Use it again:
Using reclaimed water and urban water issues

Dr. Mary Lusk

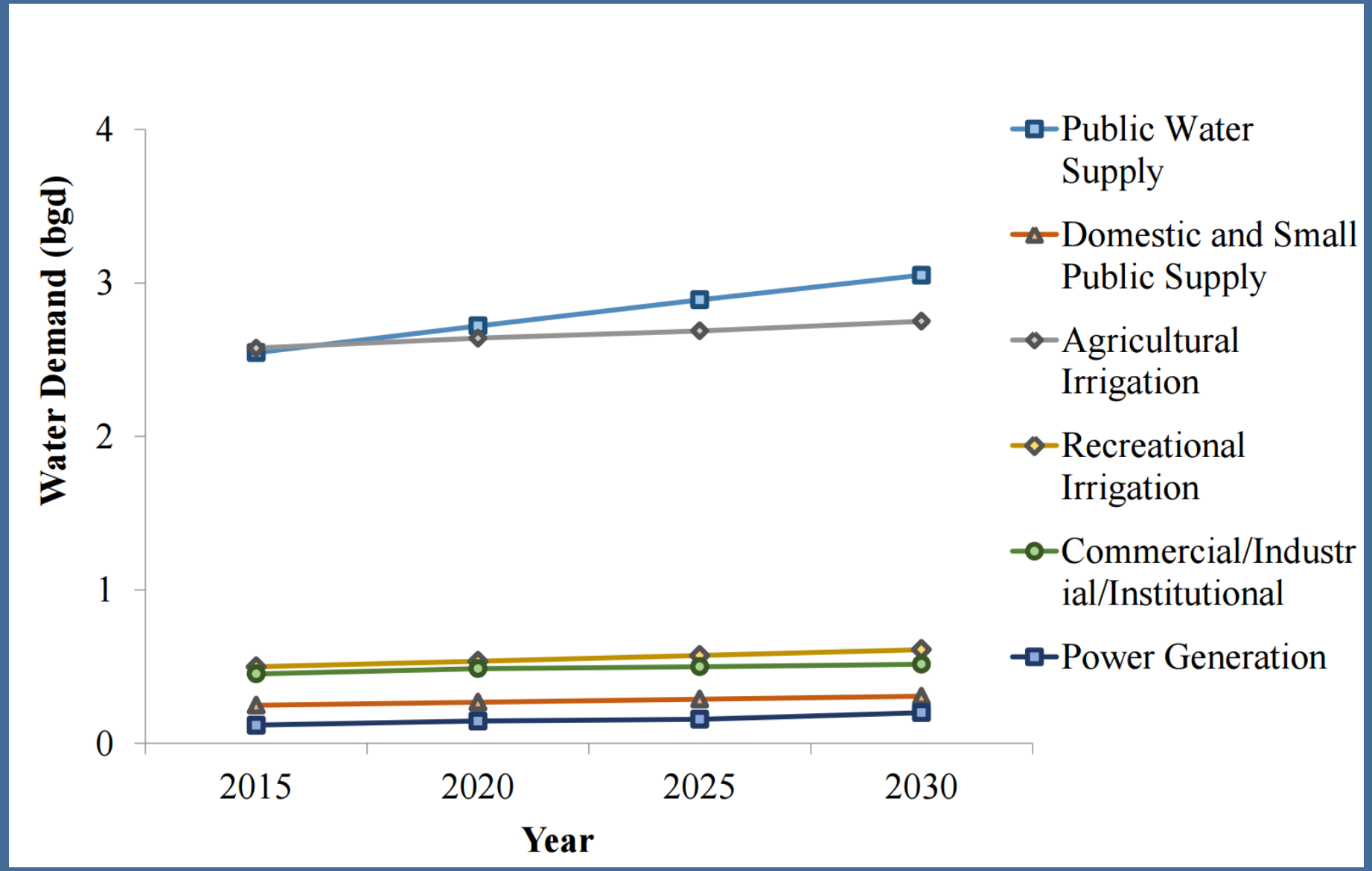
University of Florida

Objectives

- Introduce water supply issues in Florida
- Explain how reclaimed water is produced
- Outline ways that reclaimed water can be used, including landscape, agricultural, and other uses
- Describe the chemical constituents in reclaimed water and their fate in the environment
- Overview ways to account for salts and nutrients from reclaimed water in landscape plans

Water Supply in Florida

Got an extra 300 million gallons per day?


