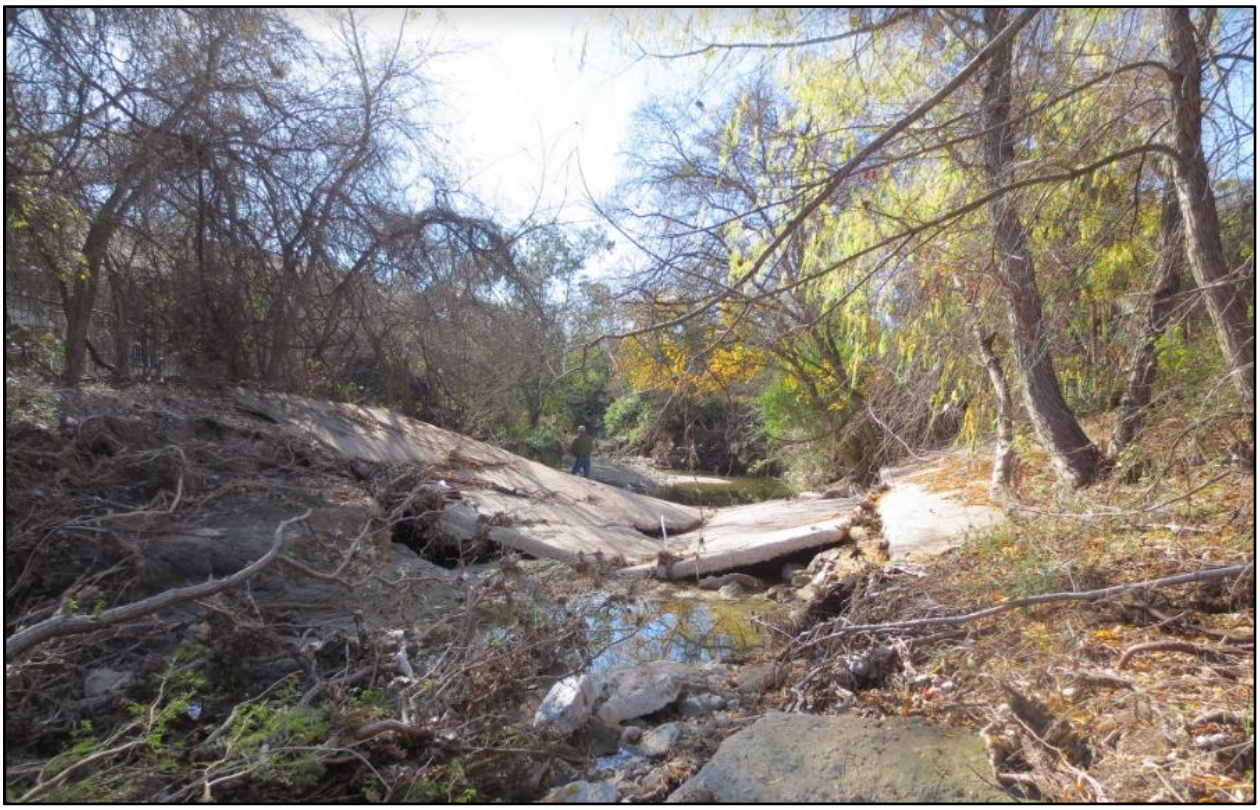
5th Symposium on Urbanization and Stream Ecology



Moving the bar on multidisciplinary solutions to wicked urban stream problems

February 12-15, 2020
Palmer Events Center, Austin, TX USA

SUSE5
SYMPOSIUM ON URBANIZATION AND STREAM ECOLOGY

Meeting Supporters & Sponsors

We want to thank our sponsors Baer Engineering, Michael Van Valkenburgh Associates, Eureka Water Probes, Sustainable Streams, Lycoming College Clean Water Institute, Puhoi Stour, and the National Science Foundation (Award DEB-2012128) for supporting the 5th Symposium on Urbanization and Stream Ecology.

National Science Foundation Support

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Staryn Wagner - City of Austin

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Bob Smith - Lycoming College
Chris Walsh - University of Melbourne
Seth Wenger - University of Georgia, River Basins Center

Contents

General Information

Meeting Schedule

Day 1: February 12, 2020
Location: Austin Central Library, 710 W César Chávez St, Austin TX

2:30 PM – 7:30 PM	Registration Table Open
3:00 PM – 3:30 PM	Welcome to SUSE5: Why are we here?
3:30 PM – 4:30 PM	Plenary Presentation by Dr. Kelly Turner STORMS: Translating Local Decision-Making to Environmental Outcomes
4:30 PM – 7:30 PM	Evening Social (drinks and appetizers)
5:00 PM – 6:00 PM	Plenary Presentation by Dr. Chris Walsh You need a little space, in the right place, and a lot of demand for the water. Lessons for urban stream protection from the Little Stringybark Creek Project.

Day Two: February 13, 2020
Location: Palmer Events Center, 2nd floor, 900 Barton Springs Rd, Austin TX

8:00 AM – 8:30 AM	Arrival, Registration, and Coffee
8:30 AM – 8:45 AM	Welcome to SUSE5
8:45 AM – 9:45 AM	Wicked Problems and Structured Decision Making
9:45 AM – 10:00 AM	Case Studies and Meeting Structure
10:00 AM – 10:30 AM	--- Break ---
10:30 AM – 12:00 PM	Work Session 1: Introduction to Case Studies, Problem Scoping
12:00 PM – 1:30 PM	Lunch and Plenary Presentation by Dr. Michael Chadwick Urban Streams in London: wicked problems and messy solutions?
1:30 PM – 3:30 PM	Work Session 2: Digging In, Further Problem Framing, Objectives

3:30 PM – 4:00 PM	---- Break ---
4:00 PM – 6:00 PM	Poster Session 1
6:00 PM and beyond	Dinner on your own

Day Three: February 14, 2020
Location: Palmer Events Center, 2nd floor, 900 Barton Springs Rd, Austin TX

8:15 AM – 8:30 AM	Load Vans and Depart for Field Trips
8:30 AM – 12:00 PM	Work Session 3: Field Trip to Case Study Sites, Developing Solutions
12:00 PM – 1:30 PM	Lunch and Plenary Presentation by Dr. Taurai Bere Urban stream time bombs: critical reflections on sustainability of urban stream water resources in developing countries.
1:30 PM – 3:30 PM	Work Session 4: Convergent Thinking, Refining Solutions, Presentation Development
3:30 PM – 4:00 PM	---- Break ---
4:00 PM – 6:00 PM	Poster Session 2
6:00 PM and beyond	Dinner on your own. Prepare for Group Presentations

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Day Four: February 15, 2020
Location: Palmer Events Center, 2nd floor, 900 Barton Springs Rd, Austin TX

8:00 AM – 8:30 AM	Arrival, Coffee, and Networking
8:30 AM – 8:45 AM	Agenda and Publication Planning
8:45 AM – 9:30 AM	Case Study 1, Team Presentation and Discussion
9:30 AM – 10:15 AM	Case Study 2, Team Presentation and Discussion
10:15 AM – 10:45 AM	---- Break ---
10:45 AM – 11:30 AM	Case Study 3, Team Presentation and Discussion
11:30 AM – 12:15 PM	Case Study 4, Team Presentation and Discussion
12:15 PM – 1:30 PM	Lunch and Panel Closing Discussion
1:30 PM	--- End of Symposium --

Plenary Speakers

The SUSE5 program includes invited talks by four scientists working on the forefront of urban stream research: Prof. Taurai Bere, Dr. Michael Chadwick, Asst. Prof. V. Kelly Turner, and Assoc. Prof. Chris Walsh will join us in Austin. Please see more about their work and the subjects of their talks below.

Asst. Prof. Kelly Turner

V. Kelly Turner is an Assistant Professor at the University of California, Los Angeles where she is Associate Director of Urban Environment Research at the Luskin Center for Innovation and faculty affiliate at the Institute of Environment and Sustainability. She researches the relationship between institutions, urban design, and the environment. Her approach draws from social-ecological systems frameworks to address urban planning and design problem domains. In recent work she has used this approach to investigate microclimate regulation, green infrastructure for stormwater management, and residential landscaping.

Plenary Talk: STORMS: Translating Local Decision-Making to Environmental Outcomes

This talk describes the interdisciplinary STORMS project, which aims to determine how heterogeneous decision-making processes and management actions in the Cleveland, Ohio and Denver, Colorado regions influence environmental outcomes at the watershed scale. One aspect of the project aims to understand the role formal rules and individual norms in shaping stormwater management actions, especially the likelihood of adopting green infrastructure as a stormwater control measure. Emerging results from the project will be presented and discussed with respect to the capacity of regional stormwater management programs to facilitate collective action to improve hydrology and ecosystem health in urban regions.

Assoc. Prof. Chris Walsh

Chris Walsh co-leads the interdisciplinary Waterway Ecosystem Research Group (https://thewerg.org) at the University of Melbourne and is also a principal researcher in the Melbourne Waterway Research-Practice Partnership (https://mwrpp.org), a collaboration between Melbourne Water and The University of Melbourne. He has arrived at this point after 25 years a stream ecologist, most notably studying streams of urban environments, and working with practitioners towards urban land and water management for stream protection. He is a confirmed urbanite in the great metropolis of Melbourne, where he convened the first Symposium on Urbanization and Stream Ecology in 2003.

Plenary Talk: You need a little space, in the right place, and a lot of demand for the water. Lessons for urban stream protection from the Little Stringybark Creek Project.

In this talk, Chris will describe The Little Stringybark Creek project; a large, ambitious, catchment-scale experiment designed to test if the ecological degradation of streams resulting from urban stormwater runoff could be reversed through retrofitting catchment drainage systems. After installation of more than 600 dispersed stormwater control projects across 5 small experimental catchments, and 17 years of hydrologic and ecological monitoring of their streams (and control and reference streams), in-stream responses have been variable, but lessons learnt have been big and influential. The talk will highlight lessons from the project, and how they have influenced plans for major stormwater retention and harvesting in a large greenfield development in northwest Melbourne, to protect currently rural Emu Creek: the site of the next experiment.

Dr. Michael Chadwick

Michael Chadwick is a Senior Lecturer at King's College London interested in exploring both applied and basic ecological questions in aquatic science. A central aim of his research has been to understand the effects of natural and human-induced ecosystem changes in lotic ecosystems. Past work has spanned large spatial scales in varied aquatic systems. This includes work on the main channel of the Mobile River (Alabama), tidally-influenced rivers in England, tributaries of the St. Johns River (Florida), and intermittent streams (Maine and Florida). Current projects focus on evaluating London's urban rivers.

Plenary Talk: Urban Streams in London: wicked problems

and messy solutions?

In this talk, Michael will present research which has evaluated ecological structure and functional processes among highly urbanized tributaries of the River Thames in Greater London, UK. Given the history of river use and urban development in London, these streams suffer from a myriad of pressures ranging from intensive urban development, sewage misconnections to invasive species. Regulatory pressures to achieve good ecological potential along with grassroots citizen science have driven restoration activities which have provided mixed results. As such, improving these streams could be viewed as a classic wicked problem which will require rigorous science and policy to achieve sustainable healthy conditions. The talk will seek to draw parallels from research in other regions to contextualize London's urban river issues.

Prof. Taurai Bere

Taurai Bere is a Professor at the Chinhoyi University of Technology in Zimbabwe. His areas of expertise include river health assessment, biological monitoring of aquatic systems (especially diatom-based biological monitoring), aquatic eco-toxicology, and integrated water resources management. He has published over 40 research articles in peer reviewed international journals, has won research grants from international funding organisations and has presented his work at several international conferences.

Plenary Talk: Urban stream time bombs: critical reflections on sustainability of urban stream water resources in developing countries.

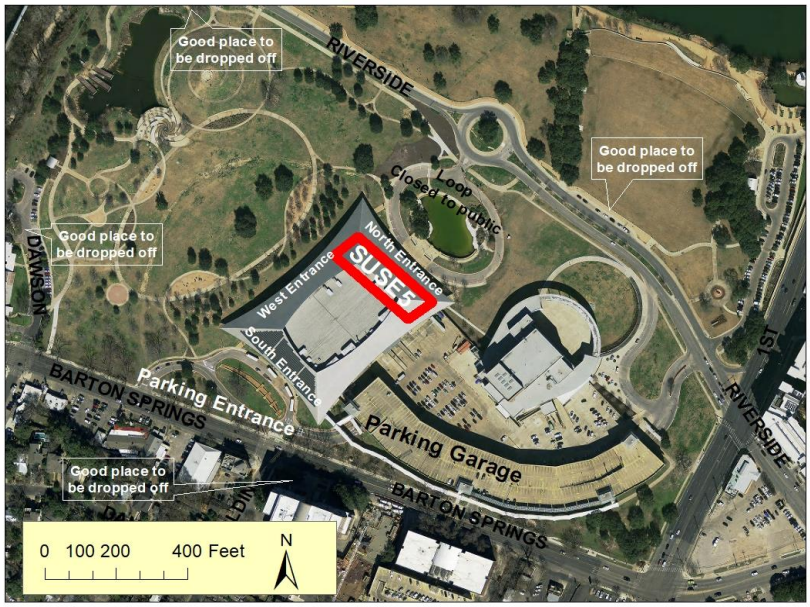
Taurai will describe that in developing countries, urban streams are under severe pressure from such activities as water abstraction, discharge of untreated sewage, siltation and pollution, leading to changes in the ecological integrity, abundance, and quality of freshwater resources. In this talk, Taurai will critically analyse the current threats to ecological integrity of urban streams in developing countries and their implications on sustainability and proffer science-based solutions to these threats. Water pollution, eutrophication, invasive species, siltation, water abstraction and climate change are highlighted as major threats to urban streams in developing countries. Challenges include funding, inadequate infrastructure for freshwater research and management, inadequate and poor implementation of the existing policy frameworks due to lack of political will and corruption leading to breakdown in public service delivery. A balanced science program characterised by building long-term stability required to support decision and policy making by maintaining an integrated monitoring program and a comprehensive scientific data management program is proposed.

