



Case study of Extension outreach to a small acreage and urban grazing operator in Salt Lake County, Utah, U.S.A.

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Abstract

Utah State University (USU) Extension provides outreach and technical assistance to urban and small acreage producers to help operations navigate local environmental and urbanization challenges. According to the 2020 U.S. Census, Utah was the fastest-growing U.S. state from 2010 to 2020. Most urban development is concentrated along Utah's I-15 corridor, known as the Wasatch Front, which is sandwiched between major mountain ranges. Salt Lake County is Utah's most densely populated county, and in 2020, it housed 36% of Utah's total population (U.S. Census Bureau 2020). Land acquisition is a significant concern for local producers due to high land costs and population density ($\approx 1,600$ people/square mile). The USDA Census (NASS 2017) reported that most farms (66%) were between 1 and 9 acres and therefore most producers in Salt Lake County farm or graze small acreages that interface residential communities. Salt Lake County has an arid climate and low annual participation rate (34 cm) so supplemental irrigation is essential to sustain many landscape plants (Kopp et al. 2013).

Rapid urbanization has strengthened local interest in the preservation of remaining farms and grazing lands. For example, Salt Lake County government developed an urban farming initiative that explores opportunities to lease County-owned land parcels to local agriculture operators. In 2023, a private landowner/leaser contacted USU Extension seeking assistance to enhance the environmental function of the property. The 5,000 square meter parcel could legally house up to 6 horses and was surrounded by adjacent wetlands that ultimately drained into an area watershed. Extension worked with the client to develop an urban interface plan, design a rotational grazing pasture system, and address soil management and water quality concerns. Key takeaways from this case study illustrate ways Extension can work with small acreage operators in urbanized areas to enhance sustainable management and environmental stewardship of fragmented agricultural landscapes.

Introduction

The Cooperative Extension Service in the U.S. provides research-based, non-biased information and outreach to residents. Traditionally land grant Universities specialized in mechanical arts and the agricultural sciences and are still vanguard providers of technical support to local producers and land managers. Statewide, Utah has lost about 20% of its agriculture lands (2.7 million acres) in the past 60 years to development and mining extraction which has impacted food security, clean water, wildlife habitat, and recreational opportunities (Jeremias 2024). Nearly all farms and ranches in urbanized Salt Lake County have been converted to homes and businesses and many remaining agriculture properties are fragmented and surrounded by public and private development. Animal managers in urban areas, particularly those with surface water bodies, face an elevated risk of the public coming into contact with contaminants such as pathogens and nutrients that originated from their operation. A 2023 outbreak of Shiga toxin producing *Escherichia coli* O157:H7 in Utah sickened at least 13 children who were thought to be exposed via untreated irrigation water. City dwellers are not always attuned to the dangers of untreated water bodies. In the Utah case, the sickened children were drinking and playing in contaminated water thought to have originated from animal feces in open reservoirs. A subsequent Center for Disease Control (CDC) incident report cited a need to better educate the public on the dangers of human and animal exposure to contaminants in untreated water. Each year the Utah Department of Environmental Quality monitors several water bodies within Salt Lake County for waterborne pathogens and Harmful Algal Blooms (HABs). Cyanobacteria are aquatic bacteria that photosynthesize like algae and form blooms in surface water bodies with high nutrient loads, often from sources such as manure run-off and landscape fertilization that reaches storm drains. Therefore, waterborne pathogens and HAB blooms directly connect property management decisions with public health and safety concerns in urban areas. HAB warnings are frequent in Utah in the summer months and impact residents who visit public parks and open spaces with access to reservoirs, streams, and open canals carrying water. Posted warnings inform visitors that HABs produce dangerous toxins and pose a serious health risk to humans, pets, livestock, and wildlife exposed to the water. From personal experience, many in the public are poorly informed on the exposure risks of waterborne pathogens and HABs. Our Extension office fields several calls each year from the public with questions about potential health implications to both people and pets. Therefore, the objectives of this case study are to detail a site management plan that was developed with one urban horse manager on best management practices that both enhanced the property site and minimized the risk of nutrients and pathogens contaminating water sources. Discussion from this case study carries relevance to city managers that must conscientiously navigate decisions pertaining to the co-existence of urban agriculture operations and adjacent communities.

