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Reclaiming Water for Urban Foodsheds: Program Overview

Krishna Pagilla, Professor and Chair
Department of Civil and Environmental Engineering

David Hanigan, Assistant Professor
Department of Civil and Environmental Engineering

Yu Yang, Associate Professor
Department of Civil and Environmental Engineering

Paul Verburg, Assistant Professor
Department of Natural Resources & Environmental Sciences

Kelley Sterle, Assistant Research Professor and Outreach Specialist, Water Resources
University of Nevada, Reno Extension

Loretta Singletary, Professor and Interdisciplinary Outreach Liaison
University of Nevada, Reno Extension, Department of Economics

Reclaiming Water for Urban Foodsheds *integrates basic scientific research with Extension outreach to examine the feasibility of using reclaimed water resources for irrigated agriculture in urban environments. Funded by a grant [2017-69007-26309] from the USDA National Institute of Food and Agriculture, research is conducted in University of Nevada, Reno campus laboratories and the Nevada Agricultural Experiment Main Station Farm and Greenhouse Complex. This fact sheet provides a research program overview, and subsequent fact sheets will disseminate research results as part of a series.*

Introduction

Wastewater from domestic and industrial sources has the potential to provide both water and nutrients to support agriculture within close proximity to urban areas. Sixty percent of irrigated croplands across the globe are located within 20 kilometers of urban areas (Thebo et al., 2014). Due to its close proximity to consumers, urban agriculture is an important economic

driver and also enhances food security. Direct wastewater reuse for agriculture is limited in the U.S., although it is commonly practiced worldwide, often at small scales and with minimal or no water treatment.

In arid and semi-arid areas, such as Nevada and the western U.S., conflicts often arise between competing environmental and agricultural water users during prolonged droughts and summer low-flow periods. Policies that support and facilitate the use of highly treated wastewater for irrigated agriculture may help alleviate conflicts over scarce resources (Blanco-Gutierrez et al., 2013).

The key constituents removed from treated wastewater are biochemical oxygen demand, total suspended solids, nitrogen, phosphorous, microorganisms (as bacterial indicators) and some inorganic/organic chemicals. Although regulations exist in Nevada and California, for wastewater reuse for irrigated agriculture, further treatments may be required to remove additional pollutants including emerging contaminants that are present in wastewater effluent. These include pharmaceuticals, personal care products, surfactants, flame retardants, plasticizers, pesticides and herbicides (Jelic et al., 2011). The extent to which some of these compounds may bioaccumulate or biomagnify through the food chain is unknown; therefore, potential exists for harmful effects to ecosystems or human beings even at low concentrations (nanogram or microgram per liter).

The *Reclaiming Water for Urban Foodsheds* research program addresses this knowledge gap by investigating the potential use of reclaimed water in urban irrigated agriculture and identifying any potential associated human health impacts and necessary mitigation measures. The resulting knowledge aims to support the adaptation of wastewater treatment systems to produce water suitable for irrigated agriculture.

Reclaimed water could provide a cost effective and sustainable resource in the context of the food-energy-water nexus. Such knowledge will also enhance water sustainability in arid regions, such as the Truckee-Carson River System of northwestern Nevada, which includes the Truckee Meadows high-desert foodshed and surrounding agricultural communities.

Research Objectives

The key research objectives of the *Reclaiming Water for Urban Foodsheds* program are to:

- Identify chemical contaminants in reclaimed water used for urban irrigated agriculture;
- Determine pathways of contaminant entrainment via water, soils and sediment into agricultural products (i.e., forage crop and animal production);
- Develop predictive models for the fate of trace organic chemicals during wastewater reuse and evaluate associated human health risks of identified contaminants at their respective concentrations; and

- Develop health risk mitigation strategies over the course of the agricultural production chain, particularly focusing on reclaimed water production for irrigation.