Location Information

Meeting Location Information

Austin Central Library **Day 1: Weds Feb 12, 2020**
710 W César Chávez St. Austin, TX
Phone: (512) 974-7400
http://library.austintexas.gov/central-library

Palmer Events Center **Days 2-4: Th Feb 13 - Sat Feb 15**
900 Barton Springs Road Austin, TX
Phone:(512) 404-4500
https://www.palmereventscenter.com



Lodging Information

Extended Stay America - Austin (~$130 per night)
507 S 1st St, Austin, TX 78704
(512) 476-1818
https://www.extendedstayamerica.com

Stay Alfred 422 at The Lake (~$150)
422 W Riverside Dr, Austin, TX 78703
(866) 232-3864
https://www.stayalfred.com

The Hotel Carpenter (~$240)
400 Josephine St, Austin, TX 78704
(512) 682-5300
http://carpenterhotel.com/

AirBnB (~$80+)
https://www.airbnb.com

Transportation

- Google maps has good local transit information, including arrival bus times.
- Capital Metro has bus route information and a trip planner. Metrobus fare is $1.25 for a single ride or $2.50 for a 24hr pass.
- Bike and scooter rental, walking and local buses are the easiest ways to move around if you are not too far. Taxis, Uber, and Lyft for the longer distance but be aware of traffic.

From the airport: Take bus #20 from the airport to downtown, this route is fast and easy. The airport bus stop is located curb-side at arrivals (ABIA Lower Level). Metrobus fare is $1.25 for a single ride or $2.50 for a 24-hr pass.

To Austin Central Library: Library paid parking is limited and local traffic is pretty bad from 3:30 to 5:30 pm. Coming from/near the airport? Bus #20 takes you downtown just ½ mile (LaVaca/4th stop) to the library (or one block to the Bus 3 stop to the library).

To Palmer Events Center: paid parking available ($8.00). Local traffic is pretty bad from 3:30 to 5:30 pm. Coming from/near the airport? bus #20 takes you downtown (VicMathias/AuditoriumShores stop) less than 1/3 mile to the Palmer Events Center.

Places to eat

Walking distance (+ or a bit farther) from Palmer Events Center

- Terry Black's BBQ is across the street for those interested in Austin's notoriety for its barbecue (specially the smoked brisket and other meats).
- Sandy's Hamburgers has been around since the 1940's, old fashion burgers, fries, ice cream...you get the picture. No website...but here is the menu
- El Alma Restaurant Bar has a fresh approach to Mexican antojitos, soups, salads, tacos, enchiladas, sides and desserts
- Thundercloud Subs, affordable sandwich chain, "fresh, fast and healthy".
- (+) Home Slice Pizza, this ain't NY, or New Haven, but this is pretty good pizza.
- (+) Fresa's (South First) is a bit of a hike, but has great mexican food with a chicken focus.
- (+) Sway, fancy Thai food, really good, also on S. First street.
- (+) Loro, asian smokehouse, fancy and interesting, cheap happy hour, more than a walk, but not much more.

(ask your local hosts if you want specialized suggestions)

Finding Austin's other amazing places to eat… oh my, that responsibility is for the experts. Check out some guides: EaterAustin, SoMuchLife, AustinFoodBlogger, VisitAustin, BonAppetit

Places to gather

Walking distance from Palmer Events Center

- Fareground is a modern food hall with six restaurants, beer, wine, cocktails & an outdoor picnic area
- Bennu Coffee on Congress is a 24-hr cafe with indoor/outdoor seating, popular with students
- Aussie's is an old-school grill and sports bar. Go fast, it's a dying breed.

SUSE5 Code of Conduct

Code of Conduct and Statement on Diversity and Inclusivity

The Symposium on Urbanization and Stream Ecology (SUSE) is an interdisciplinary meeting that aims to further the scientific study of stream ecosystems in urban landscapes with the goal of generating meaningful advancements in urban stream ecology that improve urban environments and their receiving waters. The interdisciplinary nature of SUSE attracts participants from diverse professional, scientific, and academic backgrounds, and we encourage participation by individuals from diverse cultural, gender, socio-economic, and racial backgrounds and a diversity of physical capabilities.

A guiding principle of SUSE is that diversity and inclusivity yield innovation, creativity, and representation essential for transformative scientific advancements and integrated management solutions. The benefits of diversity can serve the professional and personal growth of SUSE participants. As agreed upon by the Advisory Board, SUSE does not discriminate based on an individual's race, creed, color, ethnicity, national origin, religion, sex, sexual orientation, gender expression, physical or mental ability, or any other trait inherent to the identification of one's 'self'. Every SUSE is inclusive and intends to celebrate our differences to develop new ideas in urban stream ecology and management.

To achieve this guiding principle, SUSE has implemented the following code-of-conduct for all meetings (not exclusive of additional meeting-specific conduct requirements or statements):

1. SUSE is a harassment-free meeting. Any sexual harassment or other forms of harassment based on an individual's race, creed, color, ethnicity, national origin, religion, sex, sexual orientation, gender expression, physical or mental ability, or any other trait inherent to the identification of one's 'self' will not be tolerated.
2. SUSE has zero tolerance for any sexual violence or assault or any violent or non-violent action meant to harm or intimidate any individual during the meeting.
3. SUSE has zero tolerance for any discriminatory behavior based on race, creed, color, ethnicity, national origin, religion, sex, sexual orientation, gender expression, physical or mental ability, or any other trait inherent to the identification of one's 'self'.

Any person found to be violating the code of conduct or acting in any manner that conflicts with SUSE's overall goal to promote diversity and inclusivity will be asked to leave the meeting without any refund of their registration fees or expenses (e.g.,

accommodations). Any individual whose actions are in violation of local, state, or federal law will be referred to the local authorities in a manner consistent with Title IX regulations (https://www2.ed.gov/about/offices/list/ocr/docs/tix_dis.html) where applicable.

REPORTING

Any individual who is the target of or witnesses to any violation of the SUSE code-of-conduct or any action that is antithetical to the SUSE overall goal to promote diversity and inclusivity should feel empowered to report the incident to any meeting organizers (see the meeting program for designated contacts) or the SUSE Advisory Board (see the SUSE meeting program for designated contacts).

Please contact Robert F. Smith (smithr@lycoming.edu) or any of the members of the SUSE advisory board if you have any questions about this policy.

V.02 (Reviewed by the SUSE advisory board 11/20/2019)

SUSE5
SYMPOSIUM ON URBANIZATION AND STREAM ECOLOGY

ACTIVITIES

Meeting Products

Do you have a great idea for a synthesis paper on wicked urban stream problems? Do you have a paper on urban stream ecology close to ready for submission? Did you come up with an exciting and novel idea in your working sessions that could become a paper?

We invite all participants of SUSE5 to contribute to one or more journal articles that will be submitted for publication as special series in one or more journals (e.g., Freshwater Science, Urban Ecosystems, ASCE Journal of Sustainable Water in the Built Environment). Past SUSE meetings have resulted in special series of papers in the Journal of the North American Benthological Society (24:3 in September 2005, 28:4 in December 2009) and Freshwater Science (35:1 in March 2016) that have been highly cited and have greatly enhanced the field of urban stream ecology and restoration. With the growing interest and research in urban stream ecology, we anticipate that this year's meeting will result in similar, high-quality papers and special issues.

All article ideas from SUSE5 participants are welcomed for consideration in a special issue. Possible types of papers include:

Contributed Papers

- Urban restoration lessons learned
- Empirical monitoring studies
- Synthesis studies

SUSE5 Case Study Products

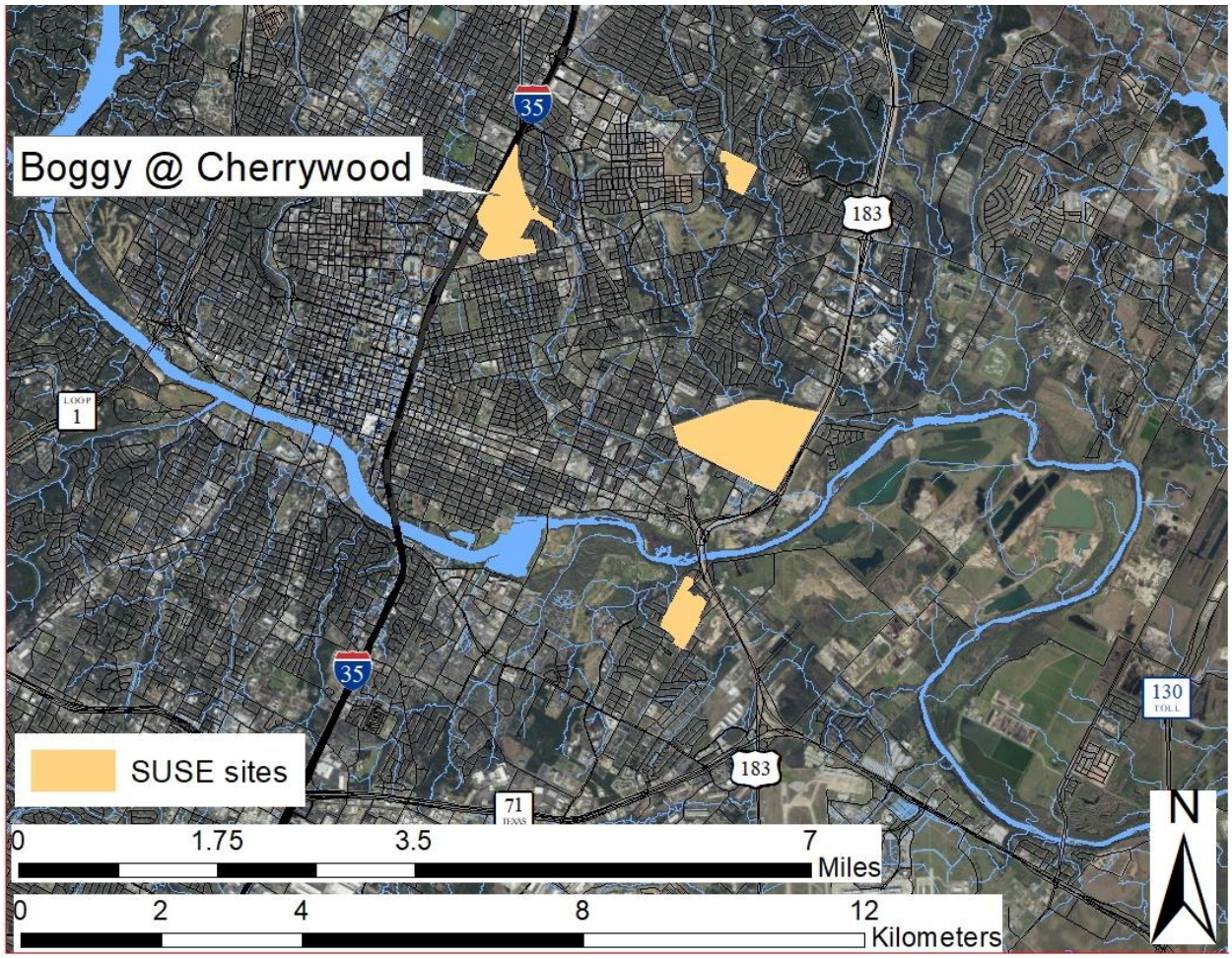
- Wicked problem toolbox
- Solutions/approaches to each of the 4 case studies
- Social experiment results

After the meeting, you will receive an email with a link to submit paper ideas. Ideas must include a tentative title, authors, abstract or brief description, and an anticipated timeline for submission (e.g., 6 months, up to 1 year). The deadline for submitting article ideas for consideration will be mid to late March, 2020.

Feel free to talk to any of the SUSE5 product planning sub-committee (Megan Fork, Bob Hawley, Krissy Hopkins, Sujay Kaushal, and Blanca Rios-Touma, Allison Roy) during or after the meeting if you have any thoughts, questions, or ideas about journal articles or other possible meeting products.

Restoration Case Studies

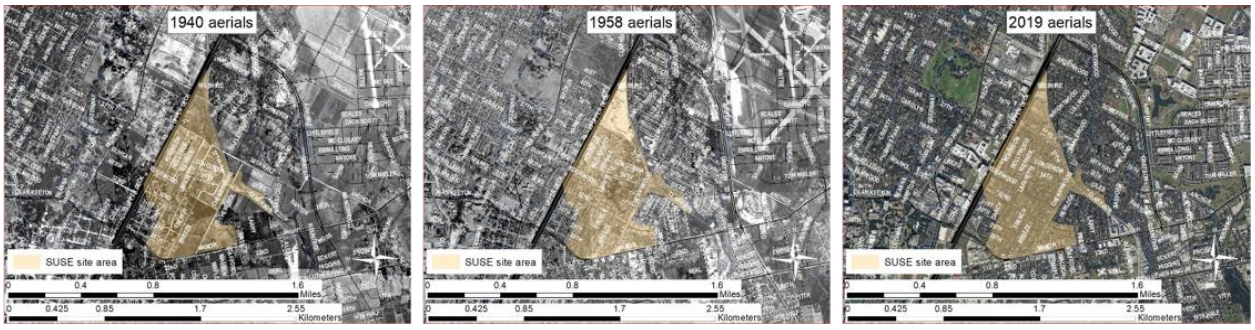
SUSE5 Case I: Boggy Creek @ Cherrywood



Use street view to get a sense of the site: https://goo.gl/maps/xx8icgm93VhS8XP39

What's the history of the area and its community?