Methods

Three site visits were made to a 5,000 m² horse farm in 2024. The property was assessed for size, proximity and orientation to adjacent properties and uses, slopes and other geographical features, water bodies, pasture condition, manure management, barn and corral lay-out, irrigation infrastructure, soil conditions, and existing flora and fauna. Approximately a third of the farm site housed the barn, parking area, and corral and was owned by the operator. The remaining property (pasture) was leased from the County. Another property immediately adjacent to the farm site was also housed horses and was leased from the County. The leased parcels were connected to and part of the Holladay Lions portion (153,000 m²) of Big Cottonwood Regional Park which is owned and operated by Salt Lake County Parks and Recreation. The broader public park features natural areas, wetland drainage areas, playgrounds, sports fields, and a recreation center. Site assessment observations for the study area are organized under the subsequent pasture, manure, and landscape headings.

Pasture

At the time of site visits, there was very little vegetative growth on the leased pasture area. A major priority of the property manager was to increase vegetative growth in the pasture in an effort to restore seasonal grazing potential. The adjacent corral and barn were zoned to house up to 4 horses, and the leased property was zoned for 6 horses. The operator wanted to utilize the 3156 m² pasture for forage. A small seasonal stream bordered the pasture area on two sides. During the first site visit in May 2024, the stream contained water and flowed toward wetland drainage areas. The stream delineated the property boundary between two leased parcels, so the manager had fenced along the stream to keep the horses out of the waterway and restrict their movement off property. Natural vegetative growth on the streambank was lush and diverse with desirable species, such as timothy (*Phleum pratense*) in abundance. The natural existence of timothy and other wet thriving plant species indicated adequate soil moisture. The manager did have access to treated water via the corral, however the pasture did not have permanent irrigation infrastructure at the time of site visits.

Manure

Environmental Protection Agency (EPA) and state animal feeding operation (AFO) regulations prohibit any discharge of manure or feed into a federal water or water of the state (USU 2024). There is no minimum amount of contamination, or number of animals exemption. There is a grazing exemption where livestock within the pasture can directly access water but only if there is adequate vegetation present across the entire area. Horses produce about 5.4 metric tons of manure per year, and that amount doubles with bedding included. Therefore, six horses housed on a 5,000 square meter parcel will generate 65.3 metric tons of waste per year. During site visits, the manager was disposing all waste via sanitation collection. Although discarding manure into a landfill is not ideal from a nutrient recycling perspective, it is a safe disposal method. The site was assessed for feasibility of on-site composting because many local gardeners seek out sources of nutrients like composted animal manures. Manure storage ordinances vary by state and municipality, but a pile must typically be distanced a minimum of 30.48 meters away from streams, ponds, or wells. Nutrient values vary from source and type, but horse manure contains roughly 0.7% N, 0.4% P₂O₅, and 1.1% K₂O (Stock and Miller 2019). Manure that enters water sources via run-off or windblown dust can contribute to nutrient loading in surface water bodies causing algal blooms and other environmental degradative processes.

Landscape

The land manager prioritized landscape improvements including dead plant matter removal, noxious weed control, planting of desirable trees, shrubs, forbs, and grasses, and diversification of landscape plants. Trees and shrubs are important assets to pastures since they help cool the landscape in the summer and provide a windbreak in cold weather. Root systems stabilize streambanks and hillsides, reduce run-off, and operate as landscape filters that trap materials and settle sediments. Diverse landscape plantings also enhance habitat for beneficial insects and urban wildlife. Dense vegetation keeps the soil covered and helps trap and reduce dust. Our Extension team worked with the land manager to identify desired vegetation, identify and manage noxious weeds including appropriate herbicide options for use around water bodies, discuss long-term control of invasive trees and shrubs, and draw connections between soil conditions and appropriate plant selections.

Results

Pasture

Given the limited size, proximity to wetland soils, and testimony from the manager that the pasture stayed green most of the year, it was determined that established pasture grasses would likely receive adequate

moisture most weeks through subsurface irrigation. The manager was encouraged to manually run a sprinkler during grass seed germination and prolonged periods of dry conditions. Soil samples collected from the pasture area indicated a loamy soil with normal pH (8), very high salinity (3-5 dS/m) and high to very high phosphorus and potassium levels (mg/kg). Samples within the pasture area were difficult to collect due to extreme soil compaction, so the manager was advised to till the soil prior to seeding to lessen surface compaction. There is a correlation between blade height and root depth, so the manager was instructed to restrict grazing until the pasture was 17.8 to 20.3 cm in height. Grazing below 7.6 cm drastically impacts root mass which weakens the grass stand and pre-disposes the pasture to weed invasion (Barnhill and McKendrick 2008). The manager was encouraged to divide the pasture acreage into two to three paddocks and develop a rotational grazing plan which confines animals in one section of paddock while non-grazed areas 'rest' and produce forage. In Utah, most irrigated paddocks can be re-grazed after three to four weeks of 'rest' and a minimum of four paddocks are necessary for sustainable rotational grazing systems. The leased pasture footprint was insufficient for four confined paddocks, so the manager was encouraged to utilize the corral when pastures needed rest and to feed hay. One suggestion was to allow horses paddock access for a few hours in the morning and evening to ensure the nutritional needs of animals were met while eliminating excessive trampling. It was also advised to only irrigate after grazing to avoid hoof compaction on wet soils.

