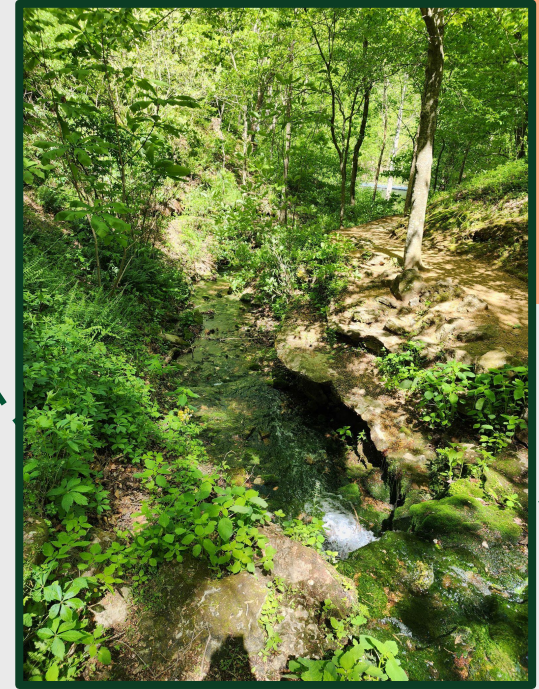


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The Effects of Urbanization on Stream Quality In NWA



Crystal Springs at Crystal
Bridges Museum of American Art

Environmental Geology
Paul Lowrey, Instructor
Presented By: Maxwell Hasler
Northwest Arkansas Community
Bentonville, AR 72712



Introduction

- In the past couple years alone, Benton County has become the fastest growing county in Arkansas with a +5.7% population change and continues to project this lead for years to come
- As population grows housing, commercial buildings, and infrastructure grow with it
- Large scale buildings, highways, etc. are being built and improved on left and right
- Northwest Arkansas is experiencing growth like no other county and will soon become as big as Little Rock





Project Overview

- Conduct and survey the effects urbanization has on stream quality
- The overarching goal was to use simple and easy to read ways to measure the impact urbanization had on many factors, including a stream's pH level, plant/animal life, contaminants, and trash accumulation.
- Measurements were then taken and implemented into ArcGIS Pro software on a map displaying all the analytical data collected





Curriculum

- Utilize Global Positioning Systems and GIS technology
- Recognize the relationships between humans and the environment, particularly the effects of population growth on natural systems including soil degradation and desertification.





Community

- With the production of the map I designed, I hope to provide policymakers and community members with a simple and easy to understand map showcasing the effects of urbanization on local stream quality
- The data provided in the ArcGIS software is something that can be used to help identify at risk areas for environmental management and conservation efforts
- In light of this project/product, I hope to encourage greater environmental responsibility and stewardship across the Northwest Arkansas area from community members, all the way to city officials





Town Branch Creek (Downtown Bentonville)

- Located right next to Downtown Bentonville
- First of two samples collected from Town Branch Creek
- One of two streams that runs directly in through Crystal Bridges





Osage Creek Tributary

- Located right next to Horseshoe Bend Park and just off the Razorback Regional Greenway trail
- The stream originates just southeast of Rogers next to East New Hope Road and ends in the Illinois River located in the small town of Pedro just east of Siloam Springs





Little Sugar Creek

- Sample was taken just south of what was known as Lake Bella Vista
- This stream is a tributary into the larger Elk River
- Lateral erosion is beginning to take place resulting in the collapse of the Razorback Regional Greenway trail





Hidden Springs Creek

- Located near the entrance of Slaughter Pen Bike Park and North Bentonville Trail Head
- In June of 2022, construction on expanding the North Bentonville Trail began around the stream
- Fast Forward to today, construction in the area is complete and leftover bits of construction equipment was noted in the stream





Town Branch Creek (Below Wastewater Facility)

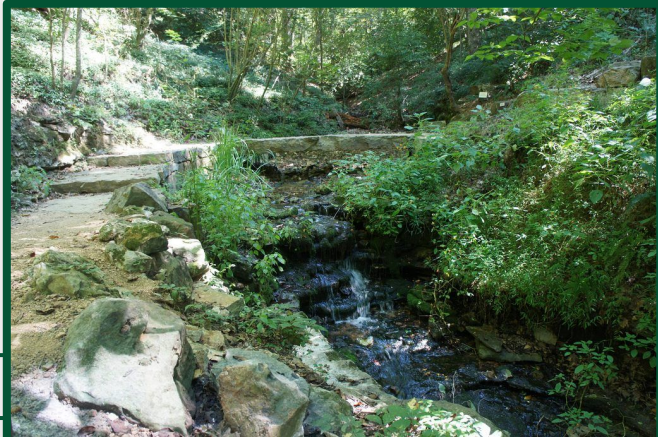
- As stated in the header, this part of Town Branch Creek is located just .36 miles from the Bentonville Wastewater Facility output
- Dense vegetation surrounds the stream area
- Second of two samples collected from Town Branch Creek