This area is located within the Cherrywood neighborhood. By the 1940's most of this neighborhood area was already developed with streets and residential areas; density has increased modestly since then. Development similar to current conditions (with the large commercial areas and parking lots) was completed by 1960 prior to the modern regulations regarding water quality, creek buffers, floodplain and erosion risk. The ~206 acres (0.84 Km^2) in this vicinity has ~25% impervious cover, however the total drainage area of ~357 acres (1.44 Km^2) has ~60% impervious cover according to 2017 data.



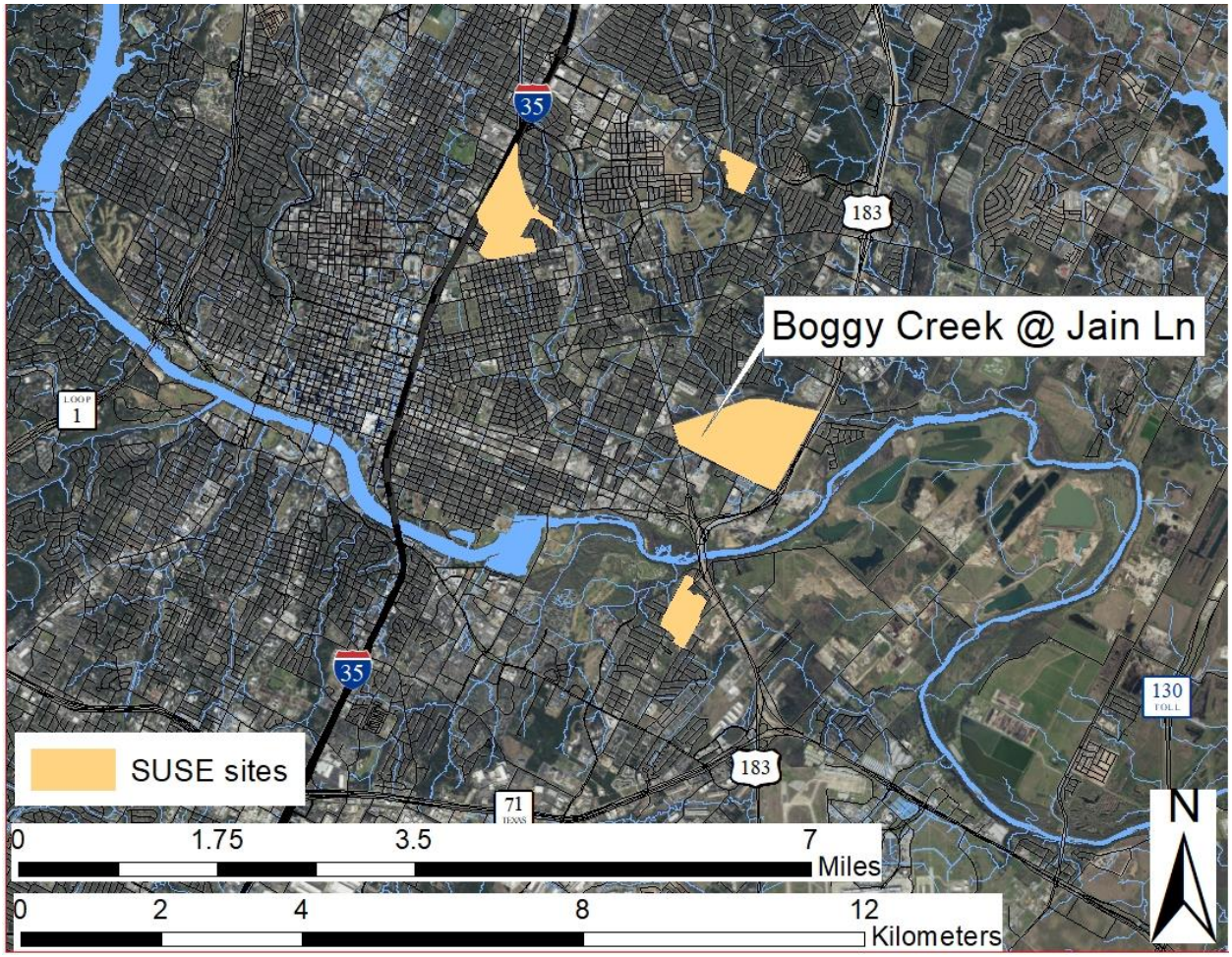
Why is Boggy Creek @ Cherrywood in the City of Austin Watershed Protection's radar?

Three converging tributaries of Boggy Creek have erosion concerns and coincide with flooding complaints in adjacent buildings and yards.

Sections of the stream network are buried (pipes) and those that are not buried tend to have relatively tight corridors and face both erosion and flooding challenges. This creates a complex case.

The water quality of this section of the creek can see improvements. The presence of *E. coli* in routine monitoring samples makes the water quality poor for contact recreation. Habitat and aquatic life scores are good and improving over the 1994 to 2017 sampling period.

SUSE5 Case II: Boggy Creek @ Jain Ln

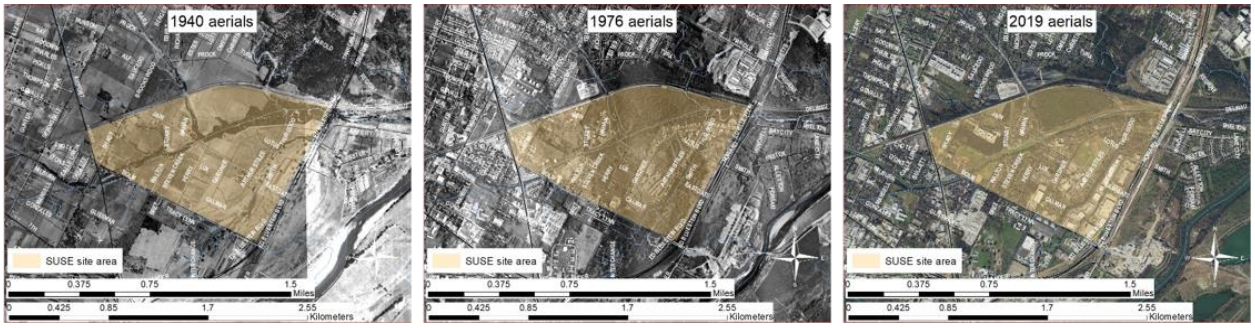


Use street view to get a sense of the site: https://goo.gl/maps/WMVAqsh3LLG2

What's the history of the area and its community?

The Johnston Terrace neighborhood surrounds this section of Boggy Creek. The neighborhood is predominantly a Hispanic community with historical social and environmental justice activism. Access to meaningful transportation and equity in services have been some of the social justice sought by the community.

In the 1940's most of the area was mostly farmland. Residential development near the creek in this area happened in the mid 1970's and commercial development in the early 1980's before any of the current regulations pertaining to water quality, creek buffers, floodplain and erosion risk. The nearly 395 acres (1.59 Km2) the creek have approximately 34% impervious cover while the 8,564 acres (34.7 Km^2) of area draining to this section of Boggy Creek have about 50% impervious cover according to 2017 data. In the 1980's the City of Austin in partnership with the Army Corps of Engineers channelized close to 3 miles (4.8 Km) of Boggy Creek to address flooding risk from properties surrounding it and removing nearly 1,600 structures from the floodplain.

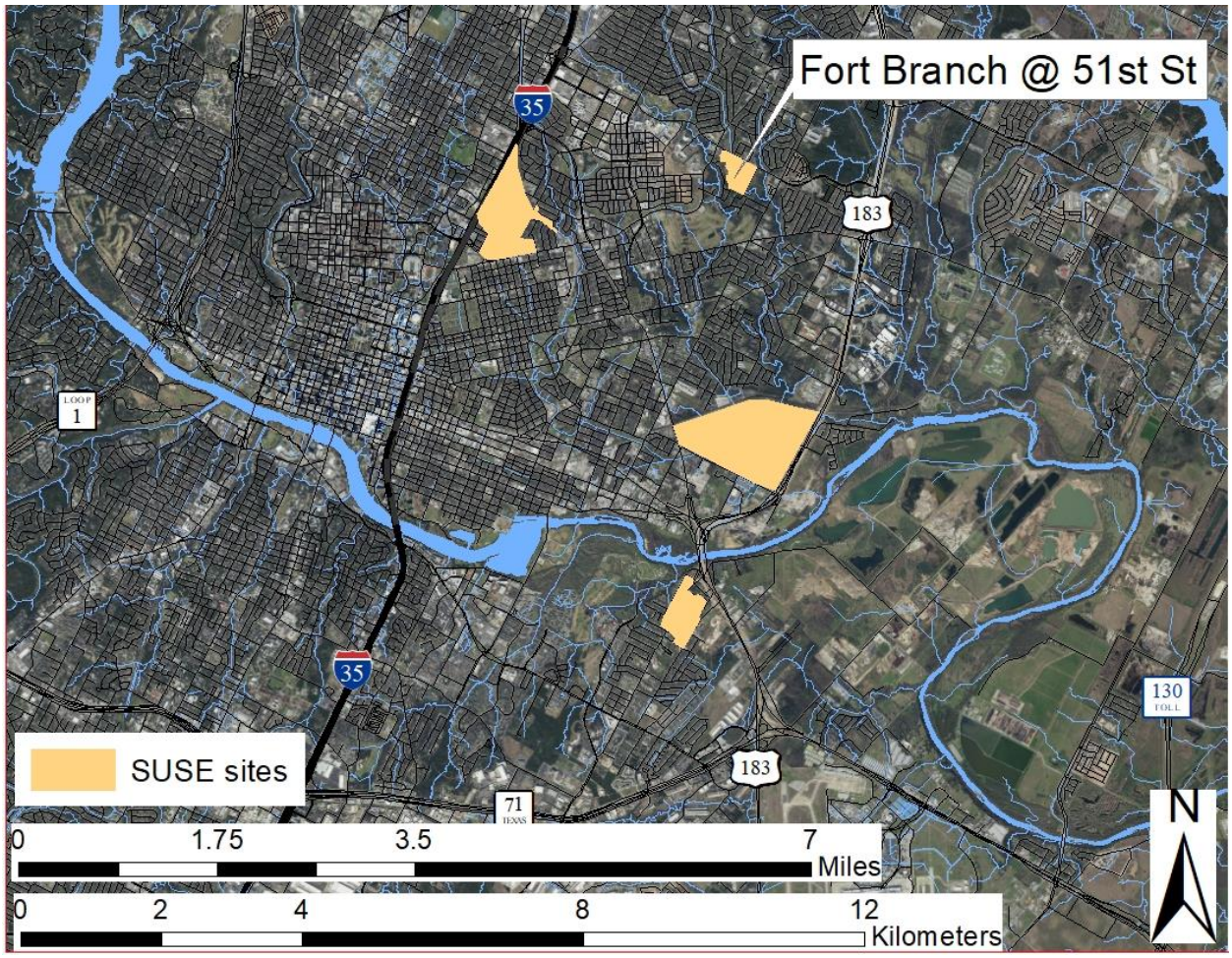


Why is this area in the City of Austin Watershed Protection's radar?

Sediment deposition in this non-concreted section of a historical Army Corps flood control project has led to concerns of reduced flood conveyance capacity while it has created wetland plant communities and improved habitat for aquatic organisms.

Engineered erosion control structures have blown out and ongoing bank erosion threatens pipes and other infrastructure while contributing to sediment deposition in the main channel. Rather than returning to the original flood control design, City staff posed the question: Could we do something more "creek friendly?" This section of Boggy Creek has overall good creek health indicators likely to be adversely impacted by large sediment removal to return the creek to the original flood conveyance design.

SUSE5 Case III: Fort Branch Creek @ 51st Street

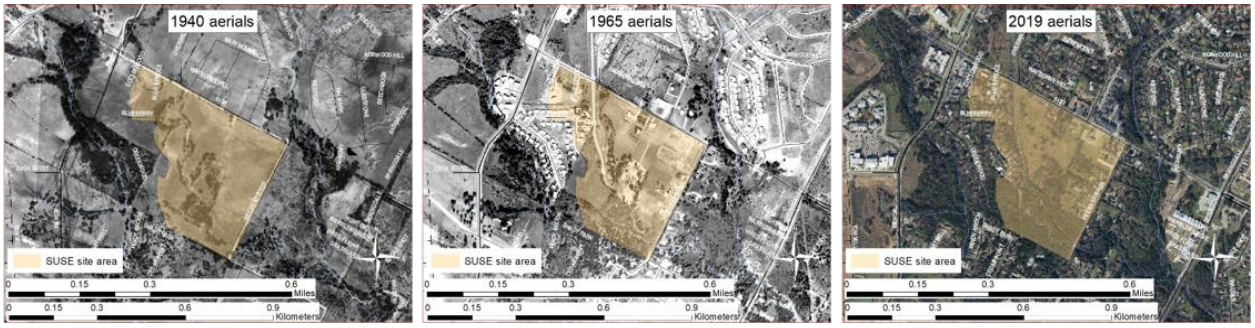


Use street view to get a sense of the site: https://goo.gl/maps/np9R2ssvBtdWqTST8

What's the history of the area and its community?

This area is located within the Rathgeber Village neighborhood. In the 1940's most of the area was mostly farmland. Residential and commercial development near the creek in this area happened mostly between late 1960's and early 1970's before any of the current regulations pertaining water quality, creek buffers, floodplain and erosion risk. The area around the creek, about 45 acres (0.18 Km^2), has approximately 25% impervious cover while the area that drains to this section of Fort Branch Creek, about 1023 acres (4.1 Km^2), has about 52% impervious cover according to 2017 data.

The proximity of the Mueller development nearby has greatly increased property values in the area leading to displacement and gentrification. New construction has also begun in undeveloped parcels recently.