Methods

The University of Nevada, Reno project team members have been conducting basic and applied research related to reclaimed water production, water reuse for urban irrigated agriculture, student education, and integrated research and Extension outreach focused on innovative water-use efficiency and equity, soil health, economically viable and sustainable agricultural production, and related public policy and decision-making processes.

Research team members and students conduct the research in campus laboratories and at the farm scale using Nevada Agricultural Experiment Station laboratories. These include the Greenhouse Complex, located on the University campus, and Main Station Field Laboratory, which uses treated water released from the adjacent Truckee Meadows Water Reclamation Facility (Figure 1).

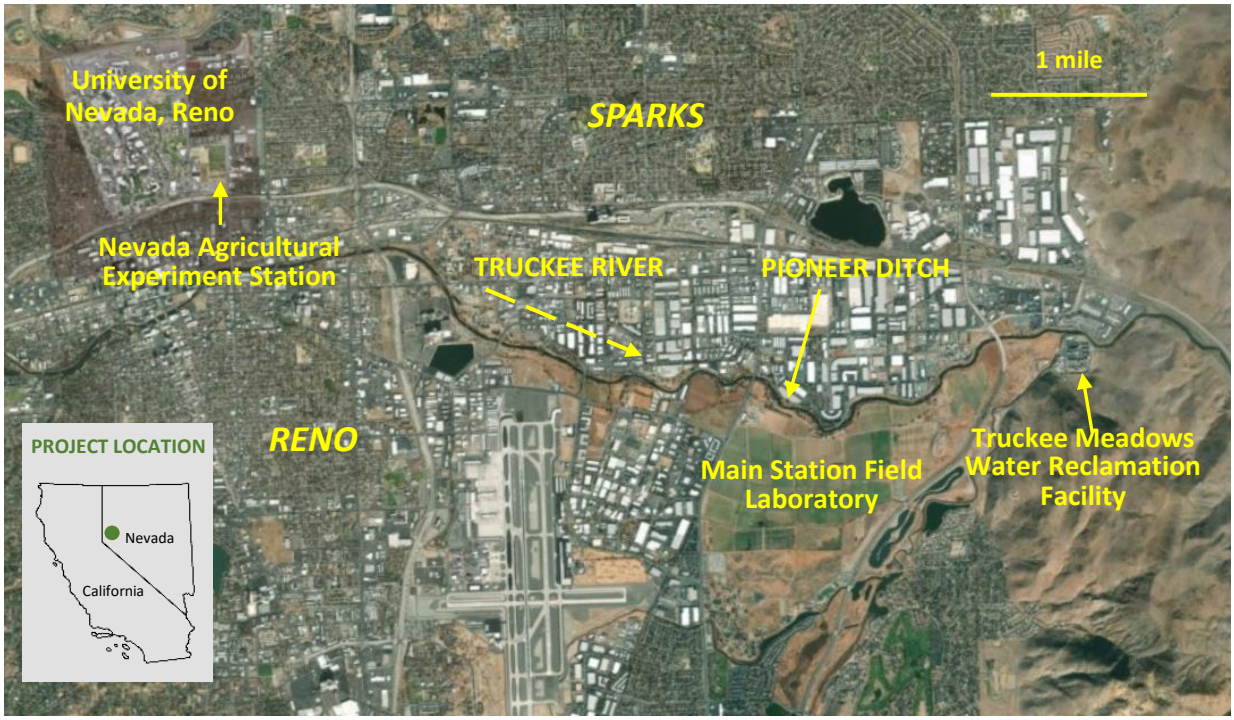

Figure 1. Map depicting key locations for the *Reclaiming Water for Urban Foodsheds* integrated research program, including Nevada Agricultural Experiment Station facilities, university laboratories and Truckee River waterways. Map created by Kelley Sterle, University of Nevada, Reno Extension.

