

# IRG Track 2: Integrating Environmental Sensor Networks and Real-Time Forecasting to Adaptively Manage Water Quality and Build Social Trust

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## Take-Home Messages

- We have developed a near-term, iterative forecasting system (*FLARE*: Forecasting Lake And Reservoir Ecosystems) that generates 16-day probabilistic water quality forecasts updated daily with sensor observations for drinking water managers at Falling Creek Reservoir (Roanoke, Virginia, USA)
- Forecasts are already being used by managers and successfully predicted multiple water quality impairment events 4-13 days in advance during 2018-2020
- The *FLARE* forecasting system uses all open-source software and tools (wireless sensor gateways, lake models, ensemble Kalman filters, secure peer-to-peer networking) that can be directly scaled to other lakes and reservoirs
- Implementation of this system did not affect the public's trust in their drinking water utility or their drinking water

## Major activities and products

- We have developed a scalable, end-to-end forecasting system with sensors, cyberinfrastructure, models, and managers that serves as a model for other water utilities
- To date, our team has >20 publications, >100 presentations, and a provisional patent application
- We have generalized our forecasting software within an open-source R package, and are now applying it to five other lakes and reservoirs
- We conducted a survey of 350 Roanoke residents and found that implementation of forecasting technology into their drinking water supply did not affect their trust in their drinking water or utility

