Case Study Challenge 2020
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Under the Asphalt: The transformation of urban rivers

Summary

Before 1900, 95% of the U.S. population lived on farms and in the countryside. Farms were located in the floodplains of rivers and streams, which provided water and rich soil. Towns developed in farming communities as a place for banks, pharmacies, and commerce.

Towns became cities when they developed governance systems. The electrification of cities and invention of assembly-line manufacturing brought people to cities. The increased housing and commerce caused cities to enlarge. By 1940, half of the U.S. population lived in cities.

Human civilization arose because of a productive, diverse natural world. Those original towns were located in floodplains because the land was level and supported agriculture. As the populations of cities grew, automobiles allowed expansion of urban areas into suburbs. The concentration of people in cities led to the 1948 Water Pollution Control Act prohibiting discharging untreated sewage into waterways. Today over 80% of the U.S. population lives in cities. As cities expanded, humans needed to transform the original waterway to build more roads and houses. Thus, developers put streams and rivers in deep concrete channels. Some streams were even piped underground to make places for asphalt roads. This pattern was repeated in all developed countries. Many cities have buried a majority of the original stream network. For example, London, UK, has more than 20 subterranean streams. These urban transformations result in loss of riparian and aquatic habitats and reductions of plant and animal populations.

Streams provide flood protection, allowing surface rainwater to percolate through soil. Artificial channels result in flash floods during rainy seasons. Realigning a stream to flow through an underground pipe or concrete channel eliminates the uneven streambed that traps sediment. This sediment then forms a dam when it deposits in one place, such as a bend in the channel. This leads to flooding or erosion of the channel as the water goes around the dam. In the 1960s, the meandering 100-mile Kissimmee River was engineered into a 44-mile long canal. This resulted in a 90% loss of waterfowl in the area, chemical pollution of downstream Lake Okeechobee, and flash flooding.

The 1972 Clean Water Act prohibits discharging chemicals from point sources into waterways. Stormwater, nonpoint runoff, is now the largest source of water pollution. Riparian zones bordering streams allow soil microbes to remove chemicals as water percolates through soil before entering the stream. Urbanization has replaced this natural filter with impervious hard surfaces including roads, rooftops, and parking lots. When the riparian area is paved, runoff from roads, roofs, and parking lots goes directly to streams, which carry it to lakes, rivers, or oceans. Nutrients from stormwater encourage algal and bacterial growth resulting in oxygen depletion and dead zones in lakes and oceans. Storm drains also carry litter, including plastics, into the ocean.

Future

Humans transformed streams through agriculture and cities. However, piping streams underground reduces the biodiversity that allowed the original settlement. New York City and Seattle plan to use rooftop and roadside gardens to mimic how nature lets water run through soil. Catch basins are used in San Francisco to remove litter from stormwater runoff.

Worldwide, cities are again making efforts to transform urban streams. This time, the streams are valued as a necessary condition to development rather than an impediment. This movement to "daylight" streams uncovers and restores buried streams reducing polluted runoff and flash flooding.

Channeled streams are often concentrated in low-income and minority areas, i.e. older parts of cities. Urban streams could provide green and blue spaces for cultural and recreational uses. Blue spaces demonstrably improve human health and property value. Restoring entire streams may not be physically possible. Yonkers, NY, and Kalamazoo, MI, experienced economic revitalization after daylighting portions of streams. The question now is, do we need laws or can we transform our waterways on our own?

Questions

1. Differentiate storm drains and sewers. Where does rainwater go in your community?
2. How do healthy urban streams affect human well-being? Affect property value?
3. Discuss the obstacles to daylighting streams?
4. As the city planner, you propose a stormwater tax to clean and manage stormwater. How will you answer people who say "You can't tax rainwater, it's natural"?
5. How could restoring a stream improve quality of human life?

News articles

1. Serres, C. (January 3, 2019). Cities sue refiners over sealant in ponds; Seven cities say cleanup of carcinogenic chemicals should rest with manufacturers. *Star Tribune* (Minneapolis, MN). Local Section, p. 1B. http://www.startribune.com/minnesota-cities-sue-refiners-over-cost-of-cleaning-up-polluted-stormwater-ponds/503826042/

2. Chason, R. (January 7, 2019). Chesapeake Bay receives D+ on report card. *Washington Post*. Maryland Politics, https://www.washingtonpost.com/local/md-politics/chesapeake-bay-receives-d-on-report-card/2019/01/07/81aa8902-129b-11e9-803c-4ef28312c8b9_story.html

3. Squires, N. (March 11, 2019). Athens plans to uncover long-hidden river where Socrates taught. *Daily Telegraph* (London), World News, p. 16.

4. Barnard, A. (August 5, 2019). "Algae Bloom Fouls New Jersey's Largest Lake and Ruins Summer." *New York Times*, NY REGION section, p. A17.

5. Rogers, P, (October 2, 2019). Plastic tide: 7 trillion bits wash into bay every year. *The Mercury* News, News, p. 1.

References

1. Gies, E. (2018). Sponge cities. *Scientific American 319*(6), 80-85.

2. Kenney, M. A., P. R. Wilcock, B. F. Hobbs, N. E. Flores, and D. C. Martínez. (2012). Is urban stream restoration worth it? *Journal of the American Water Resources Association*, *48*(3). DOI: 10.1111/j.1752-1688.2011.00635.x

3. Perkins, S. (2004). Paved paradise. *Science News, 166*(10), 152-153.

4. Riley, A. (2016). *Restoring neighborhood streams: Planning, design, and construction*. Washington, D.C.: Island Press.

5. Smardon, R., S. Moran, and A. Baptiste. (2018). *Revitalizing Urban Waterway Communities: Streams of Environmental Justice*. New York: Routledge.

6. Urban Land Use and Water Quality. (2019). U.S. Geological Survey. https://www.usgs.gov/mission-areas/water-resources/science/urban-land-use-and-water-quality?qt-science_center_objects=0#qt-science_center_objects. In addition to an overview of urban stream ecology, this site has links to news, related publications, and data tools.