The pathway to be tracked, sampled and measured for emerging contaminant concentrations and their seasonal variation is shown in Figure 2. The Main Station Field Laboratory demonstrated local treated wastewater reuse for urban agricultural irrigation, where currently about 10 to 15 percent of treated effluent water is used for agricultural purposes. This water reuse makes available additional surface water to the Pioneer Ditch of the

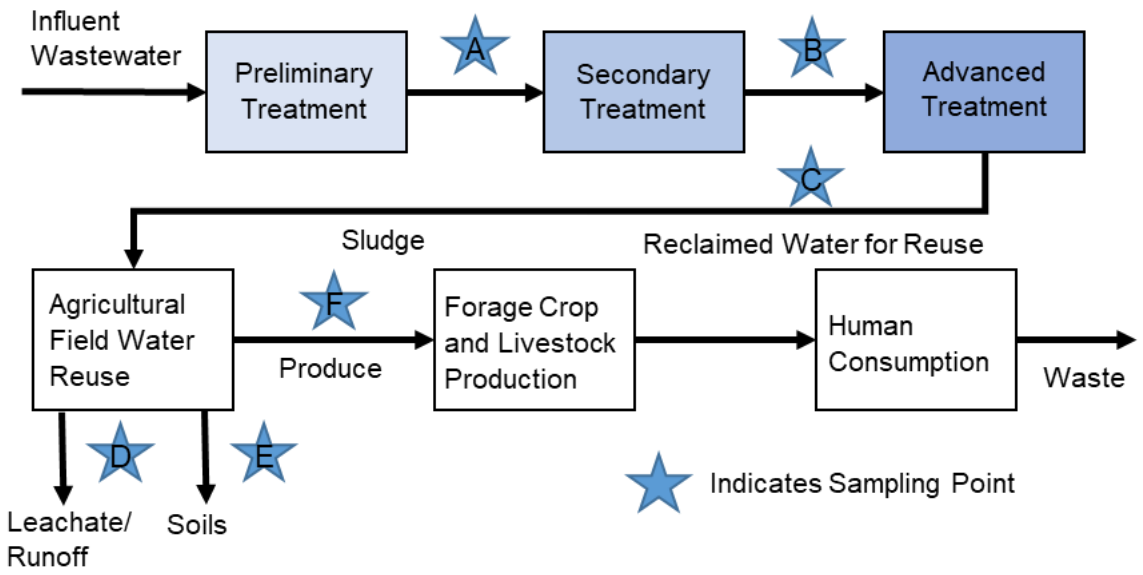

Figure 2. Schematic demonstrating sampling points of emerging contaminant pathways in reclaimed water used for urban irrigated agriculture.

Truckee River. That is, replacing surface water with reclaimed water for agricultural irrigation increases the natural flow of the water in the Truckee River available to lease for downstream environmental or agricultural purposes.

Additionally, the consumptive use of effluent water increases its ability to meet mass load discharge limits for nitrogen and phosphorus during irrigation periods. The integrated research taking place at the Main Station Farm Laboratory benefits the surrounding arid Truckee Meadows region. This research and findings have clear implications for urban irrigated agriculture in other arid regions in the western U.S. and globally.

Expected Outcomes and Impacts

Expected outcomes include contributions to both basic and applied research. Research outcomes are integrated with Extension outreach to educate and enhance the decision-making capacity of:

- Agricultural producers concerning the benefits and risks associated with reclaimed water use for irrigation;
- Water reclamation facility and water utility staff concerning the potential risks, mitigation needs and methods to improve suitability of reclaimed water for use in irrigated agricultural production; and
- Affected stakeholder communities, including food consumers and policy makers, about the feasibility of using reclaimed water resources for irrigated agriculture.

Project research findings are shared with all of these stakeholders. Additionally, project findings are used to educate middle school, high school, undergraduate and graduate students.

Sharing the results of this research project with the public increases awareness of this alternative water resource. It also improves specific knowledge, skills and capacity to practice sustainable agriculture and water management, thus enhancing the nation's food security and water resiliency.

References

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