Water Demand (bgd)
4
3
2
1
0
2015
2020
2025
2030
Year
Public Water Supply
Domestic and Small Public Supply
Agricultural Irrigation
Recreational Irrigation
Commercial/Industrial/Institutional
Power Generation

Florida's Water Forecast

Over the next 20 years…	Net Demand Change	Future Demand Not Met	Future Demand Not Met after Conservation	Potential Water from AWS Projects
Statewide	1,394 mgd	538 mgd	277-331 mgd	1,981 mgd

Where is this water going to come from????

What is Reclaimed Water?

Also known as recycled water or reuse water

Former domestic wastewater that has been treated and disinfected at a wastewater treatment plant.

It can then be disposed of or put to some beneficial reuse.

How Reclaimed Water is Produced

- **Primary Treatment**
- Sewage held in a basin so solids can settle
- **Secondary Treatment**
- Water left behind is chemically and/or biologically treated to remove impurities
- **Advanced Treatment**
- Further treatment to remove harmful chemicals and pathogens

“water that has received at least secondary treatment and basic disinfection and is reused after flowing out of a domestic wastewater treatment facility”

Chapter 373, Florida Statutes

How is Reclaimed Water Regulated in Florida?

- Standards established by FDEP
- Transmitted in purple pipes that are kept separate from drinking water
- Areas of use must post signs to alert the public of reclaimed water use
- Not for drinking or sanitary purposes
- Florida is pilot testing applications and treatment technologies that will allow for increased reuse, including potable reuse

Is Reclaimed Water the Same as Grey Water?

- No
- Grey water: wastewater from households or businesses, but contains no fecal contamination
  - From laundry, bath, shower
  - Not from toilet
  - Re-used at place of origin, such as in the home or backyard garden