Crystal Springs

- Located at Crystal Bridges Museum of American Art behind the Frank Lloyd Wright House
- The smallest stream of the sample size
- The spring itself is natural but the stream path was man made
- One of the only streams with almost total foliage in and around the stream

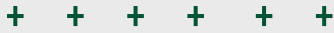
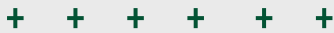




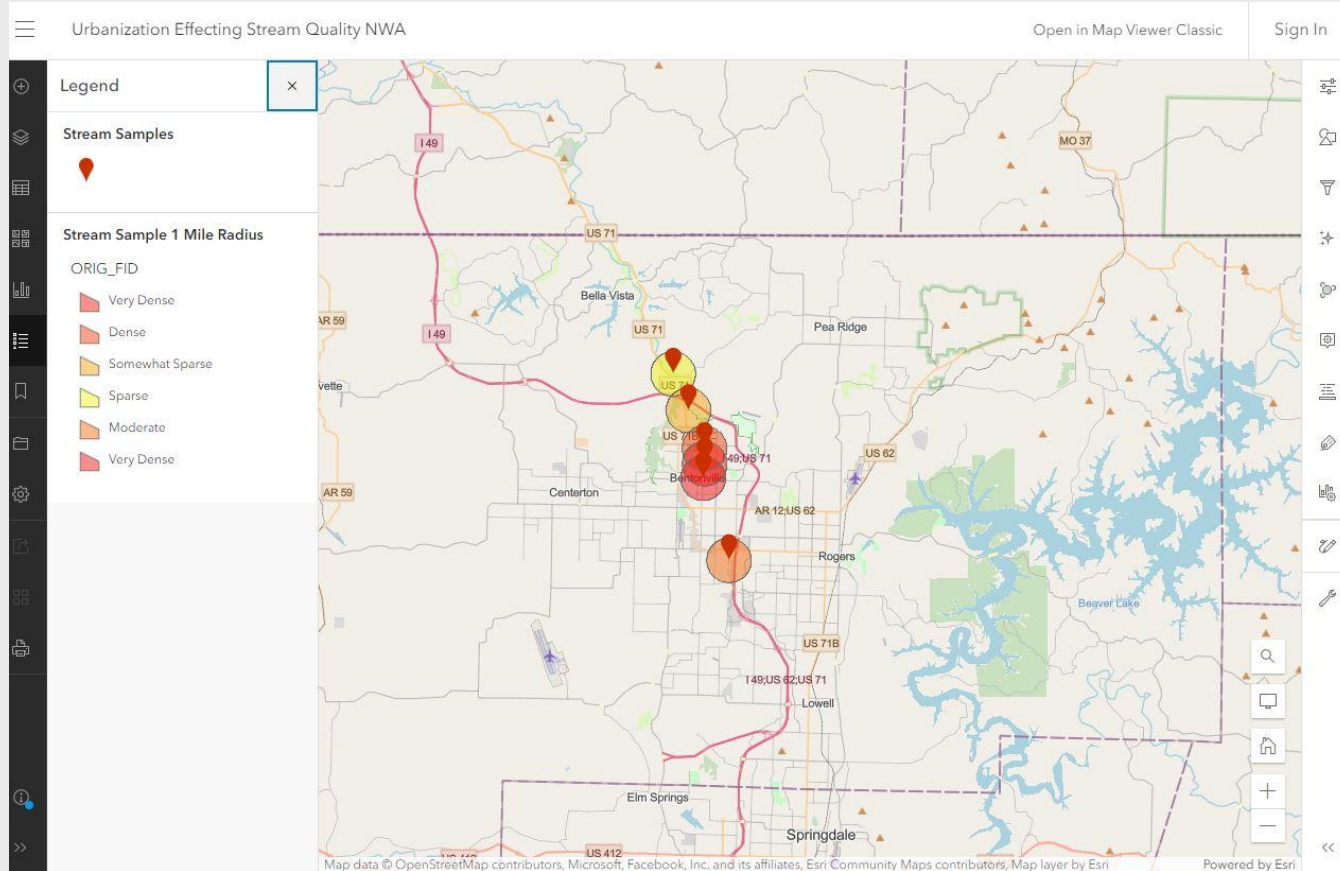
Product: ArcGIS Map

The screenshot displays the ArcGIS Map interface. The map shows a network of roads (AR 59, US 71, US 62, AR 12, US 62, US 71B, Rogers) and water bodies (Beaver Lake). Several stream samples are marked with colored circles (red, orange, yellow) along the roads. The interface includes a Contents pane on the left with a search bar and drawing order options. Below the map is a data table for 'Stream Samples'.