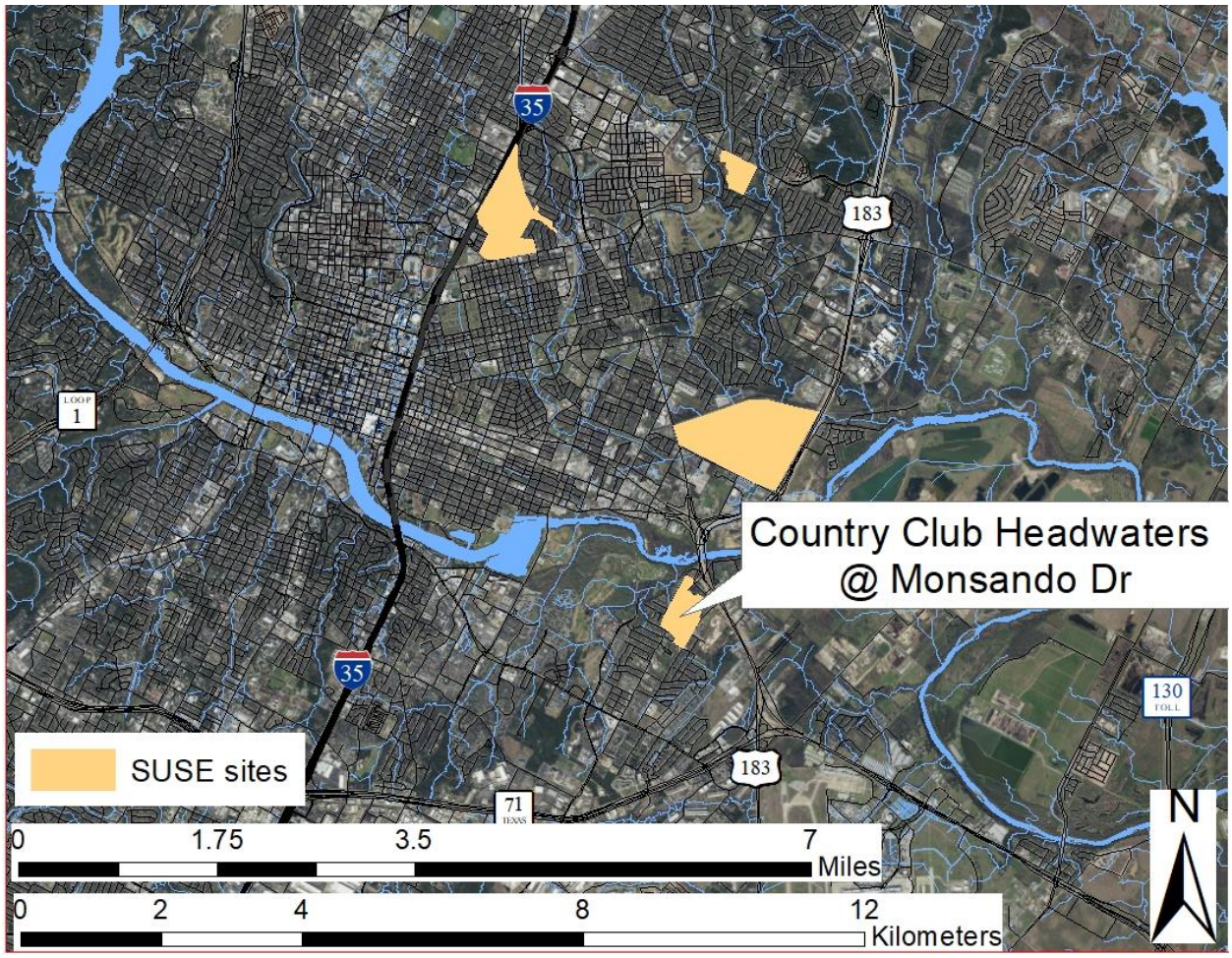
Why is this area in the City of Austin Watershed Protection Department's radar?

Ongoing erosion has damaged both the concrete channel in the upper reach and the natural channel in the lower reach. Sections where concrete is broken have apparently contributed to aquatic habitat and wetlands in some areas.

The 100-year floodplain affects the area along Blue Spruce Rd. Localized flooding problems have been identified near Manor and 51st St. Other flood objectives relate to minimizing risk to structures in the 100-year floodplain as required by the National Flood Insurance Program.

Water quality monitoring shows worsening scores for contact recreation (due to high *E. coli*); marginal non-improving habitat scores, very good recent non-contact recreation and aquatic life, and fair overall scores.

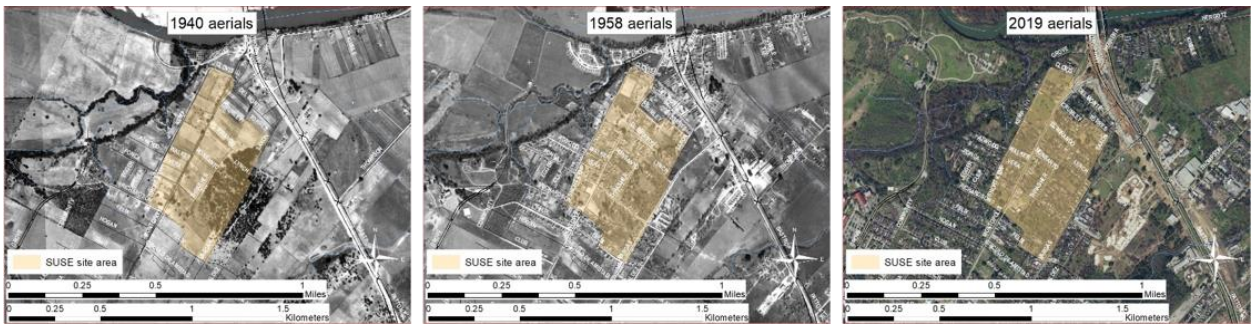
SUSE5 Case IV: Country Club East Creek headwaters @ Monsanto Dr



Use street view to get a sense of the site: https://goo.gl/maps/TQjrFZKFWr62

What's the history of the area and its community?

This area is located within the Montopolis neighborhood. The community in this area is predominantly Hispanic. In the 1940's most of the area was farmland. Residential and commercial development in this area happened mostly between late 1950's and mid 1980's before any of the modern regulations regarding water quality, creek buffers, floodplain and erosion risk. This headwater section of Country Club East Creek is 88 acres (0.18 Km^2) and has approximately 36% impervious cover according to 2017 data.



Why is this area on the radar of the City of Austin Watershed Protection?

Localized flooding affects many yards and buildings in this residential neighborhood. This is one of the smaller watersheds of the SUSE5 case studies; however, it is close (within 700 meters) of the Colorado River, Austin's largest waterway. Historically, the drainages in this area were placed into pipes that are frequently too small or too flat to prevent flooding.

Work Session Details

Work Session 1: Introduction to Case Studies, Problem Scoping
In the first work session, teams will spend 1.5 hours exploring case study descriptions, existing data, and reports and framing the problem, including determining the spatial and temporal scope, constraints, and key uncertainties.

Work Session 2: Digging In, Further Problem Framing, Objectives
The second work session (2 hours) teams will develop a list of objectives (or values) that should be considered based on the problem framed in the first work session. Teams will brainstorm some possible solutions and identify locations to visit during the field trip.

Work Session 3: Field Trips to Case Study Sites, Developing Solutions
Teams will have 3-hours to visit their case study site and ground-truth ideas from previous work sessions. This session is valuable for developing alternative solutions and identifying challenges and potential tradeoffs when trying to meet objectives.

Field Trip Logistics: Each team will be transported via a City van and have City employees as drivers and escorts to the field sites. Please arrive early to avoid missing the departure time. Please exercise safety awareness and use good judgment in the field. Never turn your back to traffic and do not enter any confined spaces like sewers or catch basins. Watch out for hazards like uneven/unstable/slippery surfaces, poison ivy, sharps, thorny vines, etc. and stick together with your group at all times.

Work Session 4: Convergent Thinking, Refining Solutions, and Presentation Development
Following the field trips, teams will have a final 2-hour work session to refine objectives, develop a means-end diagram linking alternative solutions to objectives, and identifying potential tradeoffs among alternatives. Products from this final session could include modified lists of objectives and solutions, as well as conceptual drawings and/or narratives of solution components.

Team Presentations and Discussion
At the conclusion of the meeting, teams will share their work in short, 10-minute presentations. The three group presentations for each case study will be followed by a 15-minute combined question/answer period for all groups.

Poster Sessions

Poster Session 1: Thursday 4:00 - 6:00 PM

Poster Number	Presenter	Title
1	Krista Capps	Out of sight, out of mind: septic systems and the risk they pose to freshwater ecosystems
2	Barbara Mahler	Coal-tar-based pavement sealcoat is a potent source of polycyclic aromatic hydrocarbons (PAHs) to urban streams
3	Charles Stillwell	Source identification to enhance routine water-quality sampling programs
4	Roderick Lammers	Integrating stormwater management and stream restoration strategies for greater water quality benefits
5	Jon Harding	Stream biodiversity and habitat loss in two urban river systems over 40 years
6	Peter Van Metre	Multi-stressor effects on biological communities in contrasting regions of the USA
7	Robert Hawley	Suburban stream erosion rates in Northern Kentucky exceed reference channels by an order of magnitude and follow predictable trajectories of channel evolution
8	Kathryn Russell	Predicting geomorphic disturbance and stream channel change in urban watersheds
9	Megan Fork	Patterns and changes in multiple solutes over 20 years of weekly measurements in Baltimore streams
10	Anne Jefferson	Linking water and nitrate dynamics in suburban headwater streams
11	Chris Prescott	Which “Wicked Problem” to Solve? Identifying Priority Threats When “Everything is Broken”

12	Alonso Ramirez	Tropical urban stream responses to extreme climatic events: droughts and hurricanes in Puerto Rico
13	Mateo Scoggins	An Index of Riparian Integrity for cities.
14	Brian Laub	Urban Stream Ecology Research at the University of Texas at San Antonio: A Developing Program
15	Krissy Hopkins	Can green stormwater infrastructure save suburban streams?
16	Jon Calabria	Proctor Creek Design Presentation
17	Jessica Turecek	Unifying Ecology, Hydrology and Geomorphology in River Research via Eco-hydromorphology
18	Kyle McKay	Synthesizing social and ecological outcomes to inform urban stream restoration decisions
19	Anusha Balangoda	Assessing the Biogeochemical and Ecological Impacts of Drinking Water Orthophosphate Addition to an Urban Stream Network
20	Joanna Solins	Interactive effects of urban runoff and stream channel incision on riparian soils and understory vegetation
21	Staryn Wagner	The joy and success of GSI is all in the details.
22	Kate Macneale	Active recolonization of bugs can help restore biodiversity in urban streams
23	Joseph Galella	Freshwater Salinization Syndrome, High Resolution Trends Over Space and Time
24	Scout Gockel	Using Aquatic Insects to Compare Urban and Green-space Stream Environments
25	Matthew Burns	New insights into the hydrologic behaviour of headwater streams

26	John Schwartz	Assessing Potential Ecological Functional Lift from Urban Stream Restoration
27	Katherine Abbott	Resilient river restoration through dam removal

Poster Session 2: Friday 4:00 - 6:00 PM

Poster Number	Presenter	Title
28	Rebecca Forgrave	Combined sewer overflows create novel concentration-discharge hysteresis patterns in urban streams
29	Sarah Ledford	Hydrologic retention and nutrient dynamics around urban beaver dams
30	Emily Taylor	Recovery of energy cycling following hydrologic disturbances in sub-tropical urban streams
31	Kris Taniguchi-Quan	Establishing environmental flows for the Los Angeles River: Striking the balance between wastewater reuse, aquatic life, and recreational uses
32	Brian Murphy	Integrated Assessment of the Physical Condition of Urban Streams
33	Blanca Ríos-Touma	Aquatic Biodiversity Loss on Andean Urban Streams
34	Nick Bond	Mapping wetland dynamics using remote sensing approaches to assist long-term planning in a rapidly urbanising landscape
35	Sujay Kaushal	Freshwater Salinization Syndrome Degrades Stormwater Management and Stream Restoration: Mobilization of ‘Chemical Cocktails’
36	Jacob Hosen	Building Cross-Discipline Synthesis with an Urbanized Headwater Stream Typology

37	Jenna Reimer	Short-Term Changes in Water Chemistry of an RSC in College Park, MD
38	Jennifer Courtwright	Impact of urbanization on intermittent stream hydrology and geomorphology in south central Texas
39	Kelsey Wood	Riparian Groundwater Chemistry Trade-Offs of Tree Removal in Stream Restoration Projects
40	Stuart Reichler	Large-scale environmental data collection with first-year undergraduate students
41	Sophie Hill	Looking Beyond Leaves: Nutrient Leaching Potential of Various Types of Seasonal Litterfall Within an Urban Forest
42	Robert Smith	GIS-based prioritization system for small municipality MS4 compliance projects
43	Leslie Rieck	MS4 Misunderstandings and Myths: Moving toward effective stormwater management for small municipalities
44	Erika Diaz Pascacio	Influence of land use on the riparian zone condition
45	Joseph Morgan	How should we measure dredge and fill impacts to streams under the Clean Water Act?
46	Rhys Coleman	Habitat suitability models are powerful tools for helping diverse stakeholders agree on stream restoration priorities
47	Paul Mayer	Long-term trends in hydrology and biogeochemistry in a geomorphically restored urban stream
48	Victoria Rexausen	Investigating sewage influence on nitrate δ15N and δ18O values in Baker Creek in Knoxville, T

49	Sara Burns	Statewide climate resilience planning and nature based solutions implementation in the municipal vulnerability preparedness program in Massachusetts, US
50	Tim Nuttle	Using a combination of green infrastructure, stream restoration, and forest understory restoration to reverse ecosystem meltdown in one of Pittsburgh's last urban stream systems.
51	Lindsay Olinde	Old Dogs & New Tricks: Detention SCMs tailored to mitigate erosion
52	Katie Duffy	City of Austin's Rain Catcher Pilot Program
53	Mitchell Pavao-Zuckerman	Connectivities in design and function of novel urban ecosystems
54	Marja Copeland	Interruptions to flow: The spatial and temporal patterns of road-stream crossing in Pittsburgh, PA

Poster Abstracts

Poster 1

Out of sight, out of mind: septic systems and the risk they pose to freshwater ecosystems

Capps, Krista - University of Georgia, Athens, GA USA
McDonald, Jacob - University of North Georgia, Athens, GA USA
Gaur, Nandita - University of Georgia, Athens, GA USA

Septic systems are a fundamental component of global wastewater infrastructure. In the US, one in three residences relies on septic systems for wastewater treatment, but the vast majority of these systems are poorly maintained. Improperly managed septic systems can fail and lead to groundwater and surface water contamination through increases in ambient nutrient concentrations and the release of potentially harmful pathogens, personal care products, and pharmaceuticals. However, most municipalities have limited information pertaining to the total number, location, age, and maintenance history of septic infrastructure in their jurisdiction. Here, we will discuss the important role that septic systems play in wastewater infrastructure globally and in the US. We will use septic data collected and maintained by Athens-Clarke County, Georgia to highlight ubiquitous and important information gaps about septic systems that are faced by counties throughout the US.