Top 3 RW users in the United States

California

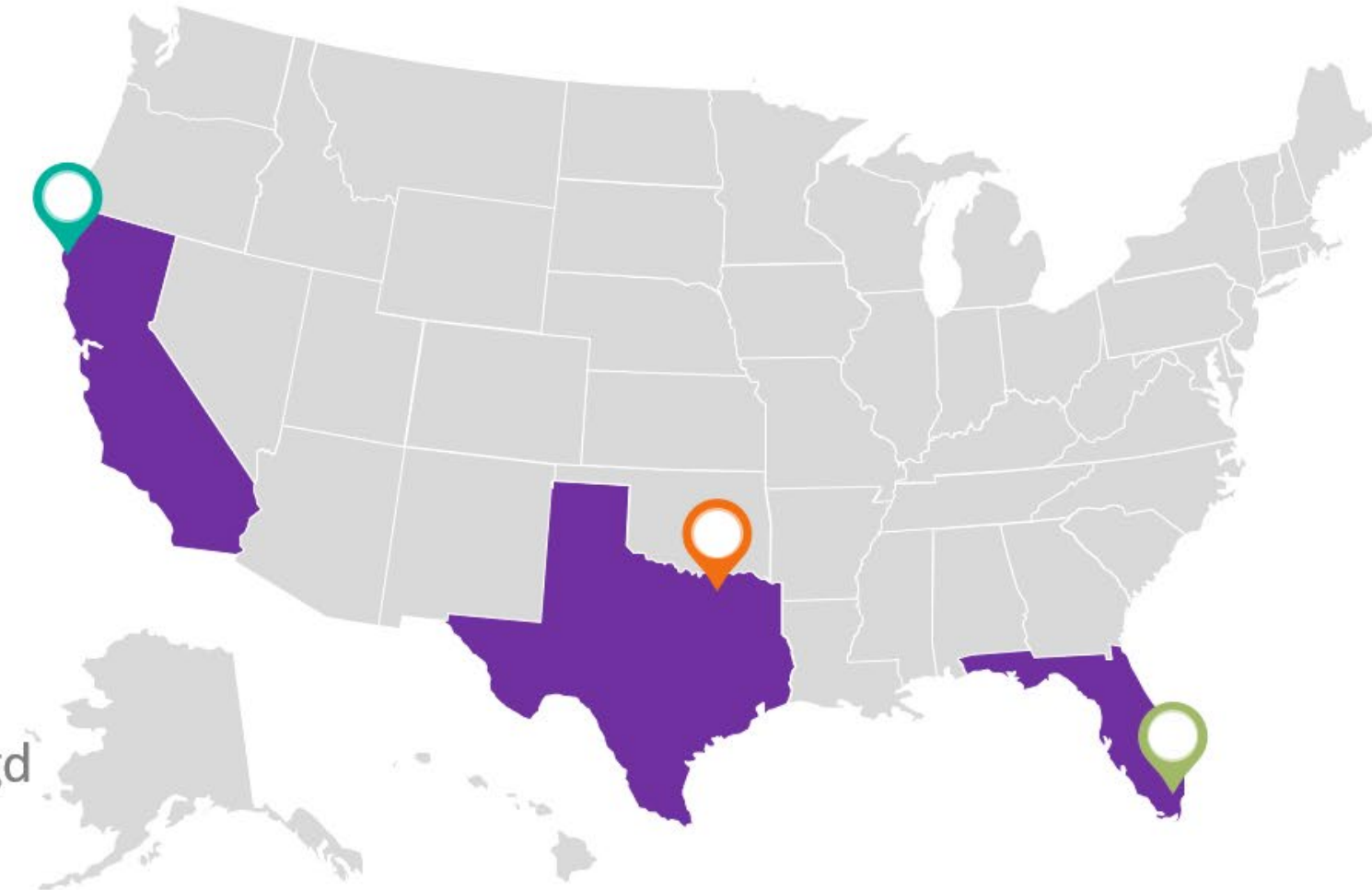
530 mgd

Texas

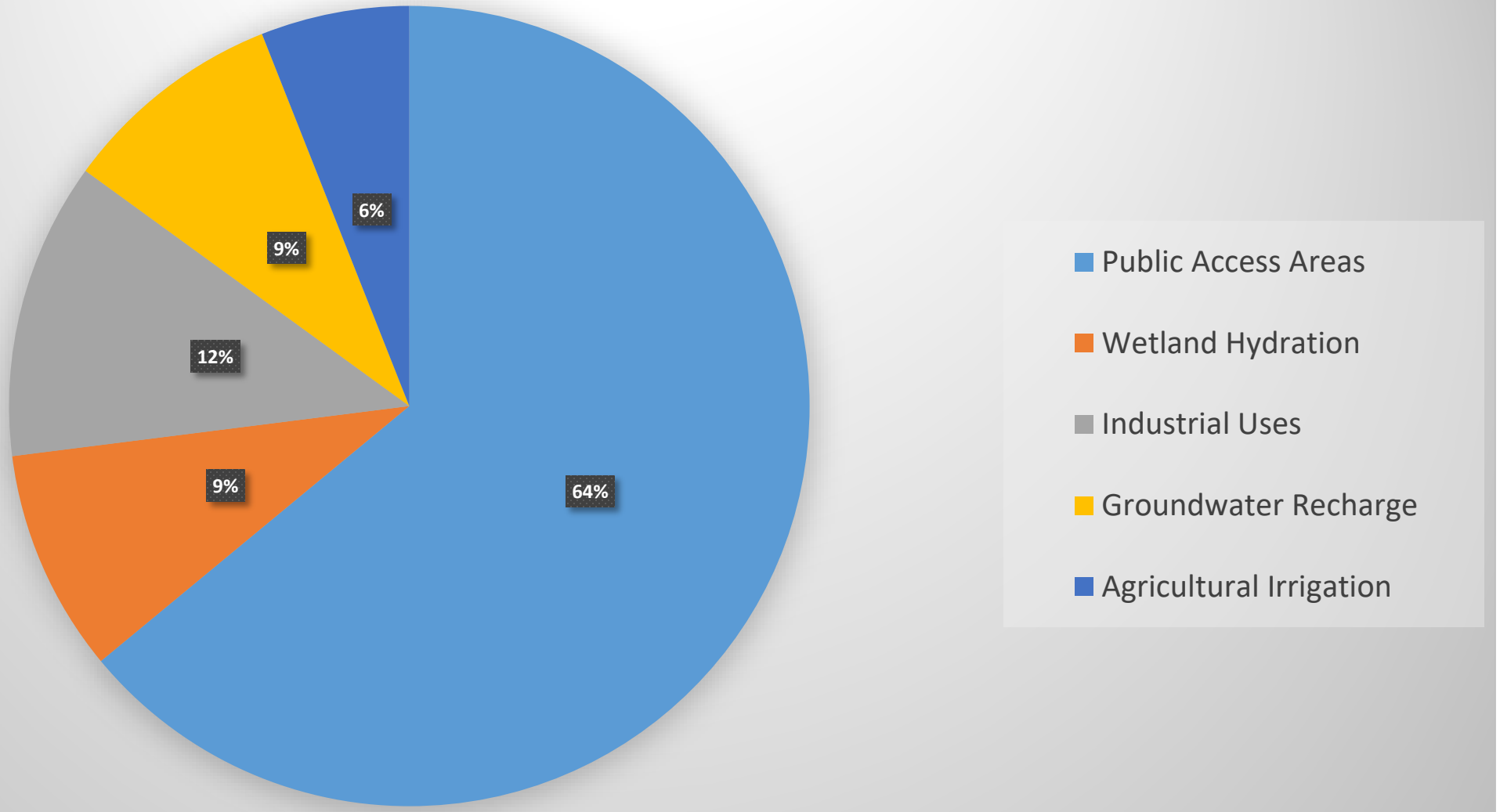
31 mgd

Florida

National leader at 884 mgd



Florida's Reclaimed Water Use by Application



Chemical Constituents of Reclaimed Water

What's in it?

Salts and Other Inorganic Compounds

- Higher levels of sodium, chloride, and boron because these are used in household products

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Salt-Tolerant Plants for Florida

Salts

Typical area reclaimed water:

- 150-300 ppm chloride salts
- Most landscape plants tolerate up to 400 ppm
- Exceptions: dwarf azalea and Chinese privet very salt intolerant