OBJECTID	SHAPE	Location	TimeAndDate	OutsideTemperature	StreamTemperature	StreamPHLevel	BuildingDensity1Mile...	MilesFromDowntown	FoamInStream	StreamPlantLife	StreamAnimalLife
1	Point Z	Town Branch Creek (Downtown Bentonville)	04/15/23 11:51 AM	65.5 F	62.8 F	6.8	Very Dense	0.1	None	Medium, Light Moss a...	None Observed
2	Point Z	Ossage Creek Tributary	04/15/23 5:18 PM	68.7 F	63.3 F	8.03	Moderate Density	3.17	Very Light	Very Low, Some Moss	Group One TAXA
3	Point Z	Little Sugar Creek	04/15/23 1:55 PM	68.4 F	62.2 F	7.7	Sparse	3.88	None	Extremely Low to None	Group One TAXA
4	Point Z	Hidden Springs Creek	04/15/23 2:28 PM	68.2 F	57.2 F	7.83	Somewhat Sparse	2.52	Light	Extremely Low to None	Group One TAXA
5	Point Z	Town Branch Creek (Below Wastewater Facility)	04/15/23 2:57 PM	67.3 F	63.1 F	8.07	Dense	1.12	Light	Low Medium, Some M...	Group One TAXA
6	Point Z	Crystal Springs	04/15/23 11:27 AM	60.0 F	60.2 F	6.56	Very Dense	0.62	None	Heavy Moss, Dense Ve...	Group One TAXA



ArcGIS Map





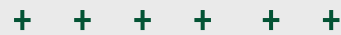
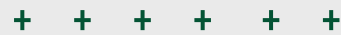
Stream Samples × Stream Samples - Cou...d StreamPHLevel *Fields: Stream Samples

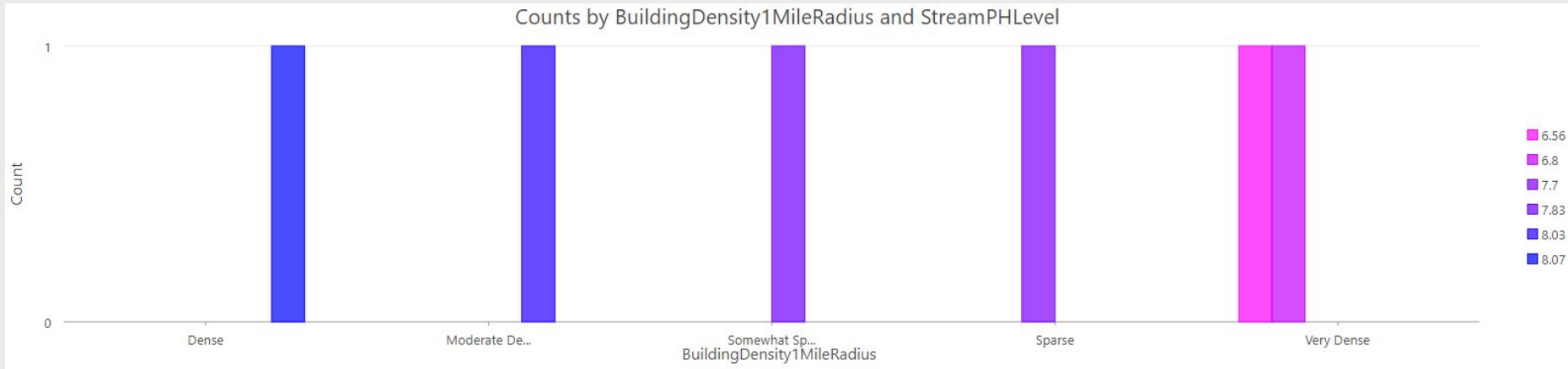
Field: Add Calculate Selection: Select By Attributes Zoom To Switch Clear Delete Copy

