Key Findings on Identifying, Prioritizing, and Converting Non-Functional Turf

Introduction

WaterNow Alliance (WaterNow) partnered with the City of Longmont (Longmont) to build on and complement its ongoing residential turf removal rebate program by establishing a data-driven target for reducing non-functional turf on city-owned property. Increasing water efficient and climate appropriate landscapes will enable the City to decrease outdoor water demand and move towards the conservation goals outlined in its Water Efficiency Master Plan. As part of this project, WaterNow conducted desktop research on existing turf conversion programs, as well as relevant academic and gray literature and other local resources describing communities' turf conversion efforts. The research focused on understanding how turf conversion programs and projects were developed and implemented, as well as identifying their impacts in water savings, cost savings, and habitat creation.

Desktop Research:

Eleven academic and gray literature resources on turf conversion efforts were reviewed by the project team:

- Alexa, Kelly, Legislative Council Staff. (2022). Developing Colorado's Turf Replacement Program.
- Hudak, Tom, "Converting turfgrass to xeriscape: Evaluating Southern Nevada water authority's "Water smart program" (2005). UNLV Theses, Dissertations, Professional Papers, and Capstones. 500.
- Jessup, K., & DeShazo, J. R. (2016). Turf replacement program impacts on households and ratepayers: An analysis for the City of Los Angeles. Luskin Center for Innovation.
- Marx, Andrew. (2021). Quantifying the Multiplier Effect of Southern California's Turf Removal Rebate Program with Time-Series Aerial Imagery. Journal of the American Water Resources Association, Vol. 57, No.2.
- Mayer, P., Lander, P., & Glenn, D. (2015a). Outdoor Water Savings Research Initiative. Alliance for Water Efficiency.
- Mayer, P., Lander, P., & Glenn, D. T. (2015b). Outdoor water efficiency offers large potential savings, but research on effectiveness remains scarce. Journal of the American Water Works Association, (2), 61.
- Pincetl, S., Gillespie, T. W., Pataki, D. E., Porse, E., Jia, S., Kidera, E., ... & Choi, D. A. (2019). Evaluating the effects of turf-replacement programs in Los Angeles. Landscape and urban planning, 185, 210-221.
- Song, J., & Wang, Z. H. (2015). Impacts of mesic and xeric urban vegetation on outdoor thermal comfort and microclimate in Phoenix, AZ. Building and Environment, 94, 558-568.
- Trust for Public Land. ParkScore Index. – Link.

- Vasquez, Jenyffer, West Basin Municipal Water District. (2021) Residential and Non-Functional CII Grass Replacement Program. WaterSMART: Water and Energy Efficiency Grants for Fiscal Year 2022. Funding Opportunity Announcement No. R22AS00023.
- Tull, C., Schmitt, E., & Atwater, P. (2016). How much water does turf removal save? Applying Bayesian structural time-series to California residential water demand. In KDD Workshop on Data Science for Food, Energy and Water, San Francisco, CA.

Nine communities with turf conversion rebate programs, or some form of water wise landscape support for their residents, were also reviewed:

- Aurora, CO
- Castle Rock, CO
- Colorado Springs, CO
- Denver Water, CO
- Fort Collins, CO
- Greeley, CO
- Las Vegas, NV
- Vail, CO
- Westminster, CO

Key Takeaways

Much of the academic and gray literature reviewed include a description of the **water saving benefits of turf conversion projects and programs.** For example, Hudak (2005) found that residential water consumption dropped 30% after participation in Southern Nevada Water Authority's Water Smart Program. Along similar lines, participants in Albuquerque's turf conversion rebate program reduced water use by 33% (Mayer et al., 2015a). Turf conversion water savings per square foot can vary, with xeriscape conversion in Las Vegas estimated to save 55.8 gallons per square foot (Mayer et al., 2015a) and turf removal in California estimated to save approximately 25 gallons per square foot (Schmitt et al., 2016). West Basin's Municipal Water District estimated they could save 40-acre feet of water per year after converting 300,000 square feet of turf using the Maximum Applied Water Allowance (MAWA) Calculation developed by California's Department of Water Resources (Vasquez, 2022).