- Camellia and gardenia may develop leaf yellowing if irrigated with reclaimed water

Dwarf Azalea and Chinese Privet:

Very salt intolerant

Salts: Some Guidelines

- Get water/soil tested for TDS (a measure of salinity)
- Plant salt-tolerant species
- Watch for leaf yellowing (and rule out that it’s not being caused by general overwatering)
- Consider drip irrigation for sensitive species or if leaf yellowing occurs
- Maintain adequate site drainage; add organic matter or break up compacted soils

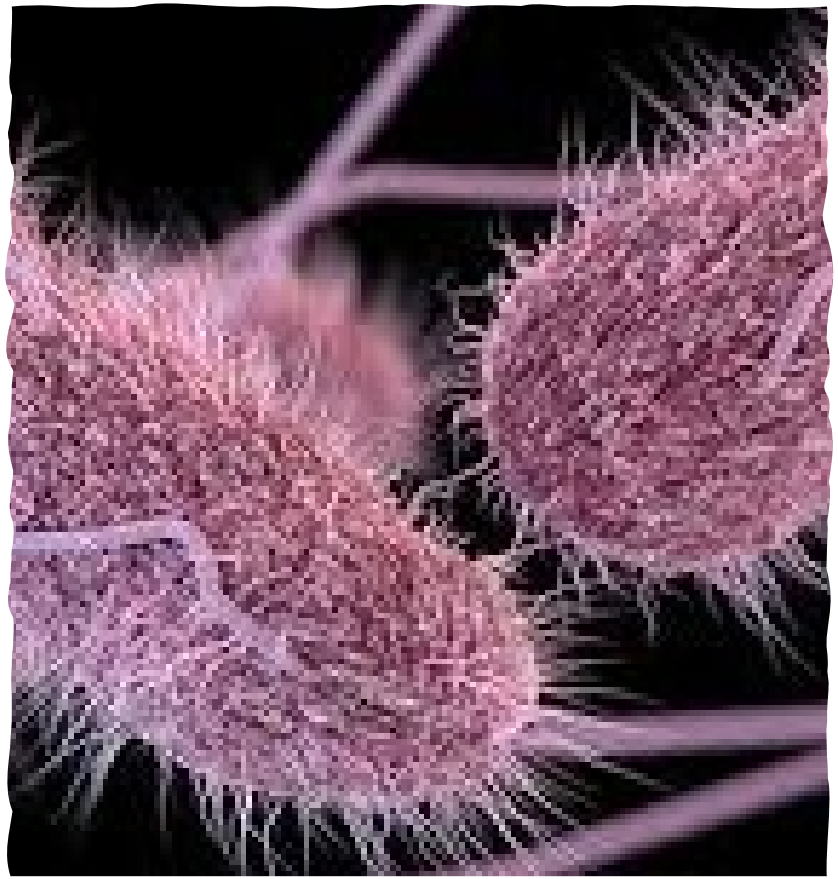
Nutrients

- Both nitrogen and phosphorus are in wastewater
- Not all is removed by wastewater treatment, so reclaimed water contains nutrients
- Account for this in your fertilizer plan!