Manure

Water test results from two on-property sample points and one additional sample point on public park property identified water highly contaminated with coliform with much of the contamination being from *E. coli*. *E. coli* levels from the two on-property samples both tested >2,400 Org/100mL and a sample taken on public park property tested 550 Org/100mL. Although not all *E. coli* bacteria make people sick, the test results do indicate that fecal material was entering water sources. Adjacent parcels of land leased by other managers also allowed for equestrian use, so the precise source/s of contamination was unclear. Drinking water should have <1 colony/100mL of water, and no *E. coli* present. Recreational water, streams or lakes are considered safe if *E. coli* is <235 Most Probable Number (MPN)/100mL in any one sample, and an average <126 MPN/100mL from 5 samples during a 30-day period (UDWQ 2021). Based on water and soil test results, manure spreading on pasture was not advised. Soil test results indicated very high phosphorus levels which raised concerns of excessive nutrient loading in nearby water sources. On-site composting and/or exposed manure storage was also not advised because it would be difficult to locate a pile 30.48 meters away from a water body and a third of the property was severely sloped. The operator could consider a fully contained manure storage system where run-off is prevented and manure could be collected by local gardeners instead of being transported to the landfill. The manager was advised to divert any clean water (i.e., rain, snowmelt) run-off away from the corral and consider establishing vegetated peripheral berms around the paddocks to prevent run-off from the pasture perimeter. Increased vegetative growth in the pasture would increase water infiltration rates, reduce run-off, improve nutrient and water holding capacities, alleviate soil compaction, and induce soil structure formation and hence should be prioritized in short and long-term site improvement activities.

Landscape

During the first site visit, the land manager shared efforts to vegetate streambanks with native plants. The manager was advised to leave the streambank vegetation undisturbed and consider planting seeds to minimize digging. Berm plantings around pasture perimeter should include plant choices that are not hazardous or harmful to the horses and provide the animals an escape from the elements. Due to the elevated salinity levels in the pasture soil samples, the manager was advised to select plants tolerant of elevated salts. Many Utah native riparian plants have moderate to low tolerance of high salinity and/or compaction, so it

is best to select plants with higher tolerances to existing site conditions. Other areas of the property were more favorable for heat and drought tolerant plant selections. The land manager was informed that drought tolerant trees and shrubs should receive frequent irrigation prior to establishment. Our advice was to spread the timing of the new plantings out so she could keep up with the irrigation needed to establish new landscape plants. Our team advised that areas identified for invasive species removal should also be targeted for new plantings to ensure disturbed ground was filled by desirable species. Finally, we encouraged the land manager to take advantage of appropriate plants that are readily available and easy to plant, such as willow whips, which are easy to harvest and root. Qualitatively, the manager shared that she has seen greater abundance in flora and fauna (birds, insects, native species) since initiating efforts to improve and diversify landscape plantings.

Discussion

Findings from this case study illustrate a need for livestock and grazing educators to work with livestock operators in urban interfaced areas. Since conducting site visits, our Extension team learned that Salt Lake County Parks and Recreation is looking to phase out lease opportunities for equestrian use on park land. An updated Master Plan projects efforts to revegetate and enhance natural areas in park land currently leased for equestrian use. Multiple horse operators with short term County leases have expressed interest in our findings, as they present a case to park officials that horses can be housed on park property in an environmentally sustainable way that also protects health and safety. Recent discussions with the Utah Division of Water Quality and Department of Agriculture and Food officials have highlighted the role of urban livestock and water degradation. More education and oversight are needed to help protect water sources in densely populated areas. Case studies that evaluate site details and constraints and provide appropriate recommendations offer a perceivable conversation bridge between user groups and officials which can both improve management practices and preserve the existence of livestock management operations embedded in urbanized landscapes.

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