Water savings have been quantified for **turf conversion programs in Colorado** as well. Castle Rock's Colorado Scape Renovation programs have shown a 19 percent reduction in outdoor water use after removing approximately 217,980 square feet of turfgrass since 2015. In addition, Castle Rock's non-residential program has resulted in a 29 percent reduction in outdoor water use. The City of Fort Collins' Residential Xeriscape Incentive Program (XIP) has achieved 6.8 gallons per square foot of water savings (39 percent), and their HOA and Commercial XIP program has achieved an 8 gallons per square foot water savings (50 percent). Resource Central quantified the water savings of xeric gardens in Colorado: a 100 square foot xeric garden saves over 7,300 gallons of water over the garden's lifetime compared to Kentucky Bluegrass. See the Turf Conversion Database and Financing the Future: How to Pay for Turf Replacement in Colorado report for more information and additional examples.

In terms of cost, a study on the impacts of Los Angeles' Turf Replacement Program found that when a $1.75 per square foot rebate is offered, typical households make back their initial investment and start saving money in less than 10 years (Jessup et al., 2016). In addition to saving money by reduced irrigation, maintenance costs can be lowered when turf is converted to water wise landscaping (Mayer et al., 2015a). Fort Collins noted that transforming Front Range HOAs is estimated to cost $0.09 per gallon saved, whereas new water supplies cost $0.10 per gallon. It is important to note that studies have noted the difficulty in quantifying water savings from outdoor water conservation programs, and cost savings are rarely documented, according to Alliance for Water Efficiency's 2015 Water Savings Research Initiative. The authors call for more standardized approaches and methods for measuring and evaluating outdoor water efficiency programs (Mayer et al., 2015b).

In a study on the effects of turf replacement programs in Los Angeles, Pincetl et al. (2019) found that a strong correlation exists between rebate program participation and home ownership, income, and supplemental rebates from a local utility, and that the most common replacement landscape is a mixture of shrubby plants and artificial turf. Both Pincetl et al. (2019) and Marx (2021) have shown that **"neighborhood adoption effect" or the "multiplier effect"** occurs when neighbors not involved in a rebate program also transform their lawns, highlighting how rebate programs can reach more than just their participants. This may also be true for turf conversion efforts on city-owned property, as residents become more familiar with alternatives to turf grass.

Some of the resources reviewed discuss the **co-benefits of turf conversion projects and programs,** including reduction in greenhouse gas emissions, improved stormwater management, and reduced Urban Heat Island effect (Vasquez, 2022; Song and Wang, 2015). The resources reviewed did not typically go into detail on how "non-functional" or "non-essential" turf are defined. The Issue Brief explaining House Bill 22-1151 for the Colorado Legislature provides both a definition and examples of non-essential turf in Colorado (Kelly, 2022). Any turf that is "ornamental and not used for recreation" qualifies as non-essential turf and a few example locations include medians, stormwater drainage and detention basins, and areas sloped more than 25% grade. To learn more about how communities in Colorado, and more broadly in the Colorado River Basin, define "non-functional" and "non-essential" turf, see this detailed summary of local definitions of non-functional turf.

Communities in Colorado have implemented turf conversion programs for residential, commercial, institutional and industrial (CII), and public properties, resulting in a wide array of benefits. For example, Fort Collins has a turf conversion rebate for residential, commercial, and parkways. Between 2016 and 2019, Fort Collins converted 200,000 square feet of turf, saving an estimated 2.8 million gallons of water each year. Co-benefits of their program include increased local jobs, improved air quality, and meeting regulatory requirements. Since 2010, Colorado Springs Utilities (CSU) has worked with Colorado Springs City Parks to identify areas for turf conversion to native grasses, a program that has improved the appearance of the parks and reduced water use and costs.

Informational Interview Insights

The project team conducted three informational interviews with Colorado communities and analysts engaged in identifying, prioritizing, and/or implementing turf conversion programs in Colorado. Key learnings from these conversations are captured below:

Turf Conversion Benefits:

- Communities found significant cost and water savings from converting non-functional turf to low-water landscapes. For example, one city found that their cost savings from turf conversion project are approximately 90 percent, because mowings are reduced from 28 to 3 per season. Water use at these converted sites is cut in half, because native grass uses 12 inches of water per year while cool-season turf uses 24 inches of water year. The turf conversions typically pay for themselves after 1 year.
- In other community, the conversion to low-water landscapes cut the number of necessary mowings in half, from 4 times per month to 2 times per month.