Nutrient Form	Untreated wastewater, ppm	Concentration after secondary wastewater treatment, ppm	Concentration after advanced wastewater treatment, ppm
Total Kjeldahl Nitrogen	31.5	13.9	0.9
Organic Nitrogen	9.5	4.4	0.1
Ammonia Nitrogen	22.0	9.5	0.8
Nitrate Nitrogen	0.1	1.4	0.7
Inorganic Phosphorus	6.1	3.4	0.1

Toor and Lusk, 2011

Pathogens



- Bacteria, viruses, protozoa, parasitic worms
- Have been detected in reclaimed water but not at harmful levels
  - E. coli and salmonella can survive for days on plant surfaces
- In Florida, there are NO documented cases of infection from reclaimed water
- Wash your hands and wash any veggies irrigated with reclaimed water, in an abundance of caution

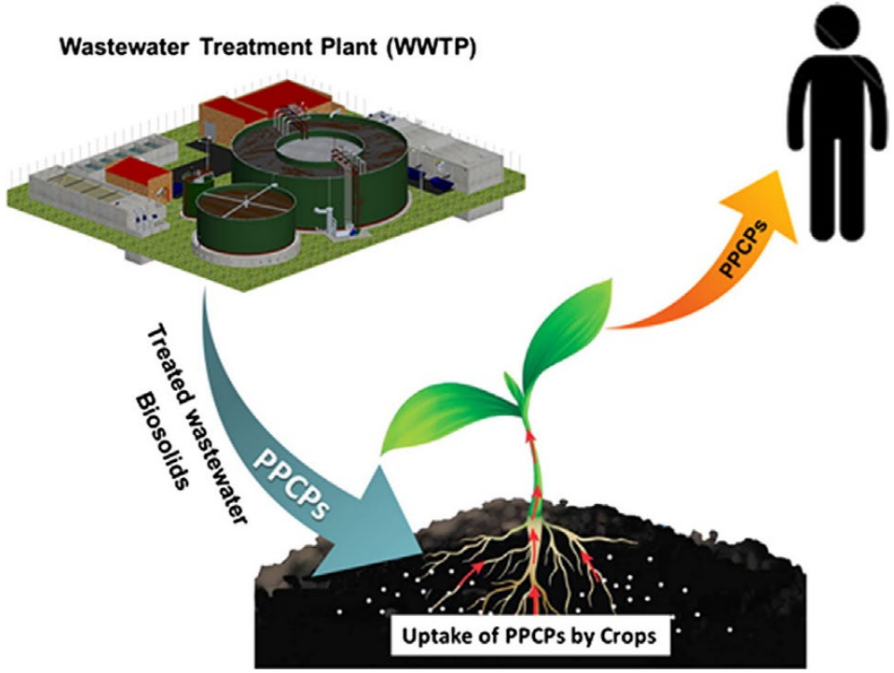
Emerging Contaminants

- Pharmaceuticals, personal care products, flame retardants, plasticizers
  - Detected in reclaimed water at ng/L to low µg/L levels
- Reclaimed water → turf runoff → surface water bodies = potential harm to aquatic wildlife
- Reclaimed water → irrigated food crops = potential plant uptake and human consumption

Emerging Contaminants

- Most-detected in wastewater

Pharmaceuticals	Personal Care Products
Antibiotics	Triclosan
Anti-inflammatory	Triclocarban
Anti-convulsants	



Wu et al., 2015

Emerging Contaminants

- Estimated annual exposure from daily eating leafy vegetables: 0.04 – 350 µg
  - Medical dose: 20 – 200 mg
- Exception: triclosan: found to accumulate in leaf tissue and provide >80% of acceptable daily intake (Carter et al., 2014)

Overwatering

- Can you over-irrigate with reclaimed water?
  - Of course! Overwatering is overwatering is overwatering!
  - Reclaimed water use is not restricted in some areas, but users should still apply recommended irrigation rates (3/4 to 1 inch per week), use a rain sensor to shut off irrigation during storms, etc.

