

Introducing a Sponge City Infrastructure Model in the DC Metropolitan Area

Nicole Re

Background

The concept of a Sponge City originated in China in the early 2000's. The goal of this urban construction model is to help improve the flood resilience of cities by soaking up and redistributing water directly at its source, just like a sponge. This in turn has a positive effect on water quality, drainage, and water treatment infrastructure. As global warming is increasing, natural disasters are becoming more extreme so it is important to mitigate flooding as it will continue to become more severe all over the world, disrupting accessibility to usable water. China's increase in population and urbanization has resulted in more impervious surfaces known as gray infrastructure that leads to less natural absorption of water. Parallels can be drawn between China's need for a Sponge City and the DC area's need for implementation of more green infrastructure. A Sponge City model will directly address the Metropolitan Washington Region's water resilience and sustainability needs.

Green infrastructure, such as green roofs, bioswales, rain gardens and permeable pavements, added to cities to help make them more absorbent of water, not only helps the flood resilience of the city but also helps mitigate many other water related problems. Urban runoff increases thermal pollution because impervious surfaces, like concrete sidewalks, heat up whereas green infrastructure absorbs then reduces heat. Another big problem that urban areas in the DC region have, is chemical runoff. One big driver of chemical pollution is road salts that end up in the waterways, especially after a big snow storm. Sponge Cities reduce the amount of chemicals that make it into the waterway by absorbing water right on sight. In a similar way, green infrastructure also has impacts on reducing pollution coming from agricultural runoff that may find its way into the city then into the waterways. As a whole, the Sponge City concept increases availability of clean water and allows for cheaper water treatment and drainage infrastructure.

Green infrastructure's focus on conservation of nature whenever possible, minimizing the impact of development on hydrology and decreasing the runoff rate of water at the site has multiple benefits to an urban community. It not only improves the water quality in numerous ways but also creates rich biodiversity, improving aesthetics and therefore overall value. Additionally, a benefit of green infrastructure over gray infrastructure is that it prevents the overflow of wastewater treatment plants. When there is too much water in a water treatment plant the wastewater overflows into our rivers and streams polluting our waterways and causing havoc. A Sponge City would prevent this through incorporating more grassy areas and plants throughout the city, which will help the grounds naturally absorb more of the water and therefore decrease chances of flooding and wastewater overflow.

To implement this plan it is important to get the community involved by educating them on this new idea. The next step is to create incentives to get people to want to make the needed changes. Simultaneously, firm policy needs to be created to encourage people to make these changes in new development. Lastly, it is important to assess what is working and what is not then revise and update policy based on the new findings.

90 Day Plan

The first step in this plan should be to educate the DC area residents on the problems surrounding flooding, thermal pollution and chemical runoff. Many people are naive to the problem and will not like change without understanding of the problem itself. Then details should be shared about the benefits of a Sponge City and how to incorporate more green infrastructure into the community. Easy ways to educate the general public include spreading the information through social media such as Instagram, Facebook and Twitter, placing signs on public transportation and holding public outreach events. In the first 90 days, it is also important to inform the public that there will be some policy changes in the future regarding their community.

A very important group to educate on these issues is the youth. They are the future of this planet and it is important to get them to understand and practice good environmental habits. Incorporating green education in schools and after school programs in the DC area emphasizing different green infrastructure ideas and their benefits will encourage children to put these concepts into practice. For example, teaching the youth simple ways to build a rain garden may lead them to persuade their families to build one. Also, teaching kids the benefits of permeable surfaces may encourage a family to incorporate more permeable surfaces in their new walkway rather than pavement the next time they are working on their yard. At this stage, policy makers will want to begin developing the policy changes needed to put a Sponge City into place.