Poster 2

Coal-tar-based pavement sealcoat is a potent source of polycyclic aromatic hydrocarbons (PAHs) to urban streams

Mahler, Barbara - U.S. Geological Survey, Austin, TX, USA
Van Metre, Peter - U.S. Geological Survey, Austin, TX, USA

Coal-tar-based pavement sealants applied to many asphalt parking lots and driveways in North America are a potent source of polycyclic aromatic hydrocarbons (PAHs) to urban streams. PAH concentrations in stormwater runoff from coal-tar-sealed pavement are highest in the months following sealant application but remain higher than concentrations in runoff from unsealed pavement for years after application. Simulated rain runoff from coal-tar-sealcoated pavement collected as long as weeks or months following sealcoat application was acutely toxic to test organisms (the cladoceran Ceriodaphnia dubia and the fish Pimephales promelas). Using the fish-liver cell line RTL-W1, runoff collected as much as 36 days following coal-tar-sealcoat application caused DNA damage and impaired DNA repair capacity, even with 100-fold dilution. Results demonstrate that pavement sealed with coal-tar-based sealcoat are “hot spots” of PAH contamination and that prolonged “hot moments” of toxicity follow coal-tar sealcoat application.

Poster 3

Source identification to enhance routine water-quality sampling programs

Stillwell, Charles - U.S. Geological Survey, Raleigh, NC USA
Hopkins, Krissy - U.S. Geological Survey, Raleigh, NC USA
Cain, Jessica - U.S. Geological Survey, Raleigh, NC USA

Municipalities conduct routine water quality sampling to comply with regulations and also to assess effects of management actions. However, linking management actions to changes in water quality can be difficult due to multiple pollutant sources in urban watersheds. To identify potential pollutant sources in Raleigh, NC, we performed a synoptic summer baseflow sampling campaign in 19 headwater streams. These small (<1 km2) watersheds represented three categories of wastewater infrastructure: high-density septic systems, old-sewered neighborhoods, and new-sewered neighborhoods. Results indicated that old-sewered streams had higher concentrations of nitrate and total nitrogen compared to new-sewered streams. Septic-system watersheds had variable nitrate concentrations warranting further exploration of explanatory variables such as soil types and septic age. These results were presented at a workshop with nearby municipalities, during which feedback was solicited on their most pressing urban stream hot topics and ways to collaborate to enhance ongoing monitoring efforts to address these issues.

Poster 4

Integrating stormwater management and stream restoration strategies for greater water quality benefits

Lammers, Roderick - University of Georgia, Athens, GA, USA
Dell, Tyler - Colorado State University, Fort Collins, CO, USA
Bledsoe, Brian - University of Georgia, Athens, GA, USA

Urbanization leads to greater runoff volumes, and higher and more frequent peak flows, which cause stream channel erosion and degrade water quality. Stormwater control measures (SCMs) and stream restoration practices are used to mitigate hydrologic alteration and stabilize stream channels – reducing downstream sediment and pollutant loading. There are strong interactions between SCMs and channel stabilization, but in practice, implementation is rarely coordinated. In this study, we examine SCMs and stream restoration in Big Dry Creek, a suburban watershed in north-central Colorado. We combine continuous hydrologic model simulations with channel evolution modeling to examine interactions between stormwater management and stream restoration for reducing loading of sediment and adsorbed phosphorus. Results indicate that integration of SCMs and stream restoration can yield synergistic reductions in pollutant loading. Piecemeal approaches miss these benefits and make restoration projects more prone to failure, wasting resources that could be better applied for pollutant mitigation.

Poster 5

Stream biodiversity and habitat loss in two urban river systems over 40 years

Harding, Jon - University of Canterbury, Christchurch, NZ

A study of benthic communities in two urbans river catchments in Christchurch, NZ in 1980 provided an opportunity to assess changes in surface river length, habitat, benthic invertebrate diversity and community composition along these rivers after 40 years. In 1980 approximately 200 sites were sampled for basic water chemistry, substrate size and benthic invertebrates. In 2019, 50 sites were resampled. Over the 40 year period 10-15% of the upper reaches are now ephemeral. In 1980 two mayfly and three aquatic beetle species were collected in a number of sites in these two rivers. However, by 2019 no mayflies or aquatic beetles were found. Community compositions have changed with more pollution tolerant species such as snails, amphipods and oligochaetes dominating. Although these results are not surprising they do provide empirical evidence of the temporal response of stream communities to urbanisation.

Poster 6

Multi-stressor effects on biological communities in contrasting regions of the USA

Van Metre, Peter - U.S. Geological Survey, Austin, TX, USA
Waite, Ian - U.S. Geological Survey, Portland, OR, USA
Schmidt, Travis - U.S. Geological Survey, Fort Collins, CO, USA
Mahler, Barbara - U.S. Geological Survey, Austin, TX, USA

The U.S. Geological Survey investigated the ecological effects of multiple physical and chemical stressors on from 75 to 98 streams in each of four regions of the United States from 2013 to 2016. Urban land uses are the dominant drivers of stream condition in the Pacific Northwest, Northeast, and Southeast Piedmont regions whereas agriculture dominates in the Midwest. Boosted regression tree (BRT) models developed for biological metrics of algal, macroinvertebrate, and fish communities indicate the strong influence of contaminants, principally pesticides, in stream impairment in the three urban regions, with more habitat influence in the agricultural Midwest region. Structural equation models (SEM) for two of the

regions link landscape drivers, reach-based variables, instream stressors, and ecological responses. Ecological models for the Piedmont region were combined with a forecast of urbanization to predict the potential extent of stream impairment in 2060 if urbanization continues as it has.

Poster 7

Suburban stream erosion rates in Northern Kentucky exceed reference channels by an order of magnitude and follow predictable trajectories of channel evolution

Hawley, R.J. - Sustainable Streams, LLC
MacMannis, K.R. - Sustainable Streams, LLC
Wooten, M.S. - SD1 [Presenting author]
Fet, E.V. - SD1
North, N.L. - Sustainable Streams, LLC

In a 10-yr study across 61 monitoring sites, average rates of streambank erosion in suburban streams (>5% total impervious area, TIA) were ~10-times higher than reference streams (< 5% TIA): 9.4 cm/yr compared to 1.0 cm/yr. Average rates of streambed downcutting were also higher in developed streams: 1.5 cm/yr compared to 0.5 cm/yr. The suburban channels follow predictable sequences of channel evolution consistent with the “classic” Channel Evolution Model (CEM) of Schumm et al. (1984): Stage 1 (dynamic equilibrium), Stage 2 (incision and coarsening), Stage 3 (further downcutting, bank failure, and widening), Stage 4 (aggradation and additional widening), and Stage 5 (recovered). The data underscored statistical differences between several CEM stages (e.g. rates of bed coarsening (p value of 0.06) and incision (p value of 0.04) between Stage 1 and Stage 2 sites). Of the 45 developed stream sites, only four were in a stage of dynamic equilibrium.

Poster 8

Predicting geomorphic disturbance and stream channel change in urban watersheds

Russell, Kathryn - University of Melbourne, Burnley, VIC, Australia
Vietz, Geoff - University of Melbourne, Burnley, VIC, Australia

Urbanization leads to enlargement and simplification of river channels, although there is currently no accepted model for the expected extent and severity of channel change given a set of watershed characteristics. Using a powerful predictive data mining technique (Boosted Regression Trees), we developed hydraulic geometry relationships between stream geomorphic metrics (bankfull width, bankfull depth, instream wood) and a suite of watershed characteristics (including urbanization-related metrics effective imperviousness (EI) and riparian forest cover) across the Greater Melbourne region (~2700 km stream length). Bankfull width and depth increased over the first 10% EI then remained constant with further increases in EI. Instream wood increased with riparian forest cover across its range and was also highest at very low EI. The results indicate that geomorphic channel degradation begins at very low levels of EI, but that some instream wood can persist at higher levels of EI if adequate riparian forest cover is preserved.

Poster 9

Patterns and changes in multiple solutes over 20 years of weekly measurements in Baltimore streams

Fork, Megan - Cary Institute of Ecosystem Studies, Millbrook, NY, USA
Reisinger, Alexander - University of Florida, Gainesville, FL, USA
Groffman, Peter - Cary Institute of Ecosystem Studies, Millbrook, NY, USA
Rosi, Emma - Cary Institute of Ecosystem Studies, Millbrook, NY, USA

Despite increasing acknowledgement that mixtures of multiple solutes and pollutants constitute the chemical stressor environment in urban streams, urban stream ecology still generally focuses on characterizing patterns of individual constituents rather than mixtures. Here, we use multi-variate approaches to characterize relevant thresholds, concentration extremes, and variability in chemical mixtures (chloride, pH, sulfate, phosphate, nitrate, TN, and TP) using 20 years of weekly monitoring in Baltimore (MD, USA) streams and compare annual patterns in mixtures among eight catchments along an urbanization gradient. This long-term dataset allows us to track how these patterns change over 20 years, and link these changes to climate and watershed management. Further, we link these long-term records to one year of weekly pharmaceutical samples in stream water. Results of this work show that multi-variate analysis of chemical stressors can reveal additional information about urban solute delivery and dynamics beyond what could be gleaned from traditional univariate approaches.

Poster 10

Linking water and nitrate dynamics in suburban headwater streams

Jefferson, Anne - Kent State University, Kent, OH, USA
Plauche, Mary - Kent State University, Kent, OH, USA

We fingerprint the sources of water and nitrate in urban streams using stable isotopes, and then develop a conceptual model to explain how nitrate concentrations change during storms as a function of the different sources. Between storms, nitrate in the streams comes from sewage from leaky pipes or septic. When heavy rainfall brings new stormwater into streams, the stormwater has nitrate was originally from the atmosphere. A first flush of atmospheric-sourced nitrate can be detected even if there isn't a clear increase in concentration. Even in streams with similar levels of imperviousness in their watersheds, different water quality responses can occur because the concentration of sewage-sourced nitrate and how much water and nitrate comes from stormwater. Stream burial also has a strong influence on nitrate concentrations at both low and high flows.

Poster 11

Which "Wicked Problem" to Solve? Identifying Priority Threats When "Everything is Broken"

Prescott, Chris - City of Portland Bureau of Environmental Services, Portland, OR, USA

Urbanization imposes a wide range of severe threats to stream health, including flashy flows, degraded habitat, high temperatures, poor water quality and impaired biotic integrity. The City of

Portland, OR, USA monitors an extensive set of instream, riparian and upland land use features to identify the greatest threats to stream health and prioritize restoration actions. The analyses indicate that culverts are the greatest threat to the integrity of fish communities (to the extent that it is difficult to detect the effect of other secondary threats) and has a strong negative effect on residents as well as migratory species. Lack of riparian vegetation was the greatest threat to macroinvertebrate communities. Stormwater indicators were also important to macroinvertebrates, but the construction of a spatial stream network to account for autocorrelation and inverse distance weighting will be required to more properly assess these threats.

Poster 12

Tropical urban stream responses to extreme climatic events: droughts and hurricanes in Puerto Rico

Ramirez, Alonso - North Carolina State University, Raleigh, NC, USA

Climate models predict an increase in the frequency of extreme climatic events in the Caribbean, in particular droughts and intense hurricanes. In 2015, Puerto Rico experienced the most severe drought in the last 50 years. Then in 2017, hurricanes Irma and Maria hit the island. Here we assess and contrast the effects of drought and hurricane disturbance on macroinvertebrate and fish assemblages in an urban stream in Puerto Rico. Long-term monitoring allowed us to assess effects on stream biota. While assemblage abundance and composition changed in response to both disturbances, drought resulted in larger shifts in assemblage structure than hurricanes. Prolonged periods of low flow are rare in our study area. However, hurricanes and tropical storms are frequent phenomena and local fauna might be preadapted to their impact. Predicted increases in drought frequency are then a major concern for the function and conservation of tropical urban streams in the Caribbean.

Poster 13

An Index of Riparian Integrity for cities

Scoggins, Mateo - City of Austin, Austin, Texas, USA
Porras, Abel - City of Austin, Austin, Texas, USA
Gonzalez, Ana - City of Austin, Austin, Texas, USA
Richter, Aaron - City of Austin, Austin, Texas, USA

After 20 years, and three different iterations, the City of Austin has settled on a GIS/remote sensing-based tool for assessing general riparian health that can be easily calculated and provides a screening level scoring system that allows for city-wide comparison and prioritization of restoration efforts. Using an algorithm that includes tree canopy, impervious cover and pervious cover (only three variables!) and breaking a stream network into 1000’ management units, the Index of Riparian Integrity allows for qualitative scoring of basic riparian function at a scale that is practical for understanding how development, the regulatory environment, and resources can be optimized toward healthy urban buffers.