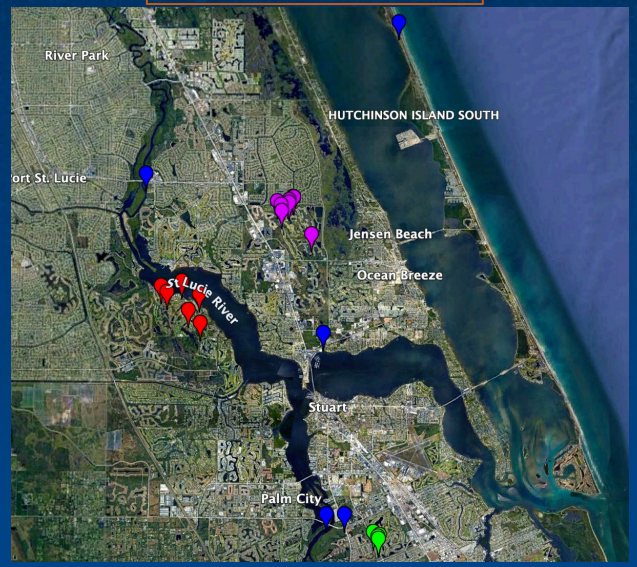
Overspray

- Teach homeowners to avoid overspray
- This can be a pathway of excess nutrient transport to water bodies when irrigating with reclaimed water

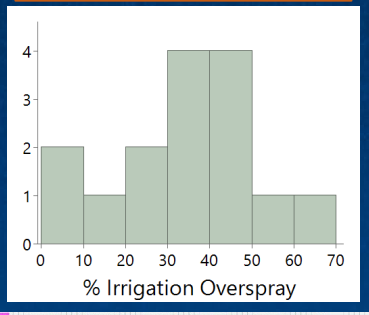
Quantifying Nutrient Loads From Residential Reclaimed Water Landscape Irrigation Overspray in the Indian River Lagoon Watershed

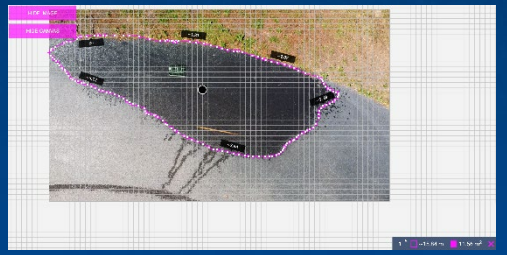
Methods

Research Area



Results





Dylan Barr & Dr. Mary Lusk
University of Florida
Gulf Coast Research and Education Center

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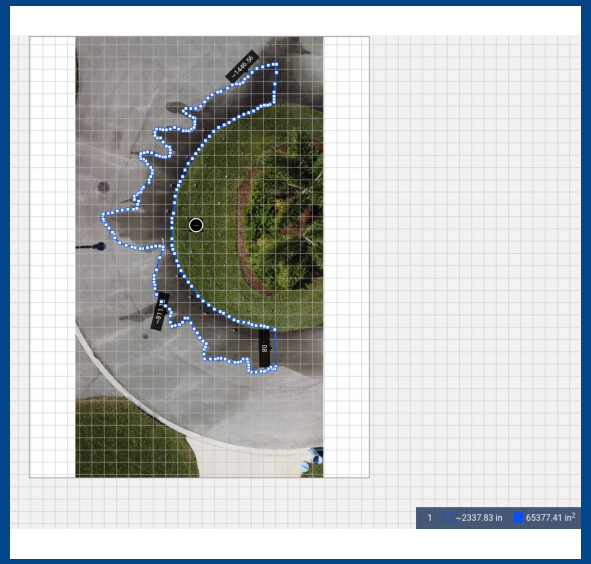
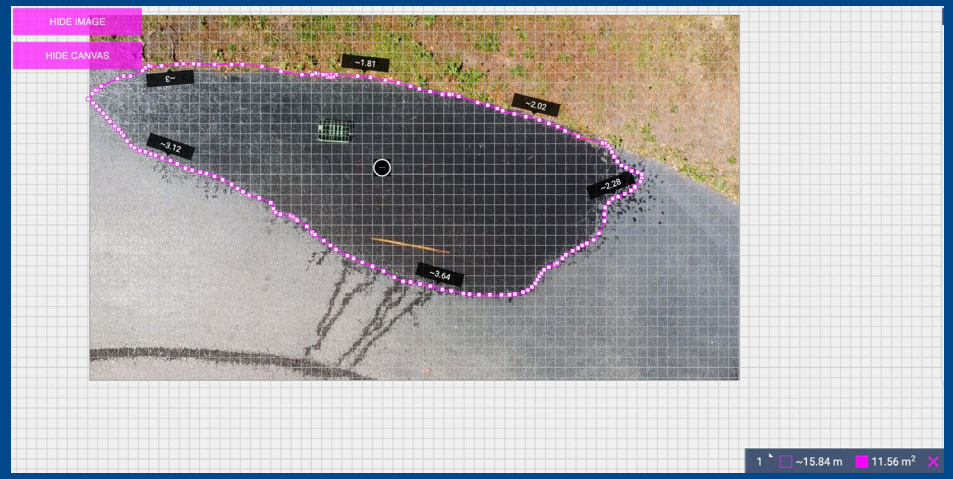
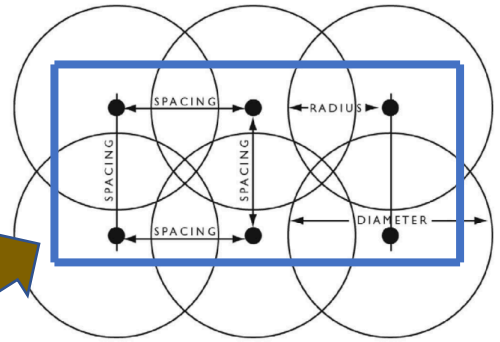
Overspray Area Calculation