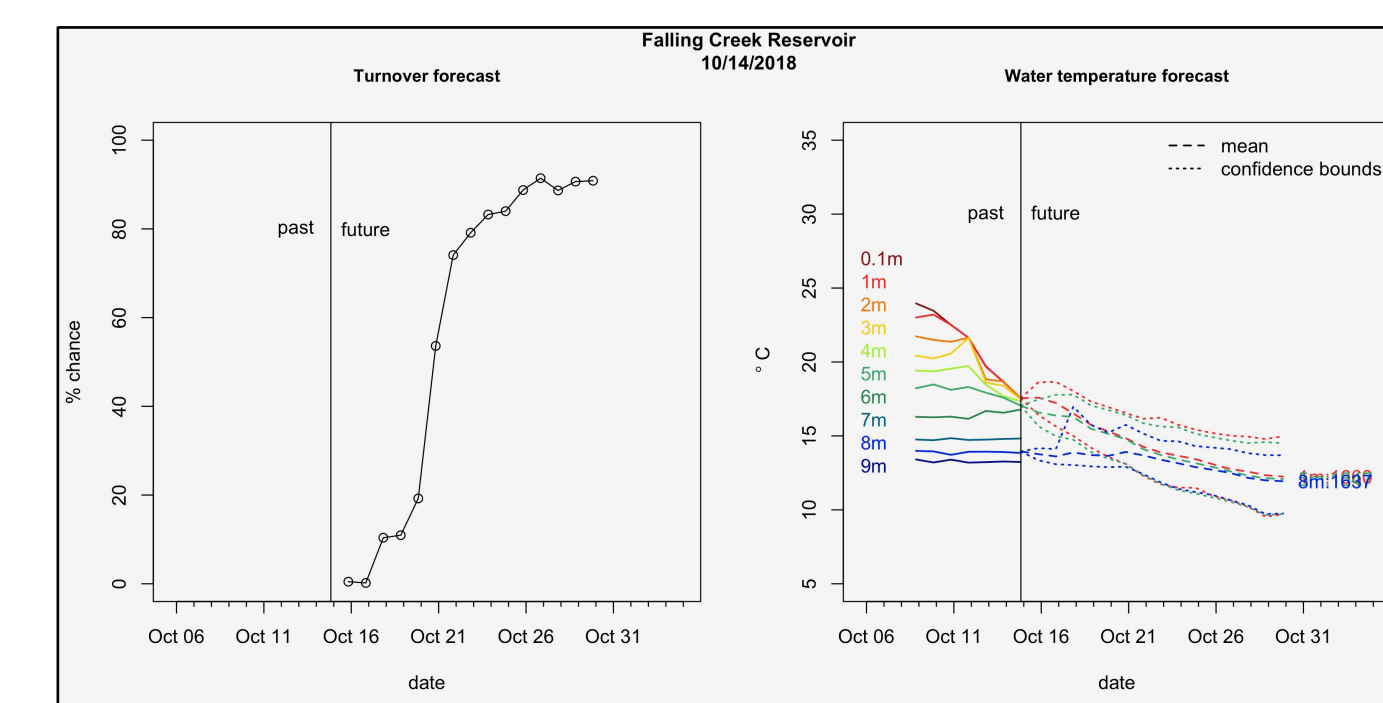
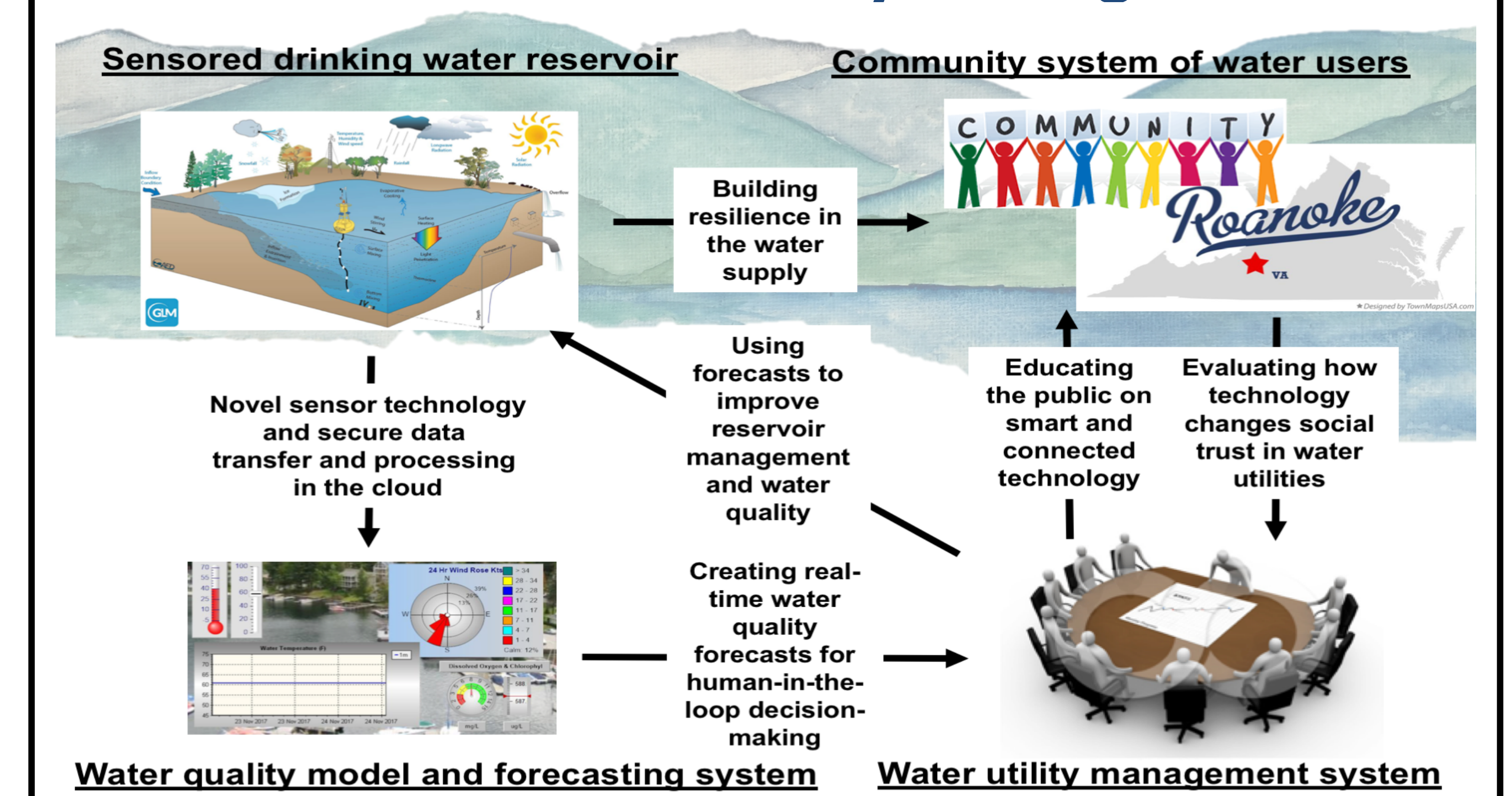
**The fundamental contribution of our project is the creation of an innovative smart water system that can be scaled to other drinking water supplies and communities worldwide.**

**We have also built two teaching modules that have trained >10,000 students in data science skills.**

## Our system, co-designed with managers, is:

- Improving *ecosystem* resilience of drinking water lakes and reservoirs to water quality threats by fostering adaptive management.
- Improving *community* resilience by increasing the capacity of an essential public service (drinking water) to cope with environmental stressors, expand communication, and build social trust.

## Forecasts are iteratively co-developed for immediate use by managers



Example figure of a forecast co-developed by our team and manager partners to inform daily water quality decision-making. These forecasts are emailed to managers every morning.

## Next steps for this year:

- Forecasting system "experiments" to test system robustness and security
- Expanding the suite of water quality models that can be integrated into the forecasting system
- Analyzing data in hand: we are working on ~10 manuscripts spanning multiple disciplines
- Further disseminating the teaching modules developed in this project