<u>Supplementary Files</u>

Culex Mosquitoes at Stormwater Control Measures and Combined Sewer Overflow Outfalls after Heavy Rainfall

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Table S1: Select list and descriptions of SCMs that use pooling and/or vegetation commonly installed in DC.

	SCM Type	Description
Uses Pooling	**Filtering System**	Capture and temporarily store stormwater on site as it passes through a filter bed of sand media. Often used for highly impervious sites such as parking lots.[1]
	Rain Barrel	Placed at the bottom of stormwater downspouts to catch and store stormwater for later use.[2]
	Stream Restoration	The use of rocks, logs, and native plants to slow down stormwater flowrate, restore the natural flow pattern of a stream, and reduce erosion to protect nearby habitats and restore aquatic ecosystems.[3]
Uses Vegetation	**Bayscaping**	Landscaping practice that replaces grass with plants native to the Chesapeake Bay. These plants have deep rooting systems that absorb more stormwater. Currently only in the Washington DC area.[4]
	Green Roof/Ecoroof	Layers of soil and vegetation used to perform bioremediation and decrease peak flowrate of stormwater on rooftops.[5] Often uses limited to no pooling because of the additional load.
	Trees	Large trees with widespread, dense canopies. The large leaves hold stormwater.[6]
Uses Both Pooling and Vegetation	**Bioretention**	Collection of stormwater through layers of sand, gravel soil, mulch, vegetation, and ponding to decrease volume and contaminants of runoff.[7]
	Grass Channel	Grassed open channel that are designed to capture, treat and/or convey stormwater runoff.[1]
	De/Retention Basin or Pond	A pond or structure used as an artificial lake to hold stormwater. Retention basins maintain a pool of water and often include vegetation while detention basins are often temporary flood control structures.[8]
	Infiltration Trench/Basin	Grassed ditches that collect stormwater and allow it to infiltrate the ground.[1]
	Rain Garden	Garden commonly consisting of native plants designed to catch stormwater runoff from impervious surfaces and promote groundwater recharge.[9]
	Stormwater Planters	Small, contained vegetated area that uses bioretention techniques to treat stormwater. Planter boxes often allow high volumes of ponding and are often located at the end of building's downspout.[1]
	Wetland	Artificial wetland containing soil, vegetation, and microorganisms that are commonly used to treat stormwater, wastewater, and/or greywater.[10]

*Note: A modified version of Table S1 was published in the supplementary materials of our earlier work (Chan et al. 2021)[11]

The descriptions commonly installed SCMs in DC that use pooling, vegetation and/or both are listed in Table S1. Please note that some SCMs types may intersect. For example, a green roof may use bioretention techniques to treat stormwater, but may not be labeled as "bioretention,"

but instead as a "green roof." We grouped and labeled SCMs based on how the DC Department of Energy and Environment labeled the dataset when it was acquired.

Table S2: Moran I test for spatial autocorrelation of residuals. N = 47.

Model/Equation	Observed	Expected	Standard Deviation	P-value
1 (at subsewersheds)	0.045	-0.022	0.056	0.24
2 (at CSO outfalls	0.036	-0.022	0.057	0.31

The Moran I's test for spatial autocorrelation of residuals was conducted using R/Rstudio[12] using the "ape" package[13]. The Moran's I test did not reveal spatial autocorrelation of the residuals for either models, Equation 1 or Equation 2 (Table S2).

Table S3 Spatial associations revealing the decrease in *Culex* mosquitoes at the CSO outfalls as well as at the subsewersheds for each increase in standard deviation of SCM within the subsewershed using a 1.15km buffer radius surrounding traps sites.

Location Type	Decrease in Culex Mosquitoes at Location Type per STDEV Increase in SCM Count	[95% Confidence Intervals]	Significant Difference from Table 1 in Main text?
Subsewersheds	54.6%	[29.8%, 70.6%]	No
Outfalls	56.0%	[32.9%, 71.2%]	No