- A drone is used to capture images of the wet overspray area (20-40ft altitude).
- Allows for a direct overhead photograph for spatial accuracy.
- Known measurement on ground is placed to set a reference scale.





Water Sample/ Volume Collection



SQUARE SPACING

Lawn/Impervious surface boundary

- Catch cans used to collect irrigation sprinkler water
- Graduated collection cup measures volume inside and outside of intended area
- Water used for nutrient analysis is collected straight from sprinkler head into separate bottles

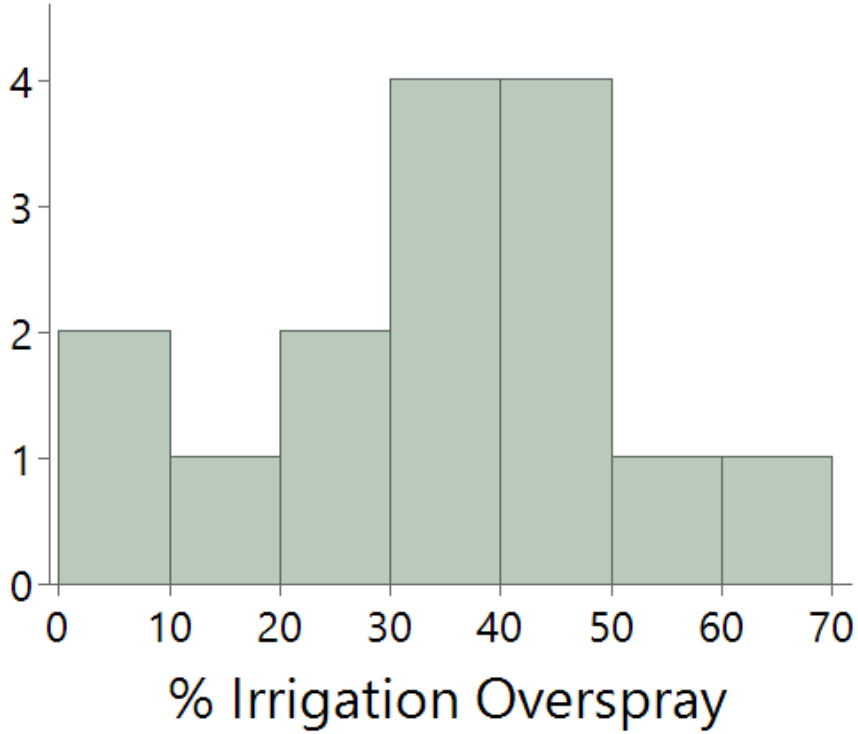
Combining Overspray Data with Nutrient Concentrations

Irrigation Volume x Nutrient Concentration = Nutrient Load

- Irrigation Volume from catch cans or Irrigation Rate
- Overspray area from drone images
- Nutrient concentration from chemical analysis

Irrigation Overspray Percentages

- 15 Sample runs performed
- Average Overspray 33.7%



LOCATION	SAMPLE TYPE	# OF SAMPLES	MEAN NO_3, MG/L	MEAN NH_4, MG/L	MEAN DISSOLVED ORGANIC N, MG/L	MEAN TOTAL N, MG/L	MEAN PO_4, MG/L	MEAN TOTAL P, MG/L
Jensen Beach Country Club	Residential RW sprinklers	38	3.8	1.8	1.03	5.6	0.45	0.52
Harbour Ridge	Residential RW sprinklers	41	0.1	0.1	0.5	0.8	0.33	0.41
Willoughby Cay, Martin County	Residential groundwater sprinklers (comparison)	10	0.03	0.09	0.17	0.3	0.01	0.02