Turf Conversion Identification and Selection Methods:

- Approaches to identifying sites with non-functional turf, and to prioritizing sites for conversion to low water landscapes, included considerations of:
  - water use analysis to determine which parks use the most water,
  - size of turf area in parks,
  - the level of use,
  - site visibility,
  - health of existing turf,
  - areas where maintaining turf is challenging, and
  - labor requirements for turf conversions.
- It is vital to tap into local knowledge from parks technicians and to conduct boots-on-the-ground visits to look at the site conditions (e.g., trees, slopes, size of turf area). These visits should also flag any potential machinery or irrigation system challenges. For instance, how difficult will it be to get machinery into a site, especially if it small and sloped? What kinds of irrigation system modifications are necessary before seeding?
- One community has found The Native Grass Guide to be foundational in selecting native grass blends for their area.

Irrigated Turf Spatial Analysis Data and Methods:

- Categorizing how turf is used through spatial analysis requires: (1) open space and parks layers, as well as (2) land use layers, specifically at the parcel scale rather than at the zone scale. Other datasets – capturing demographic, environmental justice, or other information – can help to further contextualize and prioritize sites for conversion.
- One potential source for capturing land use data in the Denver, Colorado region can be found in the Denver Regional Council of Governments (DRCOG) datasets, which are very useful for mapping irrigated turf. The regional data catalog includes open, publicly available data to help

inform decision making around land use, mobility, and changing demographics. The irrigated turf layer, found in the Land Cover dataset, is overall very accurate and has high spatial resolution (0.5 or 1 meter). The major downside to this dataset is that grass under tree canopy is not included. Grass under tree canopy typically requires does typically require less water and is often not prioritized for conversion. The Planimetrics Extent dataset, which includes geographic objects on the earth's surface, like buildings and roads, is useful for identifying different surface types, including medians.

- Additional sources of data to consider integrating into an analysis include:
    - HOA data, which is useful because many times open spaces are not in parks layer but instead are located in HOAs.
    - NAICS codes for individual businesses, which can be mapped to fine-tune which businesses might need some level of irrigated turf.
- When determining a methodology to identify "non-functional" turf, it is important to determine if the goal is to identify turf to remove or to identify turf to preserve. Additionally, turf "is a social construct," so working with a community to understand what turf they want to prioritize is critical.
- There is a balance between spending time and resources to do a detailed mapping effort of turf versus a high-level analysis. The choice depends on the overall goals and timeline of the project.

Water Saving Estimates:

- To conduct high-level water saving estimates, the percentage of total turf to be replaced and the estimated water use of the replacement landscape are needed.
- Native grass is typically much less expensive to install and maintain than xeriscaping.
- High-level scenarios of high and low replacement can provide useful water savings estimates to better understand the potential benefits of converting cool-season turf to lower water use landscaping.

Challenges:

- One community flagged that coordinating new mowing schedules and maintenance with landscaping companies on converted sites has proved somewhat challenging. Pollinator gardens require different maintenance than simply mowing grass, especially during the establishment period, and some landscaping companies are not currently prepared to maintain these new landscapes.
- Misconceptions about native grass typically expressed by community members include:
    - native grass is full of weeds,
    - native grass is a fire risk,
    - native grass will lower property value, and
    - native grass harbors mosquitos, snakes, or other pests.

Communication and Public Engagement:

- To communicate a turf to native grass project to the community, one community puts up signs at park entrances that provide an overview of the project, including the long-term goals to address common questions and contact information.
- It can also be helpful to go door to door or attend a board meeting before starting a turf conversion project, to pre-empt any questions or address any concerns from community members.
- It is important to frame how turf conversion will add value and services to an area and for the community, to ensure that residents do not feel that something is being taken away from them.
- Keeping native grass mowed and “turf-like” can be a useful tactic to reduce friction from community members in reaction to landscape changes.