OBJECTID *	SHAPE *	Location	TimeAndDate	OutsideTemperature	StreamTemperature	StreamPHLevel	BuildingDensity1Mile...	MilesFromDowntown	FoamInStream	StreamPlantLife
1	Point Z	Town Branch Creek (D...	04/15/23 11:51 AM	65.5 F	62.8 F	6.8	Very Dense	0.1	None	Medium, Light Moss and Water Lillies
2	Point Z	Osage Creek Tributary	04/15/23 5:18 PM	68.7 F	63.3 F	8.03	Moderate Density	3.17	Very Light	Very Low, Some Moss
3	Point Z	Little Sugar Creek	04/15/23 1:55 PM	68.4 F	62.2 F	7.7	Sparse	3.88	None	Extremely Low to None
4	Point Z	Hidden Springs Creek	04/15/23 2:28 PM	68.2 F	57.2 F	7.83	Somewhat Sparse	2.52	Light	Extremely Low to None
5	Point Z	Town Branch Creek (Be...	04/15/23 2:57 PM	67.3 F	63.1 F	8.07	Dense	1.12	Light	Low Medium, Some Moss
6	Point Z	Crystal Springs	04/15/23 11:27 AM	60.0 F	60.2 F	6.56	Very Dense	0.62	None	Heavy Moss, Dense Vegetation



StreamAnimalLife	StreamClarity	StreamContaminants	TrashNearOrInStream	DaysSinceLastRainEvent
None Observed	Somewhat Clear, Cloudy	Medium (Some Compound Found on Surface)	Medium Amounts in/on Stream (Plastifc Wrappers, Glass Bottles, Etc.)	2 Days Ago
Group One TAXA (Water Penny Larva, Mayfly Nymph)	Clear, Low Cloudiness	None Noticed	None	2 Days Ago
Group One TAXA (Stonefly Nymph)	Clear, Low Cloudiness	None Noticed	Low Amounts Around Stream (Plastic Wrrappers, Etc.)	2 Days Ago
Group One TAXA (Stonefly Nymph, Water Strider)	Clear, Low Cloudiness	Medium (Good Amount of Compounds on the Surface)	Medium Amounts in Stream (Construction Items Like Barriers, Bricks, Parts of Cones)	2 Days Ago
Group One TAXA (Stonefly Nymph)	Somewhat Clear, Cloudy	Very Little (Small Amount of a Compound on the Surface)	None	2 Days Ago
Group One TAXA (Stonefly Nymph)	Very Clear	None Noticed	None	2 Days Ago





- New user imputed data can continue to add on to the chart and expand values
- pH can be a helpful indicator of:
 - Mining and industrial activities releasing acidic chemicals and heavy metals
 - Agricultural runoff (fertilizers, animal waste, etc.)

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Methodology

- 03/08/23 - Begin to develop ideas on easy to read and simple to use stream quality measurements
- 03/12/23 - Draft my first ArcGIS map and research functions that best fit my needs of showing my suit of information
- 04/15/23 - Collect my 6 stream samples during the day writing my results and any interesting features seen that may prove useful to my map
- 04/23/23 - Polish my ArcGIS map with better features and stream data collected the week before as well as finish up my presentation





Project Results/Skill Building

- An ArcGIS map containing useful info on stream quality at certain points and how it interacts with Industrialization
- Further experience in not just reading ArcGIS data, but learning how to create feature classes, buffers, and data points containing specific and unique information
- Learning how to better read data correlate differences between certain data
- Time management skills





Technology Used

- ArcGIS Pro and ArcGIS Online
- Google Sheets, Slides, Maps, and Earth
- Thermometer
- PH Reader
- Phone Camera
- GPS





Acknowledgements

Crystal Bridges Museum of American Art
Arkansas Department of Environmental Quality
Macy Maddox - Biochemist
Ben Marlow - Colleague
Karen Joyce - ArcGIS Pro Instructor

CREDITS: This presentation template was created by **Slidesgo**, including icons by **Flaticon**, and infographics & images by **Freepik**





Appendices / References

-TMDL 1997 Study: <https://www.adeq.state.ar.us/water/planning/pdfs/publications/WQ97-05-2.pdf>

-Karen Joyce Youtube Channel: <https://www.youtube.com/@DrKJoyce/about>

-2019 Water Currents Report:
<https://watercurrents.uada.edu/report-shows-water-quality-trends-in-northwest-arkansas/>

-Google Maps: <https://www.google.com/maps/>

-Population Numbers:
<https://www.axios.com/local/nw-arkansas/2023/04/07/northwest-arkansas-population-growth-outpace>

-Google Earth: <https://earth.google.com/>

-Google Sheets of Stream Data:
<https://docs.google.com/spreadsheets/d/1Yd7nGW3u1SD39eRYfhZ-BASWQoIRI6sPa-cqxENsmw8/edit?usp=sharing>

-ArcGIS Map: <https://www.arcgis.com/home/item.html?id=cce72d19669743b4b241e179e8bdd126>