180 Day Plan

Once the population is educated on the issues, the next step should be implementing an incentive plan to encourage people to incorporate more green infrastructure into their yards at home, businesses, and their places of work. A sound implementation of the first 90 day plan will be relied on heavily here because without the general population knowing the benefits of green infrastructure, the incentives will be useless. A tax incentive plan for citizens and businesses that create or redevelop property to incorporate bioswales, green roofs, rain gardens or permeable pavements would be beneficial to encourage change. A tax writeoff in the form of deductibles would be a good way for policy makers to get the public's attention.

360 Day Plan

Policy to decrease the area of impervious surfaces allowed on residential, commercial and public properties is the next step to creating a Sponge City in the DC area. Regulating the amount a property owner may be required to offset an increase in pavement and gray infrastructure by implementing other green practices would be key. For example, if a builder adds impermeable walkways to a building he would be required to add a certain percent of

green space to have more elements of sponge added to the property. This plan should be implemented by decreasing the allowed amount of impervious surfaces progressively over time. Every few years there should be an increase of green to allow for the adoption until the area reaches an optimal amount of spongy surfaces. Keeping in mind that grandfathering in of existing properties may be needed. Government infrastructure itself should promote these changes by transitioning to having even more strict infrastructure requirements to encourage these changes as well as set an example. By having more green infrastructure on government buildings more people will see it and become interested in having their own. This should also help with promoting the look of green infrastructure so that it eventually becomes the norm in the DC area and eventually throughout other parts of the world. Currently, people may think that it is a drawback that this type of infrastructure looks different and stands out. But, with time the beauty of nature will show through and as more people implement green structures old gray infrastructure will look out of the norm. Another policy that goes hand in hand to help improve water drainage problems is to increase the plant growth along the banks of waterways that these cities feed into. Adding Riparian buffers or increasing vegetation of already existing ones can help reduce flooding and reduce the runoff of chemicals into the waterways. This is another small step that can make a big difference to the environment and should be part of the improvement plan .

Conclusion

In 2012 Beijing experienced a deadly flood which was a call to action to create new policy to mitigate their flooding problems. We don't want to wait until an event like this occurs in the DC metro area, so it is imperative to make changes now. The steps to changing the DC area to be more flood resistant, have less chemicals in runoff, improve water quality, and water treatment infrastructure will require social change and it is important to get the citizens and politicians on board. Once the people buy into the idea and understand the importance of

immediate action the most change will occur. The concept of a Sponge City, which has already been implemented in China, is a very reasonable, affordable and effective solution to the mitigation of water problems in the DC area. It calls for action of elected officials, business owners and homeowners to make these changes by implementing more green infrastructure into the new and already existing city framework. Once these changes become commonplace the growth of this low impact development style will take off as people are persuaded by the beauty and benefits of this trend.

More Resources

How to make your own:

- Bioswale
<http://www.ppnenvironmental.com/build-bioswale/>
- Green roofs
<https://www.dwell.com/article/diy-living-green-roof-01a7bd06>
- Rain gardens
<https://www.familyhandyman.com/project/how-to-build-a-rain-garden-in-your-yard/>
- Pervious pavement
<https://www.truegridpaver.com/complete-guide-permeable-paving-systems%EF%BB%BE/>

Bibliography

Chan, F. K., Griffiths, J. A., Higgitt, D., Xu, S., Zhu, F., Tang, Y.-T., Xu, Y., & Thorne, C. R. (2018). "sponge city" in China—a breakthrough of planning and flood risk management in the urban context. *Land Use Policy*, 76, 772–778. <https://doi.org/10.1016/j.landusepol.2018.03.005>

World Future Council. (2016, July 4). *Sponge cities: What is it all about?* World Future Council. Retrieved March 14, 2022, from <https://www.worldfuturecouncil.org/sponge-cities-what-is-it-all-about/>

Xia, J., Zhang, Y. Y., Xiong, L. H., He, S., Wang, L. F., & Yu, Z. B. (2017). Opportunities and challenges of the sponge city construction related to urban water issues in China. *Science China Earth Sciences*, 60(4), 652–658. <https://doi.org/10.1007/s11430-016-0111-8>