Yearly Nutrient Load Potential

- Calculated using nutrient concentration averages from wet and dry seasons
- Assumed a lawn size of 0.1 acres and irrigation rate of 1.1” per week
- SFWMD – 164,083 residences using RW

	HR	JBCC
	Yearly Totals/Lawn (lbs)	Yearly Totals/Lawn (lbs)
NO_3	0.052	2.13
NH_4	0.057	0.99
TDN	0.27	3.12
TP	0.15	0.32

Water Conservation

- Even without nutrient loading considerations, overspray is an issue
- Wasteful use of valuable resource, especially here in Florida
- 33.7% waste of total RW use of state (908 mgd) is 305 mgd
- Best Management Practices to reduce overspray and waste are crucial

Best Management Practices for Irrigating with Reclaimed Water

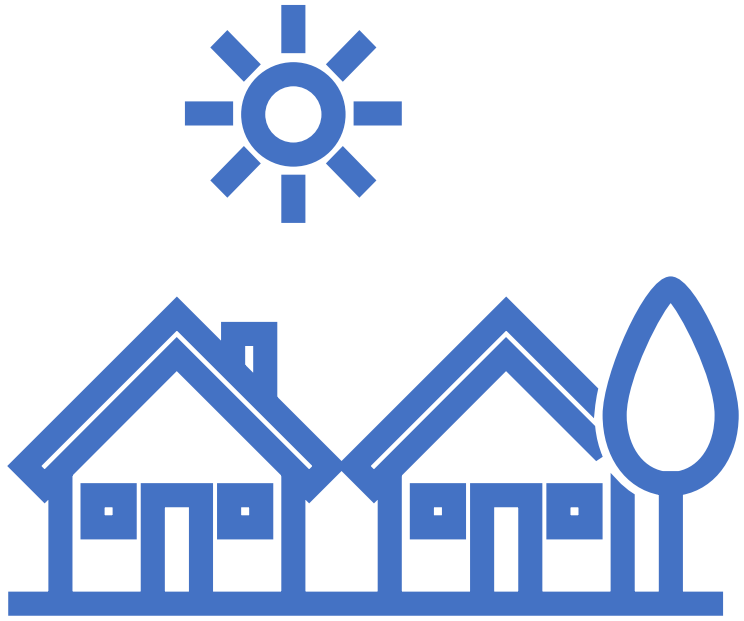
Tips for homeowners and landscape personnel

1. Know the composition of your reclaimed water

- You can call or search for your water provider on the internet to learn about the level of treatment your RW has undergone.

- You can also ask your RW provider to share any data they have on the typical chemical makeup of the RW you use.

- While the chemical composition of RW, including its nutrient content, may vary some by season, the RW provider should be able to give you a range of high and low expected values for N, P, and some other potential pollutants like salts.



2. Use the Florida-friendly landscaping principles

- Right Plant, Right Place
- Consider plants that can handle elevated salts

3. Keep irrigation equipment working properly

- A good rule of thumb is to check your irrigation system two to four times a year to make sure there are no broken lines or sprinkler heads.
- Once every few months, audit the performance of your irrigation system to check for correct application volume and uniformity.
- These regular maintenance checks will not only save water by ensuring the irrigation system runs efficiently, but will also reduce the chance of excess N and P from RW being applied to landscapes by broken or misdirected sprinkler heads.

4. Avoid irrigation overspray

- Inspect sprinkler placement, pressure and device type to ensure optimal operation.
- Often the wrong spray head is in the wrong place, which can lead to overspray and excessive runoff.
- Irrigation overspray occurs when irrigation water lands on sidewalks, streets, and other nontarget areas. This wasteful use of water not only diminishes water supply but can also be a means of N and P transport to local surface water bodies

5. Don’t overwater

- Only irrigate when soil and turf conditions indicate that irrigation is necessary. As a rule of thumb, only 3/4 to 1 inch of water is needed each week for most Florida turfgrasses.

Conclusions

- Reclaimed water is used to irrigate thousands of lawns in Florida, and is a way to offset potable water use, providing resiliency against water supply scarcity
- But reclaimed water can contain elevated nutrients that can impair surface waters
- University of Florida research in the Indian River Lagoon showed that as much as 34% of applied lawn irrigation was wasted as overspray, which can have both N and P
- Best management practices for homeowners and landscape personnel can ensure that reclaimed water is used in a way that protects water quality

Thank you!

mary.lusk@ufl.edu

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