A sensitivity analysis was conducted using a 1.15 km buffer radius, the average flight distance of *Culex* mosquitos rather than a 3km buffer radius, the maximum flight distance of *Culex* mosquitoes, in the main text. A *t*-test revealed that there was no significant difference between the results in the main text, using a 3km buffer radius (Table 1 main text), and the results using a 1.15 km buffer radius (Table S3).
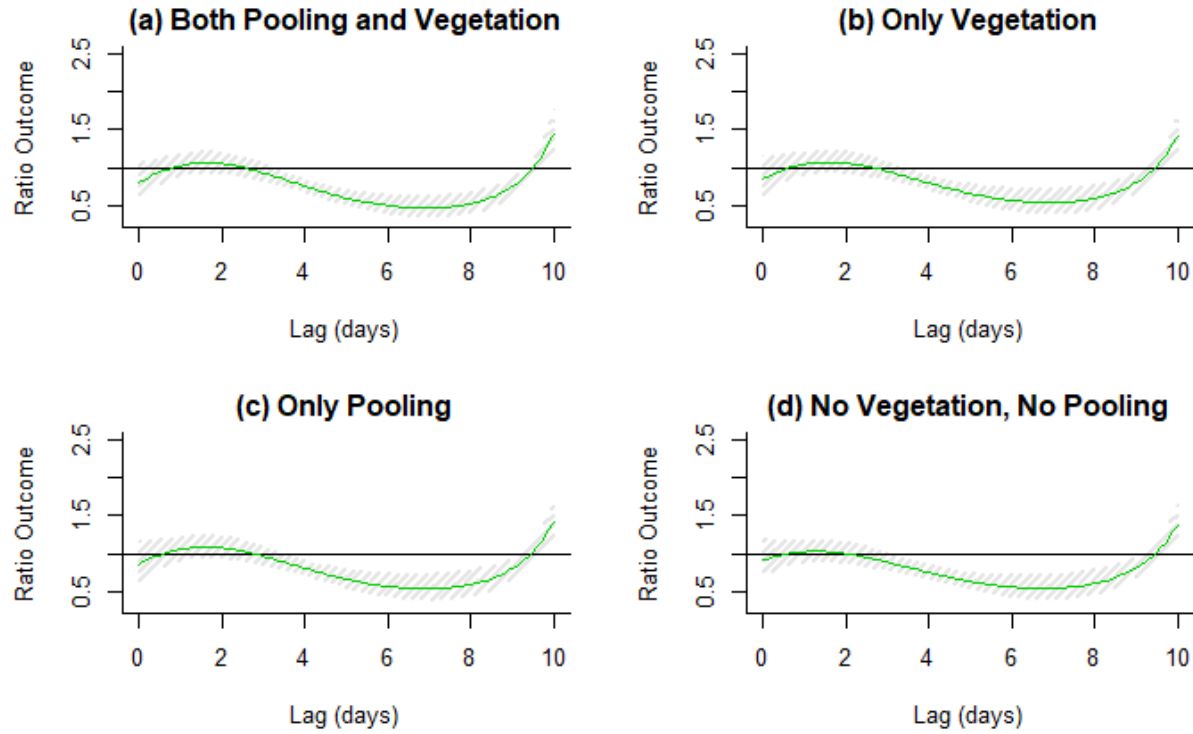
Figure S1: Lagged effect of days with at least one inch of rainfall ($\geq 95^{th}$ percentile) on *Culex* mosquito count at SCMs that use/do not use pooling and/or vegetation. Time period was 05/01/2018 to 10/31/2018. $N_{CSO\ Outfalls} =$ 47. $N_{SCM\text{-}Pool\&Veg}= 3,018$. $N_{SCM\text{-}Veg} = 7,355$. $N_{SCM\text{-}Pool} = 5,675$. $N_{SCM\text{-}NoPoolNoVeg}= 2,322$. $N_{\geq 1\ inch\ rainfall}$: 16 days.

Ratio Outcome is represented by: $\dfrac{Culex \text{ mosquito count after} \geq \text{one inch of rainfall}}{Culex \text{ mosquito count after no rainfall}}$. The 95% confidence intervals are shown in gray cross hatching. Results account for the confounding effects of temperature lags of up to 10 days.

