water Mint		x
Wild Mint		x
Alpha Diversity	26	15
Beta Diversity	Restored vs. Unrestored: 11	Unrestored vs Restored: -11
Gamma Diversity	31	

Note. Table 1 is a summary of alpha, beta, and gamma diversity of restored and unrestored AOI’s.

Vegetation Alpha Diversity

Vegetation sampling of the two AOI’s revealed a higher alpha diversity in the restored AOI with an alpha score of 26 total species observed. The unrestored AOI yielded an alpha score of 15 total species observed. See Table 1.

Vegetation Beta Diversity

Beta diversity analysis exhibited a score of 11, meaning there were 11 more unique species observed in the restored AOI vs. the unrestored AOI. See Table 1.

Vegetation Gamma Diversity

The two AOI's had an overall gamma diversity of 31. See Table 1.

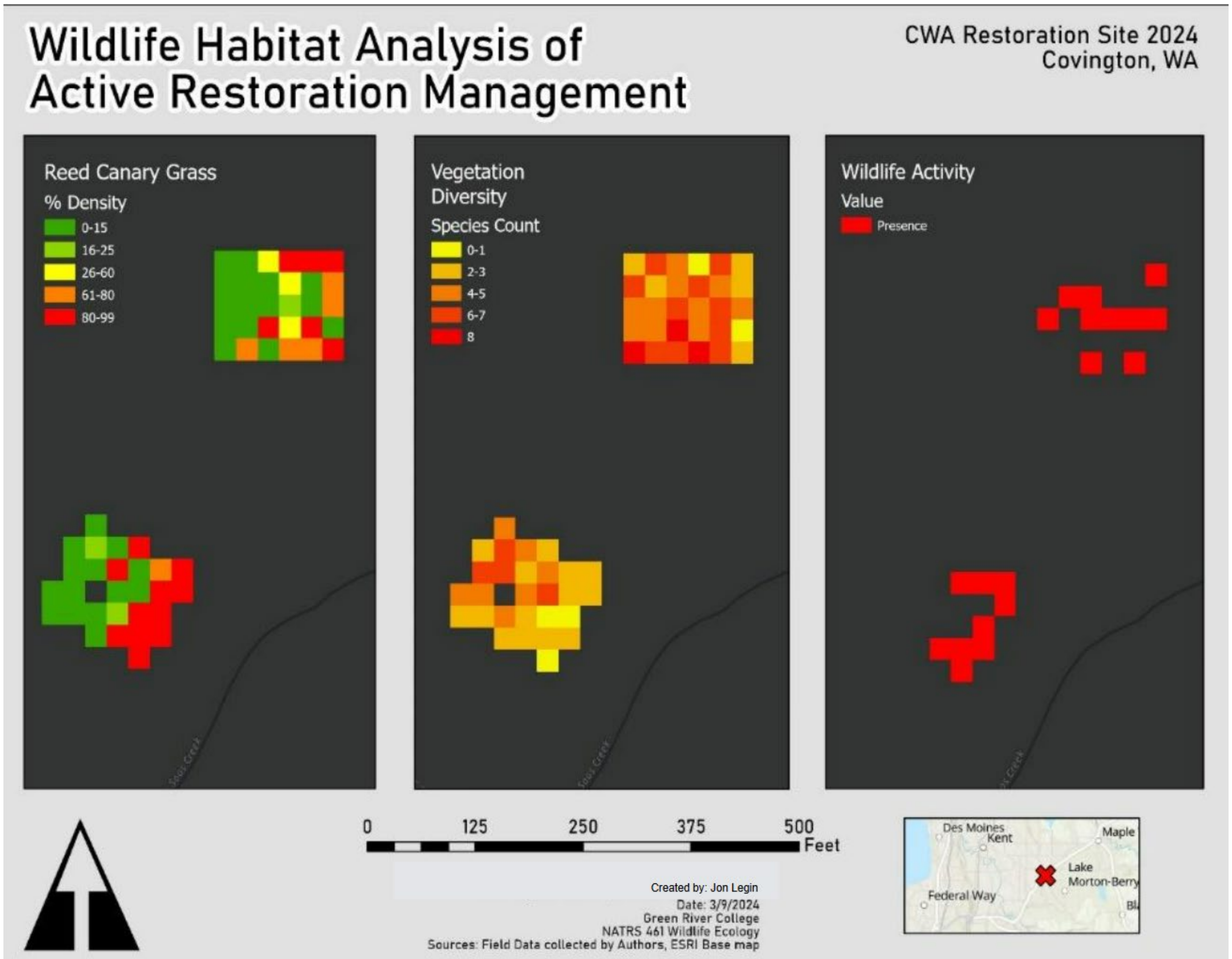
Browse Analysis

The restored AOI had 6 plots with instances of browse while the unrestored AOI had 0 plots with instances of browse.

Wildlife Use Analysis

The restored AOI had 14 instances of wildlife use in the surveyed plots. Use cases included: browse, rub, beaver, game trail, elk scat, and burrow. The unrestored AOI had 7 instances of wildlife use. Use cases included: dead shrew, game trail, flattened area (ungulate resting habitat).

Figure 4



Note. This map displays raster analysis of field notes.

Game Camera Analysis

Elk were captured by game camera 2 on February 27, 2024, at 04:23:47 AM as seen in Figure 5.

Figure 5

Note. Elk activity caught in the AOI on the deployed game cameras. The antlers, head and ear can be seen on the right half of the photo.