Poster 14

Urban Stream Ecology Research at the University of Texas at San Antonio: A Developing Program

Laub, Brian - The University of Texas at San Antonio, San Antonio, TX, USA

San Antonio, Texas (USA) is the 7th largest city in the U.S. and is expected to increase in population by 1 million over the next several decades. Expanding development will likely impact surface water and the karst aquifers of the region that are critical habitat and drinking water resources. Research in my lab focuses on understanding the impacts of urban development on aquatic environments in the region and mitigation strategies. Current projects include urban impacts on water quality in stormwater runoff, efficacy of low impact development projects on improving water quality, water quality impacts of wastewater treatment discharge, and baseline information on stream habitat and biotic communities in areas slated for development in the near future. The research will provide important understanding of aquatic systems in this relatively understudied karstic region with a mix of intermittent and perennial flow regimes.

Poster 15

Can green stormwater infrastructure save suburban streams?

Hopkin, Krissy - U.S. Geological Survey, Raleigh, NC, USA
Bhaskar, Aditi - Colorado State University, Fort Collins, CO, USA
Woznicki, Sean - Grand Valley State University, Muskegon, MI, USA
Fanelli, Rosemary - U.S. Geological Survey, Raleigh, NC, USA

Urban development is a well-known stressor for stream ecosystems, but managers struggle to find ways to mitigate its effects. For the past fifteen years we have monitored streamflow, water quality, geomorphology, and benthic communities in four watersheds located in Clarksburg, Maryland. The aim of monitoring was to assess the impacts of suburban development with a high density of green stormwater infrastructure (GSI). The monitoring design included a forested control, an urban control, and two treatment watersheds that transitioned from agriculture to suburban development with a high-density of GSI. Streamflow magnitude and timing was altered by suburban development in the treatment watersheds even with GSI implemented to treat 100% of the impervious area. Specific conductance increased all locations, but nitrate concentrations declined in Treatment 1. Benthic health scores rebounded in the Treatment 1 watershed post-construction, but not in Treatment 2. Results highlight the importance of tracking multiple indicators of stream health.

Poster 16

Proctor Creek Design Presentation

Calabria, Jon - University of Georgia, Athens, GA, USA
LAND 6390 Students - University of Georgia, Athens, GA, USA

The Proctor Creek Urban Water Federal Partnership Program fostered planning activities across many federal agencies to ameliorate several urban watersheds. Improving degraded channels and reducing sedimentation in Proctor Creek was the focus of several Corps of

Engineers plans, which prioritized over a dozen enhancement sites in the watershed. Graduate students from an elective ecological restoration course addressed landscape architecture elements in one of the projects by visualizing future conditions that increased the landscape performance of the space in concert with the stream enhancement. The design of the stream and surrounding area will be presented.

Poster 17

Unifying Ecology, Hydrology and Geomorphology in River Research via Eco-hydromorphology

Tureček, Jessica - University of Waterloo, Waterloo, ON, Canada
Murphy, Stephen - University of Waterloo, Waterloo, ON, Canada
MacVicar, Bruce - University of Waterloo, Waterloo, ON, Canada

In managing the symptoms of the urban stream syndrome, a gap persists in the theoretical understanding of interactions between multiple stressors and their collective effects on stream ecology. Most research remains siloed, perpetuating this gap and detracting from the success of ecological management by focusing on stressors of disciplinary interest, rather than stressors which most influence ecological recovery. Eco-hydromorphology presents an alternative approach to help refocus efforts through simultaneous examination of ecological, hydrological and geomorphological variables. We explored the relevance of eco-hydromorphology to river research by examining its effectiveness and uniqueness beyond its three foundational disciplines in terms of theoretical framework, implementation and management outcomes. Our key finding was that while eco-hydromorphology is increasing in application, it is still not theoretically explicit. Effective application requires fundamental advances: consistent terminology to improve communication; a robust theoretical framework with clear principles and defined explanatory power; and, innovation in statistical and mechanistic modelling.

Poster 18

Synthesizing social and ecological outcomes to inform urban stream restoration decisions

Mckay, Kyle - U.S. Army Corps of Engineers, Environmental Laboratory, USA
Weppler, Peter - U.S. Army Corps of Engineers, New York District, USA
Baron, Lisa - U.S. Army Corps of Engineers, New York District, USA

Urban stream restoration requires not only an understanding of the ecological benefits of management actions, but also the socio-economic consequences of those decisions. Given many (sometimes competing) objectives, multiple lines of evidence must often be traded-off in decision making, which is particularly challenging when objectives are disparate or are not of equal importance. We adapt classic decision-making frameworks to inform and contextualize urban stream restoration of the Bronx River in New York City. In addition to primary objectives associated with ecological benefits and monetary costs, we assess secondary outcomes related to environmental justice, stakeholder support, and ecosystem services. Overall, the secondary criteria provided important context for decision makers and assisted them in assessing the all important question of “How much ecosystem restoration is worth the investment?”

Poster 19

Assessing the Biogeochemical and Ecological Impacts of Drinking Water Orthophosphate Addition to an Urban Stream Network

Balangoda, Anusha - University of Pittsburgh, Pittsburgh, PA, USA
Dabundo, R. - University of Pittsburgh, Pittsburgh, PA, USA
Haig, S. - University of Pittsburgh, Pittsburgh, PA, USA
Elliott, Emily - University of Pittsburgh, Pittsburgh, PA, USA

As a key limiting nutrient, readily bioavailable orthophosphate (PO43-) directly affects aquatic ecosystems. As such, higher concentrations of PO43- can cause increases in autotrophic production, changes in species assemblages, and eutrophication. Despite this concern, PO43- is commonly used as an additive at drinking water treatment plants to reduce pipe corrosion and lead concentrations in drinking water. At the same time, deferred maintenance results in greater than a 30 percent loss of drinking water through failing urban water infrastructure in the Pittsburgh system. This NSF-RAPID funded study investigates the impacts of a large-scale PO43-addition to a drinking water distribution system with a specific focus on changes in urban stream nutrient dynamics, nutrient limitation, and algal growth. Monthly water samples were collected from five urban streams in the Pittsburgh, Pennsylvania water service area before and after PO43- addition. We conducted comprehensive water chemistry analyses including nutrient, anion, and trace metal concentrations. Preliminary observations reveal spatial and seasonal variations in water chemistry; however, further monitoring is required to distinguished seasonal trends from long-term changes related to PO43- additions. The scientific outcomes from this study will provide important information for decision-makers regarding future PO43- addition to other cities and related ecological impacts from nutrient enrichment to urban freshwater ecosystems.

Poster 20

Interactive effects of urban runoff and stream channel incision on riparian soils and understory vegetation

Solins, Joanna - University of California, Davis, CA, USA
Cadenasso, Mary - University of California, Davis, CA, USA

Stream channel incision is a well-established consequence of urbanization that is linked to drier conditions in riparian zones. Yet in Mediterranean-climate regions, urban runoff can dramatically increase dry-season streamflow, potentially increasing moisture in urban riparian zones. We asked whether channel incision interacted with dry-season streamflow to influence riparian soil characteristics and understory vegetation along streams in Sacramento, California. At 40 sites that varied by severity of incision and presence of dry-season streamflow, we sampled soils and vegetation on top of stream banks and at the margin of the baseflow channel, a critical location for nutrient cycling in arid systems. Channel incision limited the influence of dry-season streamflow on soil moisture, and this interaction had persistent effects on soil organic matter and perennial vegetation on bank tops. At the stream margin, channel incision was associated with reduced soil organic matter, which could limit nutrient cycling and ultimately affect water quality.

Poster 21

The joy and success of GSI is all in the details

Staryn Wagner - City of Austin, Austin, TX, USA

For any inter-agency project there are going to be barriers. Getting buy-in, developing partnerships, establishing legal agreements, funding, responsibilities, maintenance, and blah and blah and blah. The challenge that brings me the most joy is solving the technical issues. Finding designs that create solutions to some of the aforementioned problems and solutions to problems of physics. How do you get an agency to take on maintenance of a system that they don't like because they don't know how to or want to? Design it to require less maintenance. How do you release a thousand gallons of water below ground without creating a muddy mess? Run it through a coil of tubing small enough that the pressure and flow do not have the force and volume to create surfacing. And while you are at it create a few new equations people can use to apply these solutions elsewhere.

Poster 22

Active recolonization of bugs can help restore biodiversity in urban streams

Macneale, Kate - King County Water and Land Resources, Seattle, WA, USA

Can moving sensitive macroinvertebrate communities to isolated urban streams increase diversity and improve benthic index of biotic integrity (B-IBI) scores? We tested this idea in four streams in King County, WA. The recipient streams were selected because their B-IBI scores were lower than expected (given the surrounding land use), and they are far from sources of sensitive taxa. In the summer of 2018, we translocated approximately 46,000 individuals, including 40 or more unique taxa not found in the recipient streams, to each of the recipient streams. In the summer of 2019, we found several of those translocated taxa persisted, and in two of the four streams B-IBI scores improved. Continued monitoring is needed to demonstrate sustained establishment, and therefore long-term success, but these initial results suggest active recolonization of macroinvertebrates may be an appropriate tool for jump starting recovery in isolated, under-performing urban streams.

Poster 23

Freshwater Salinization Syndrome, High Resolution Trends Over Space and Time

Galella, Joseph - University of Maryland College Park, College Park, MD, USA
Kaushal, Sujay - University of Maryland College Park, College Park, MD, USA
Wood, Kelsey - University of Maryland College Park, College Park, MD, USA
Reed, Lainey - Cornell University, Ithaca, NY, USA

Freshwater salinization syndrome has been shown to alter the chemical composition of base cations, elevate alkalinity and increase salinization of fresh waters. It is believed that increased weathering of "urban karst" from acidic precipitation and the application of road salt during the winter months are two primary drivers of this process, especially in urban landscapes. Most research thus far has been regarding long term decadal trends with little focus on higher frequency datasets. In this study, bi-weekly sampling was conducted at sites within the D.C. and

Baltimore metro area, with hourly sampling being conducted during winter storms. Synoptic surveys of watersheds have also been conducted in order to explore relationships between salinity and land use. Positive relationships have been observed between Na and other base cations (Cl, Mg, K), and between specific conductance and metals including Sr, Cu, and Mn, during winter storms, indicating the occurrence of base cation exchange.

Poster 24

Using Aquatic Insects to Compare Urban and Green-space Stream Environments

Gockel, Scout - University of Texas, Austin, TX, USA
Reichler, Stuart - University of Texas, Austin, TX, USA

During the summer of 2019, a team of student researchers began collecting data from various locations along several Austin creeks for the purpose of comparing heavily urbanized locations to parks or informal green-spaces. Aquatic insects and macroinvertebrates collected from these sites, were used as biological indicators of the quality of a given ecosystem. Macroinvertebrate data was supplemented with bacterial and chemical data, as well as with qualitative assessments of each site. With the exception of E. coli, conductivity, and qualitative assessments, data showed no significant difference between stream ecosystems in urban versus green-space environments. While further research is needed, these findings may suggest that a localized stream ecosystem is affected less by the environment immediately surrounding it than initially expected.

Poster 25

New insights into the hydrologic behaviour of headwater streams

Burns, Matthew - The University of Melbourne, Richmond, VIC Australia
Walsh, Christopher - The University of Melbourne, Richmond, VIC Australia
Fletcher, Tim - The University of Melbourne, Richmond, VIC Australia
Imberger, Samantha - The University of Melbourne, Richmond, VIC Australia
Hehir, Genevieve - The University of Melbourne, Richmond, VIC Australia
Poelsma, Peter - The University of Melbourne, Richmond, VIC Australia
James, Robert - The University of Melbourne, Richmond, VIC Australia

Headwater streams are where catchment runoff first accumulates sufficiently to create overland flow paths. These headwater streams are critical regulators of downstream river health, yet their vulnerability to human activities is not matched by research effort into their ecological structure and function. To manage and protect these systems requires better understanding of their hydrologic behaviour. We have begun to monitor the hydrology of several ephemeral headwater streams in the Melbourne region. This work has been matched with water quality and ecological sampling. Here we will present on the preliminary findings from this research. The nature of the systems monitored has meant that novel field methods have been used which will be of interest to the urban stream community.

Poster 26

Assessing Potential Ecological Functional Lift from Urban Stream Restoration

Schwartz, John - University of Tennessee, Knoxville, TN, USA
Alford, Brian - University of Tennessee, Knoxville, TN, USA

Ecological improvement from stream restoration projects particularly in urban watersheds has been varied and incremental in stream condition. There is a critical need to better understand ecological responses to restoration in order to improve on design strategies, and assign restoration mitigation credits. Research goals were to: 1) compare field measured geomorphic, habitat, and biological data among urban streams (unrestored), urban restoration sites, and ecoregion reference stream sites, and by the comparisons assess the what metrics and indicators best quantify improvements to stream condition; 2) explore the use of species functional traits to discriminate among the three stream condition; and 3) assess the metrics applied in the state's stream quantification tool (TN SQT) to compute existing condition scores and the potential functional lift from urban stream restoration. Site data were collected from twelve streams in the Ridge and Valley Ecoregion consisting of four stream sites for each stream condition class.