Figure S1 reveals that accounting for the confounding effects of temperature lags up to 10 days, as opposed to accounting for temperature only on the day of in the original analysis (see Figure 5 in the main text), did not notably change the findings.
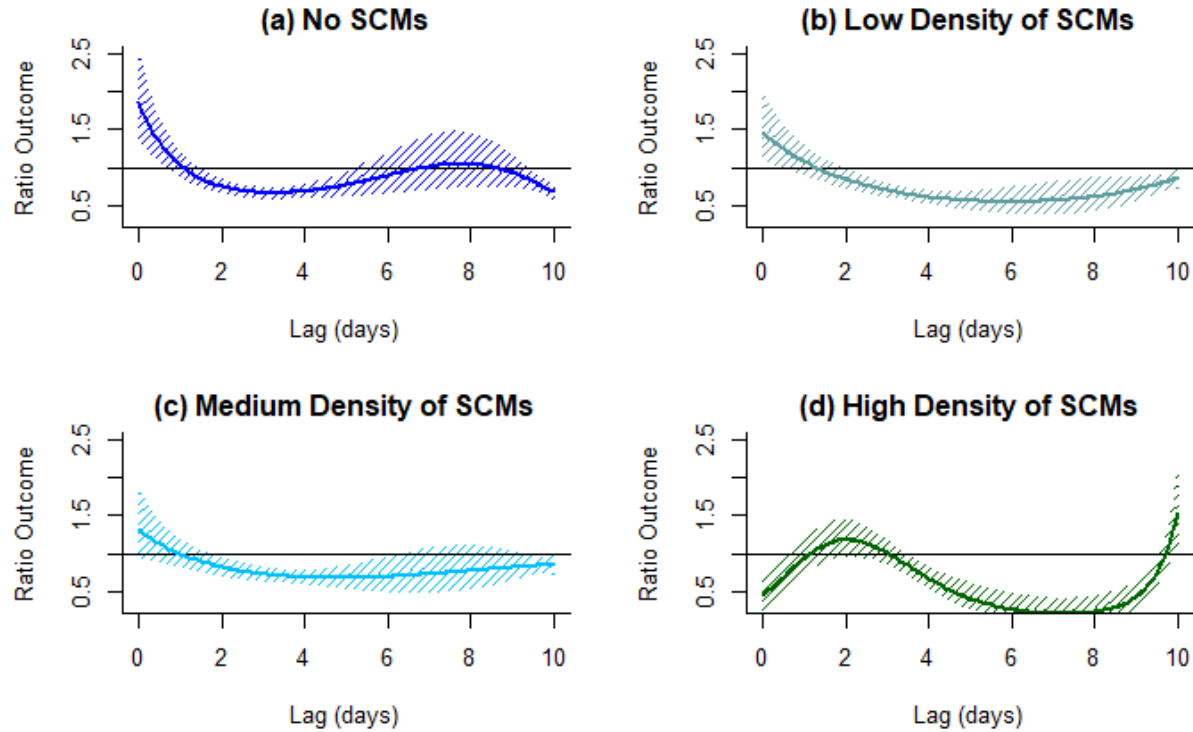
Figure S2: Lagged effect of days with at least one inch of rainfall ($\geq 95^{th}$ percentile) on *Culex* mosquito count CSO outfalls treated by varying densities of SCMs. Time period was 05/01/2018 to 10/31/2018. $N_{CSO\ Outfalls}$ = 47. $N_{No\ SCM}$ = 6 subsewersheds. $N_{Low\ Density\ SCM}$ = 14 subsewersheds. $N_{Medium\ Density\ SCM}$ = 13 subsewersheds. $N_{High\ Density\ SCM}$ = 14 subsewersheds. $N_{\geq 1\ inch\ rainfall}$: 16 days.

Ratio Outcome is represented by: $\dfrac{Culex\ \text{mosquito count after} \geq \text{one inch of rainfall}}{Culex\ \text{mosquito count after no rainfall}}$. The 95% confidence intervals are shown in cross hatching. Results account for the confounding effects of temperature lags of up to 10 days.

Figure S2 suggests that adjusting for the confounding effects of temperature lags of up to 10 days results in different findings compared to only adjusting for temperature on the day of in the original analysis (see Figure 6 in the main text). However, similarly seen in Figure 6 in the main text, subsewersheds that do not have any SCMs have the highest spike in *Culex* mosquito counts at lag 0, compared to the other subsewersheds with more SCMs. However, the increase in Culex mosquitoes seen in Figure 6 in the main text for subsewersheds that have low and medium densities of SCMs between lags 7-8 is no longer visible after adjusting for the confounding effects of temperature lags.

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