DISCUSSION

We picked two different areas, one with active restoration going on with new plants being put in the ground and an area near the restoration area, but with no restoration being done. Our findings have shown that the local elk populations have impeded the restored AOI and have had little impact on the non-restored area, while also exhibiting a differentiation of wildlife usage between the two AOI's. The area being restored has a more diverse plant species composition, while the unrestored area primarily consists of dense reed canary grass with some scattered presence of native grasses mixed in. Elk are grazers, they like open meadows with different grasses. Reed canary grass is only eaten by animals when the new shoots are coming up. When reed canary grass gets bigger, the stem gets harder, and animals do not eat it as shown in Figure 6.

Figure 6

Note. North-east view of AOI 2, with the tall reed-canary grass overtaking much of the landscape.

New plantings in a restoration site are usually nursery grown plant stock that for this site is either one gallon, or live stakes. The buds on the plantings are sweet and a preferable snack for ungulates. Restoration with new plantings is like putting down free food for ungulates; they will keep coming back for newer plantings that arebeing added for “free food.” According to a study focusing on plant establishment after restoration, wild ungulate herbivory decreased planting survival by 30%, and growth by 73% (Averett, J. P. et al., 2017). With the AOI having native grasses and sedges (as seen in the foreground of Figure 7), we thought the elk prefer those as there is an abundance of both. There is also Sitka spruce (*Picea sitchensis*) being added to the restoration site as it can thrive in wetter areas. There is a scent the Sitka spruce gives off that attracts the elk, causing the elk to rub their antlers on the tree, damaging and even completely killing the conifer. Overall, the plants used were shrubs that could withstand being in water for most of the year because the site floods. Since the restored AOI is on its third planting since 2019, future management choices should be made to include elk behavior in relation to any new plantings. In many studies, projects used a variety of browse protectors including individual tubes, larger individual cages, browse repellent sprays, and enclosures for protecting groups of plants (Wall, 2011). We propose fencing around plants to protect them from rubbing and browsing and it should be a priority in future restoration sites with active elk. For example, taking chicken wire and cutting every ten feet and then wrapping it together will help keep ungulates from browsing and rubbing plantings.

Figure 7

Note. East view of AOI 2, the foreground containing native grasses, sedges, and rushes, with invasive reed-canary grass around the perimeter.

When undertaking a riparian restoration project, it is often viewed through the lens of its ability to positively affect salmon habitat and stream health. While these are important factors for consideration, it is also essential we do not look at elk presence as a nuisance and aim to provide benefits for all wildlife in management applications. Quality wildlife habitat can be a rarity when the effects of fragmentation from human development are manifested like in our AOI and the surrounding rural-urban interface. Resource availability is already restricted in these spaces, so any plantings related to restoration are likely to encounter issues with wildlife browse and use. In this instance it is in our best interest as land managers to overplant and include vegetation suited to ungulate browse in any planting plan, like dandelion, clovers, serviceberry, willow, and native grasses. This serves a two-fold purpose: it increases available food resources while also improving survivability of primary desired species by providing alternative browse material for wildlife.

While it was not surprising to find a higher degree of diversity in vegetation composition between the restored and unrestored AOI's, there was some correlation between presence of water and a lack of diversity. The restored AOI had no standing water while the unrestored AOI had multiple instances of standing water adjacent to the dense reed canary grass. This highlights the benefits of including a diverse species composition in planting plans, as having diverse plant species with the ability to access water at varying soil depths could mitigate issues associated with water presence.

Limitations of Study/Recommendations for A Repeating Study

One of the limitations to this study is the spatial scale represented by our assessment. Our methodology employed two identically sized AOI's overlaid with a 125' x 150' grid with plots evenly spaced 25' x 25', for 30 plots total per AOI. While this spacing did allow for high intensity sampling, the smaller footprint covered in the AOI could attribute some bias to microtopography found on the ground and may not cover enough space to be statistically significant. To counter these issues, we recommend either increasing the total number of plots at the same spacing to cover a broader AOI, increasing the size of sample plots, or increasing the spacing between individual plots. As the spatial scale increases, there may also be a need to compare usage between two unique sites, rather than a comparison of two spaces within the same site. Taking the proximity of the two selected AOI's from our research into account though, it is still noticeable that our findings did exhibit a difference in wildlife usage between the two AOI’s. Our final recommendation is that the temporal scale (time) this study covers should be increased and incorporated into a larger monitoring plan to properly track and assess the ecosystem and wildlife response to restoration activities over time.

CONCLUSION

Our study found straightforward evidence of increased elk presence in our AOI undergoing restoration. The study also showed that the vegetation being used to restore the landscape is under stress from ungulate browsing and damage. It may be necessary to plant specific areas of food for elk to browse on, to protect riparian plantings, and study its effect as a protection to most of the vegetation or implement strategic fencing or barriers. Managers can benefit from tools that predict how nutritional resources, other environmental characteristics, elk productivity and performance, and elk distributions respond to management actions (Rowland et al., 2018). This information could be used to inform current and future land managers on techniques and insight for completing restoration areas with higher success rates, as well as providing safe, productive habitat for wildlife like elk. In summary, increasing site-based monitoring, starting with in-depth assessments to characterize local ungulate populations, weeds, hydrology, and soils could help see how successful this type of horticultural restoration project is at achieving their recovery goals, as well as monitoring the wildlife usage and damage, and at the same time supporting the native wildlife that use these corridors in our urban landscape.

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