Poster 27

Resilient river restoration through dam removal

Abbott, Katherine - Massachusetts Cooperative Fish and Wildlife Research Unit, University of Massachusetts, Amherst, MA, USA
Roy, Allison - U.S. Geological Survey, Massachusetts Cooperative Fish and Wildlife Research Unit, University of Massachusetts, Amherst, MA, USA
Nislow, Keith - U.S. Department of Agriculture Forest Service, Northern Research Station, University of Massachusetts, Amherst, MA, USA

A changing climate presents new challenges, and opportunities, for ecological restoration. Restoration outcomes depend on a system's resilience to future disturbances, which include urbanization and extreme climatic events. In New England streams, climate change is expected to alter flow regimes, increase water temperature, and alter biotic communities. These impacts may be compounded by development through channelization, increased impervious cover, degraded water quality, and the presence of dams, which are prevalent across New England. Dam removal is increasingly used as a means of stream restoration in this region, but little is known about how dam removal may be used to enhance resiliency to climate change from both ecological and socio-economic perspectives. Therefore, we propose to survey resource managers and restoration practitioners to understand how climate change knowledge is currently integrated into dam removal planning and implementation, and to elucidate gaps between scientific data production and data needs. In order to quantify resilience, we will identify and model a suite of metrics for a selected watershed before and after dam removal, which will incorporate ecological (e.g., biodiversity, water quality) and socio-economic (e.g., flood risk reduction, economic costs/benefits) responses. Results may be used to develop a decision-making framework for selecting sites for dam removal that provide multiple benefits. This approach may unlock previously inaccessible funding opportunities, as funders consider

climate change resiliency as a key issue in the upcoming years.

Poster 28

Combined sewer overflows create novel concentration-discharge hysteresis patterns in urban streams

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Concentration-discharge patterns are commonly used to infer watershed transport pathways for solutes to stream water. However, combined sewers, which have sewage and stormwater traveling in the same pipes, can overflow during wet weather creating a direct link from anthropogenic waste sources to nearby surface waters that our current understanding of concentration-discharge hysteresis does not account for. We combine continuous sensing of nitrate, discharge, and other water quality metrics with stable isotopes to produce finely-resolved data that allows us to assess how water quality and solute sources change throughout individual storms. Our results reveal patterns of storm concentration-discharge response comprised of three sequential parts: (1) dilution of baseflow nitrate with stormwater runoff, (2) input of high concentration nutrients from CSO activation, and (3) groundwater flushing during hydrograph recession. Quantifying these variable mechanisms for stormflow nutrient delivery is critical for to deepening our understanding of wastewater-groundwater-surface water interactions during different types of storms.

Poster 29

Hydrologic retention and nutrient dynamics around urban beaver dams

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Beaver dams are retention structures with the potential to impact hydrologic and nutrient retention in urban environments. We measured hydrologic and nutrient retention in an urban beaver dam in Atlanta, GA to better quantify the services provided by urban beaver. Hydrologic retention in ponds, measured using transit time distributions, increases compared to undammed reaches at low flow, but ponds are hypothesized to have limited capability to hold excess stormwater. Hyporheic fluxes through the dam are anoxic with high decomposition, as evidenced by very high ammonium concentrations yet average DOC concentrations. Stable isotopes of nitrate indicate denitrification through these structures and nitrate concentrations are consistently lower below the dam. Urban beaver ponds appear to be potential control points on nutrient processing at low flow in cities, but may have minimal impact on controlling stormwater fluxes. Beaver dam analogues, installed as stream restoration structures, are expected to have similar benefits.

Poster 30

Recovery of energy cycling following hydrologic disturbances in sub-tropical urban streams

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Urban streams are under considerable pressure from anthropogenically-induced stressors. Increased impervious surfaces in the watershed associated with ongoing urbanization and subsequent losses of riparian zones result in increasingly flashy hydrology, altered dissolved organic material (DOM) composition, and rising nutrient concentrations. Following storm events, urban run-off enriches streams with nutrients and DOM. Despite these stressors, urban streams maintain high rates of ecosystem metabolism, although, the response following storms is unclear. To test the effects of multiple stressors on urban streams, we continuously monitored dissolved oxygen, light, and temperature from seven streams along an urbanization gradient to estimate ecosystem metabolism and quantified DOM composition and N concentrations bi-weekly. We hypothesize that stream metabolic recovery will be subsidized by anthropogenic inputs of N and increased bioavailable DOM and will be quickest in more heavily urbanized systems. Study results will highlight how landscape practices affect urban streams' ability to recover and withstand hydrologic disturbances.

Poster 31

Establishing environmental flows for the Los Angeles River: Striking the balance between wastewater reuse, aquatic life, and recreational uses

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The State of California is invested in promoting wastewater and stormwater reuse and recycling to enhance local water resiliency in light of a changing climate. However, reuse leads to potential reductions in streamflow, especially in semi-arid urban streams during the dry season, which could impact aquatic life and recreational beneficial uses. The Los Angeles (LA) River provides an important source of habitat and recreational opportunities in the highly urbanized LA region. A framework and suite of tools, including a coupled hydrologic-hydraulic model, mechanistic flow-ecology models, and targeted interviews with recreational experts, were developed for the LA River to understand how increases in wastewater recycling, stormwater capture, and habitat restoration may impact in-stream flows and subsequently the stream ecology and recreational uses of the river. Relationships are being developed between various alternative flow regimes and the extent to which beneficial uses can be achieved. Results

indicate that management scenarios result in tradeoffs in hydrologic and hydraulic variables, which will ultimately impact the range of competing needs within the river.

Poster 32

Integrated Assessment of the Physical Condition of Urban Streams

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Urban environments are among the most dynamic on Earth, as land cover changes and human alterations continually modifies the landscape and hydrology. Rapidly developing landscapes pose complex and interdisciplinary challenges for management, planning, and decision making. To identify a solution to increasing maintenance costs and overall stream management needs in the Denver, Colorado metropolitan area, an urban stream assessment program is being developed by the Mile High Flood District. The program is an innovative method to identify the highest potential function and lowest maintenance requirements given the watershed context and community goals. The program builds on recent advances in multi-scale hydrological, geomorphological, and riparian assessments and social-ecological processes. The first results obtained on several streams support the overall goal, which is to improve our understanding of the influence anthropogenic stressors have on the physical condition of streams in the urban environment, and the science underlying urban stream management.

Poster 33

Aquatic Biodiversity Loss on Andean Urban Streams

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Andean rivers support an amazing biodiversity and important environmental services for Andean landscapes like water for agriculture and for human consumption. Urban areas in Andean countries have grown at an accelerated rate in the last decades. As a consequence, lack of wastewater treatment and riparian preservation have threatened these streams. We studied urban, rural and well-preserved streams in the Upper Guayllabamba River Basin, where Quito (capital city of Ecuador) is located. We found more than 90% of macroinvertebrate richness loss on urban streams as well as functional feeding groups. Only collectors are found in urban environments. We also found more macroinvertebrate deformities in urban streams. Urban streams in Quito have lost most of their biodiversity and ecosystem services. However, they are important green areas for citizens and deserve better attention. Well preserved streams in the area need protection since they host an amazing biodiversity that we are starting to

describe.

Poster 34

Mapping wetland dynamics using remote sensing approaches to assist long-term planning in a rapidly urbanising landscape

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Patterns of wetting and drying are major determinants of local and landscape-scale patterns of species diversity in rivers and wetlands. Tracking these cycles is therefore important for understanding species distribution patterns and population dynamics of aquatic biota. Here we used the remotely sensed Landsat Tasseled Cap transformation as a ‘wetness’ index to track wetland dynamics across the greater Melbourne region over a 31-year period. Our results demonstrate significant temporal variation in the number of wetlands and total area of wetland habitat over time – trends that are strongly linked to interannual climatic cycles. These data will be used to explore temporal dynamics in the occurrence of aquatic organisms across permanent and intermittent urban and rural wetlands to help prioritise the protection of these habitats within the context of a drying climate and rapidly expanding urban footprint.

Poster 35

Freshwater Salinization Syndrome Degrades Stormwater Management and Stream Restoration: Mobilization of ‘Chemical Cocktails’

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Doody, Thomas - University of Maryland, College Park, MD, USA
Wood, Kelsey - University of Maryland, College Park, MD, USA
Galella, Joseph - University of Maryland, College Park, MD, USA
Nguyen, William - University of Maryland,College Park, MD, USA
Reimer, Jenna - University of Maryland, College Park, MD, USA
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Billions of dollars are spent on attempts to improve urban water quality using stormwater best management practices (BMPs) and stream restoration. While stream restoration and stormwater BMPs can retain contaminants, there is also potential to remobilize contaminants from increased ion exchange, solubility, and microbial processes associated with Freshwater Salinization Syndrome (FSS). We investigated mobilization of chemical cocktails, or novel combinations of elements, across stream restoration and stormwater BMPs in response to FSS. There were significant relationships between nitrogen and salt cations and bromide, sulfate, and chloride in urban streams, which indicated co-transport of chemical cocktails. Salinization experiments showed mobilization of metals, nutrients, and base cations from sediments of restored streams and stormwater BMPs across construction age. Our results suggest that Freshwater Salinization Syndrome can degrade contaminant retention functions in urban streams and wetlands and enhance release of various chemical cocktails. Freshwater salinization should be considered in urban stormwater management strategies.

Poster 36

Building Cross-Discipline Synthesis with an Urbanized Headwater Stream Typology

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Urbanized headwater streams are difficult to define, because these systems have different meanings to different stakeholders. If one were to ask hydrologists, ecologists, social scientists, water resource managers, and residents of urbanized areas to define an urbanized headwater stream, the answers would vary and might even conflict. We argue that the first step toward unifying research and knowledge on urbanized headwaters is to recognize that different definitions and perspectives on these waterways must be explicitly considered. Examining when and where definitions diverge is a critical step to creating novel, interdisciplinary collaborations and generating pioneering research on urbanized headwater streams. To organize these perspectives, we propose a typology of urbanized headwater stream channel types, including streams that resemble forested systems, concrete-lined streams, and green infrastructure such as bioswales. Using this framework, scientists can capture the heterogeneity of urbanized headwaters to start understanding how to study and compare these systems.

Poster 37

Short-Term Changes in Water Chemistry of an RSC in College Park, MD

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Kaushal, Sujay - University of Maryland, College Park, MD, USA
Wood, Kelsey - University of Maryland, College Park, MD, USA

Stream restoration projects may have unintended consequences on water quality that are not well understood due to a lack of monitoring before and after restoration. Campus Creek in College Park, Maryland was restored during the summer of 2019 using regenerative stormwater conveyance (RSC): an open-channel approach utilizing a series of step pools and sand

channels to slow and filter streamwater and retain nutrients such as nitrogen, phosphorus, heavy metals, and road salts before they are transported further downstream. However, standing pools that raise water temperatures and decrease dissolved oxygen could potentially release metals that have sorbed onto the streambed as an unintended consequence. Pre-restoration water chemistry data has been collected routinely over the past three years and will be compared to post-restoration sampling to identify benefits and trade-offs of RSC restoration. Assessing stream restoration benefits and trade-offs can lead to new approaches on nutrient management and future stream restoration projects.

Poster 38

Impact of urbanization on intermittent stream hydrology and geomorphology in south central Texas

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Little is known about controls on intermittent stream hydrology and geomorphology or impacts of urbanization on intermittent streams. Urbanization of intermittent streams may increase flashiness of flows and decrease pool habitat. Alternatively, urbanization may perennialize streams and increase pool habitat. We used USGS gauge data and publicly available geospatial data sets to determine natural factors controlling intermittent flow regimes and pool persistence in south central Texas. Then we determined if dams and urbanization have impacted flow regimes, pool persistence and connectivity, and channel morphology in the San Antonio-Austin urban corridor. We found that clay and depth to bedrock were the main drivers of intermittent flow regimes, pool persistence, and bankfull widths. Flood control dams and/or urbanization increased flow consistency and pool persistence but pools were highly fragmented. We found evidence of channel widening in urbanized reaches which may increase length of dry periods or disconnect perennial and intermittent reaches.

Poster 39

Riparian Groundwater Chemistry Trade-Offs of Tree Removal in Stream Restoration Projects

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Kaushal, Sujay - University of Maryland, College Park, MD, USA
Vidon, Philippe - Suny ESF, Syracuse, NY, USA
Galella, Joseph - University of Maryland, College Park, MD, USA

We aim to assess the impact of tree removal during stream restoration projects on riparian groundwater quality over space and time. Twenty-nine wells installed across 5 sites in watersheds of the Baltimore-Washington D.C. metropolitan areas in Maryland encompass a range in restoration ages from current up to 20 years to provide insight into water quality recovery rates following tree removal. Wells are sampled about monthly and the water is analyzed for carbon (organic and inorganic), nitrogen, major cations, and metals. Preliminary results show plant nutrients such as N, Ca, and K were elevated in riparian reaches where trees were removed 5 years ago compared to reaches with mature trees. Concentrations of dissolved

organic carbon (DOC) and total dissolved nitrogen (TDN) peaked 5 years following tree removal and then declined approaching pre-disturbance conditions with increasing riparian tree age.

Poster 40

Large-scale environmental data collection with first-year undergraduate students

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Shear, Ruth - The University of Texas at Austin, Austin, TX, USA
Poteet, Mary - The University of Texas at Austin, Austin, TX, USA

At many universities faculty research and teaching are at odds. The Freshman Research Initiative (FRI) unifies these two central missions. Starting in their first year at university, FRI students are placed in research labs where they learn critical skills performing research while receiving credit towards their degrees. The Urban Ecosystems research group starts with 60 freshmen each Fall. During the Fall the students learn about research, urban ecology, and practice lab techniques. In the Spring and Summer they focus on specific projects collecting environmental data in and around Austin. Because we have three faculty members with a wide variety of expertise, senior students to mentor the freshmen, and so many student researchers, we can collect large amounts of diverse data. In the last year we collected thousands of data points about stream microbiology, macrobiology, molecular biology, chemistry, and ecology as well as terrestrial air quality, species diversity, and carbon capture.

Poster 41

Looking Beyond Leaves: Nutrient Leaching Potential of Various Types of Seasonal Litterfall Within an Urban Forest

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Hale, Rebecca - Idaho State University, Pocatello, ID, USA

Urban trees play a key role in managing the volume of stormwater runoff, yet inundation of their litterfall leaches significant amounts of nitrogen and phosphorus into stormwater. Most research has focused on large-volume deciduous leaf sources, but year-round inputs such as blossoms and seeds could contribute to nutrient loads in unexpected ways. We collected samples of various litterfall types from common urban trees planted across a mid-sized urban landscape within a larger semi-arid climate. We found significant differences in the type and amount of nutrients leached based on the type of litter input as well as significant variation across species. Understanding the differences in nitrogen and phosphorus leached across seasonal litterfall inputs from urban trees has implications for city management as street sweeping, tree planting, and overall urban design programs. By incorporating this information, stakeholders can work towards building more sustainable urban landscapes with minimal impacts on water quality.

Poster 42

GIS-based prioritization system for small municipality MS4 compliance projects

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Schwenk, Bailey - Lycoming College, Williamsport, PA, USA
Rieck, Leslie - Lycoming College, Williamsport, PA, USA

Federal regulations require small municipalities to manage stormwater transported through municipal separate storm sewer systems (MS4). Suitable project locations for best management practices (BMPs) to fulfill MS4 requirements can be difficult to identify, especially for small municipalities with limited resources. We are creating a GIS-based project prioritization tool for a coalition of municipalities in Lycoming County, PA, USA to aid in identifying suitable locations for BMP projects. A location suitability index is being developed from relevant federal and state regulations and local stakeholder input using landcover, parcel, hydrology, stormwater system, and other spatial data. Efforts to date demonstrate that ideal locations for BMPs are limited, especially for streambank restoration. The locations of combined sewer areas excluded from load calculations also substantially limit project options.

Poster 43

MS4 Misunderstandings and Myths: Moving toward effective stormwater management for small municipalities

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Carson, Craig - McCormick Taylor, Baltimore, MD, USA
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Scoggins, Mateo - City of Austin, Austin, TX, USA
Smith, Robert - Lycoming College, Williamsport, PA, USA

Federal regulations for municipal separate storm sewers (MS4) in the United States have been in place since 1990 as part of the Nation Pollutant Discharge Elimination System (NPDES), aiming to reduce sediment and pollutant loads originating from urban areas. However, small-municipality MS4s frequently grapple with several misunderstandings, resulting in a lack of stakeholder buy-in and actionable stormwater management plans. We summarize common misunderstandings concerning MS4 requirements and offer real-world examples of efficient, effective MS4 frameworks. For example, many municipalities see no funding mechanism for implementing stormwater plans. Taxes are a potential mechanism yet often unpalatable to local municipalities, but grants or the creation of a stormwater utility can offset costs to local communities. Best management practices (BMPs) can create real, concrete improvements for surrounding communities, and improved understanding of the structure and options within the MS4 program will help small municipalities make informed choices about management plans.

Poster 44

Influence of land use on the riparian zone condition

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Ortega-Argueta, Alejandro - El Colegio de la Frontera Sur (ECOSUR), México
Castillo-Uzcanga, María Mercedes - El Colegio de la Frontera Sur (ECOSUR), México
Ramírez-Marcial, Neptalí - El Colegio de la Frontera Sur (ECOSUR), México

Riparian vegetation is strongly influenced by the surrounding land use. While it is known that urbanization processes can affect the ecological condition of the riparian zone, the specific responses require a further understanding. The Sabinal River basin, in southern Mexico,

represents a useful system to study riparian zones in an urban-rural context. This watershed has undergone important alterations in its riparian vegetation due to fragmentation and land use change, as part of a metropolitan phenomenon. This study examined physical elements at local and landscape levels in order to describe alterations in the riparian zone. A Principal Component Analysis (PCA) was conducted based on the database generated by applying the Riparian Quality Index (RQI) in fifteen different reaches. Soil compaction and modification of stream banks were the main aspects associated with urban areas, they appeared as excellent indicators of the urbanization process intensity which may enhance degradation of fluvial ecosystems.

Poster 45

How should we measure dredge and fill impacts to streams under the Clean Water Act?

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Dredge and fill impacts to streams, which reconfigure physical channel dimensions through dredging, channelization, stabilization, culverting, and filling, can have significant, large-scale impacts on the ecological integrity and functions of urban streams. In the United States, these impacts are regulated under the Clean Water Act (CWA) and other laws by multiple governmental institutions at the state and federal level. However, the way in which dredge and fill impacts to streams are measured is not consistent across institutions, causing wide geographic and cross-program variation in how these impacts are regulated. We describe national trends in the use of channel length and/or streambed area, the primary metrics used to measure and regulate stream impacts under the CWA, and then examine potential environmental consequences of metric choice. We then explore emerging alternatives to the length/area binary and consider new partnerships that could resolve institutional conflicts and better incorporate freshwater science principles into decision-making.

Poster 46

Habitat suitability models are powerful tools for helping diverse stakeholders agree on stream restoration priorities

Coleman, Rhys - Melbourne Water, University of Melbourne, Australia
Chee, Yung En - University of Melbourne, Australia
Bond, Nick - La Trobe University, Australia
Rossrakesh, Sharyn - Melbourne Water, Australia
Walsh, Chris - University of Melbourne, Australia

We developed spatially explicit, quantitative models and applied conservation prioritisation software (Zonation) to support stakeholder deliberations to identify priority actions and targets in Melbourne's Healthy Waterway Strategy. Habitat suitability models (HSMs) covered 52 macroinvertebrate families, 13 native fish species, and platypus. Using the HSM outputs, Zonation prioritised cost-effective management actions across a >8,000-km stream network to optimise protection and restoration of instream biodiversity. The benefits of this approach included: spatially continuous estimates of biodiversity across the region, ability to consider potential interactive impacts of future threats (urban growth, climate change), ability to quantify

expected differences made by individual or combined management actions, prioritisation of actions are based on cost-effectiveness, ability to spatially prioritise management actions and set quantitative management targets. The mapping outputs were also an effective way to summarise and communicate data to different audiences during the strategy co-design process.

Poster 47

Long-term trends in hydrology and biogeochemistry in a geomorphically restored urban stream

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Pennino, Michael - U.S. Environmental Protection Agency, National Center for Environmental Assessment, Washington, DC, USA
Newcomer-Johnson, Tammy - U.S. Environmental Protection Agency, National Exposure Research Lab, Cincinnati, OH, USA
Kaushal, Sujay - University of Maryland-College Park, College Park, MD, USA

We present data from a decadal scale study of Minebank Run, a stream restored in Baltimore, MD, USA in the Chesapeake Bay watershed designed alleviate stream incision, flashy hydrology, and improve water quality. Restoration features including oxbows, bank stabilization techniques, and weirs. Using a BACI design, we examined relationships between hydrology and biogeochemistry before and after restoration. Nitrate (NO3-) concentration in surface water declined after restoration and converged with NO3- patterns observed at a control site. Ground water NO3- declined and dissolved organic carbon increased after restoration. Flashiness decreased after restoration. NO3- concentrations and flux were estimated using EGRET (Exploration and Graphics for RivEr Trends) package to run the Weighted Regressions on Time, Discharge and Season (WRTDS) model. Both NO3- concentration and variability, and therefore flux, declined over time after the restoration. Nitrogen transformation was strongly influenced by ground water residence time and carbon quantity.

Poster 48

Investigating sewage influence on nitrate δ15N and δ18O values in Baker Creek in Knoxville, TN

Rexausen, Victoria - University of Tennessee-Knoxville, TN, USA

Urban development can result in elevated nitrate concentrations from a number of nonpoint sources including manure and sewage. Previous indication of leaky infrastructure coupled with elevated nitrate loading in Baker Creek Watershed in Knoxville, TN suggested contribution of sewage to nitrate loading in this watershed. This study employs nitrate isotopic tracers to investigate the likelihood of pollution from human septic tanks in Baker Creek. Dry weather samples were taken from throughout Baker Creek Watershed and analyzed for the isotpic composition of nitrate molecules. Although this study did not find conclusive evidence of such pollution, it did explore useful applications of nitrate isotopic tracers in hydrologic studies. The study recommends future research using nitrate isotopes as tracers in surface waters, as well as ways to improve environmental modeling using stable isotope geochemistry.

Poster 49

Statewide climate resilience planning and nature based solutions implementation in the municipal vulnerability preparedness program in Massachusetts, US

Burns, Sara - The Nature Conservancy, Boston, MA, USA

The state of Massachusetts developed a municipal level planning process to translate historic natural hazard experience into a climate change future in 2016. This Municipal Vulnerability Preparedness (MVP) Program launched using a stakeholder driven planning process developed by The Nature Conservancy (TNC). TNC scientists collaborated to train over 500 service providers in the facilitation process and the role for nature-based solutions projects in resilience planning. The MVP program also funds implementation projects, giving priority to nature-based solutions. Since 2016, 260 municipalities have participated in the planning process, and 67 projects have been funded for implementation. Municipalities across MA are self-organizing into resilient watershed units and thinking cumulatively about the climate change and natural hazard impacts of impervious cover and altered hydrology. This poster will share MVP information, example implementation projects and explore the future potential of this framing to enhance societal well-being through watershed health.

Poster 50

Using a combination of green infrastructure, stream restoration, and forest understory restoration to reverse ecosystem meltdown in one of Pittsburgh's last urban stream systems

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Messerly,Devin - Civil & Environmental Consultants, Inc., Pittsburgh, PA/Columbus, OH, USA
Hazelwood, Brad - Civil & Environmental Consultants, Inc., Pittsburgh, PA/Columbus, OH, USA

Woods Run in Riverview Park comprises one of Pittsburgh's few remaining open stream systems. As Woods Run exits the park, it is captured by the combined sewer system and contributes to combined sewage overflows during rain. Pittsburgh Water and Sewer Authority was interested in controlling runoff, sediment, and debris entering sewers. We discovered excess runoff and sedimentation were caused by a series of interacting factors in the watershed contributing to a meltdown in the ability of the stream and forest ecosystems to provide stormwater management services. Our design combines bioretention from roadways, forest understory restoration, and stream restoration to create healthier ecosystems that reduce combined sewage overflows.

Poster 51

Old Dogs & New Tricks: Detention SCMs tailored to mitigate erosion

Lindsay Olinde - City of Austin, Austin, TX, USA
Bob Hawley - Sustainable Streams, Louisville, KY, USA

Improving watershed resilience in our urban communities requires implementing a suite of

solutions that collectively buffer effects of urbanization. Hydromodification alters the flow regimes in streams by causing more frequent and longer periods of erosion. These shifts intensify risks to infrastructure and aquatic ecosystems. We will present examples of how cities can expand stormwater management services beyond water quality and flood control by including consideration of reduced stream erosion. SCM projects that are new build and retrofits can be cost-effective and designed to incorporate erosive thresholds, referred to as “Critical Discharge” or Qcrit. We will also present the monitoring methods that can locally validate a region’s erosive thresholds. The discussed concepts of stream erosion mitigation via detention SCMs is also applicable to policy and planning for proactively mitigating effects of climate change in urban streams.

Poster 52

City of Austin's Rain Catcher Pilot Program

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Denise, Delaney - City of Austin, Watershed Protection Department, Austin, TX, USA

With every rain event in Austin, stormwater rushes off impervious surfaces carrying pollutants to waterways. En route to the waterways, stormwater erodes land and can flood properties. A solution to slow down stormwater and improve water quality is to install green stormwater infrastructure (GSI) systems like rain gardens and cisterns. The City of Austin’s Watershed Protection Department (WPD) is currently implementing the Rain Catcher Pilot Program (RCPP) in the headwaters of the Waller Creek Watershed to increase the prevalence of distributed GSI systems on residential, public, and commercial properties. The RCPP incorporates existing WPD and Austin Water discounts, rebates, capital funding, and educational programs to encourage the installation of GSI systems that achieve stormwater management and water conservation objectives.

Poster 53

Connectivities in design and function of novel urban ecosystems

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Gerlak, Andrea - University of Arizona, Tucson, AZ, USA

Green infrastructure (GI) is often presented as a solution to urban environmental challenges, yet there are considerable gaps in understanding how GI functions in place and how GI is adopted. Here, I present an interdisciplinary project that investigates the natural science and decision-making dimensions of GI in Tucson, Arizona, USA. The project uses ecosystem services as a nexus to understand what is possible and what is practical with respect to GI implementation. I discuss a recent science-policy dialogue with the goal of understanding how managers and stakeholders value ecosystem services and place these services in broader factors affecting GI adoption. We used participatory modeling approaches to see how different sectors conceptualize GI. These conceptual frameworks shed light on the conflicting goals and points of synergy in the decision making process. We find that GI can serve as a nexus and a socio-ecohydrologic hotspot that enhances connectivities in urban ecosystems.

Poster 54

Interruptions to flow: The spatial and temporal patterns of road-stream crossing in Pittsburgh, PA

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Bain, Daniel - University of Pittsburgh, Pittsburgh, PA, USA

This intersection of stream networks and urbanization has altered flows of sediment and water flows. In particular, this interruption of stream flow leads to development of backwaters upstream of the road-stream crossing which can alter biogeochemical cycling in urban watersheds. The history of human activity in these disturbed watersheds creates challenges when trying to predict where backwaters will form, how their presence influences connectivity, and thus geomorphological and biogeochemical process in streams. Here, we examine the historical expansion of road networks in Pittsburgh, PA along a rural to urban gradient to evaluate the relationships between the patterns of road development and backwater formation. The data indicate that 1) backwater formation seems to be less prominent watersheds with extensive flood control structures and 2) historical landscape patterns of the roads (ie., ridges or valleys) determines the modern road placement and thus the location of road-stream crossings. Clarification of these spatiotemporal patterns of road-streams crossings will improve our understanding of where connectivity is interrupted in urban landscapes and the role that these interruptions are likely to play in sediment transport and biogeochemical processing.