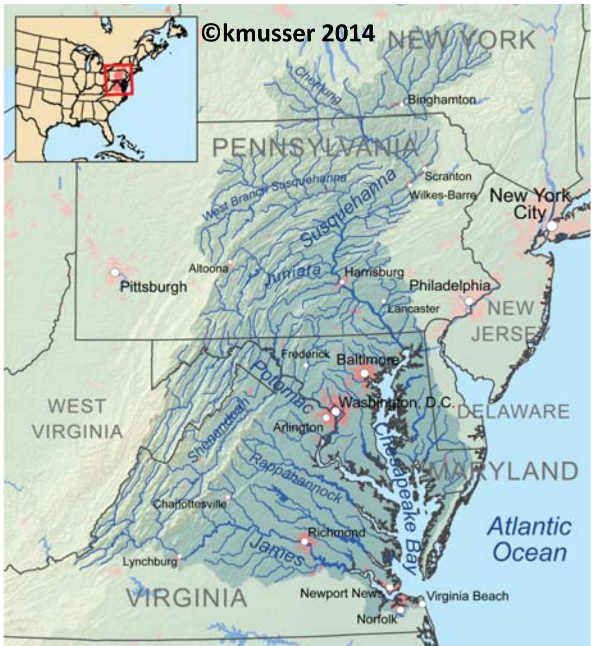
Chesapeake Bay: A case study



The Chesapeake Bay Watershed includes 6 states and Washington D.C. and is currently under federally mandated total maximum daily load (TMDL) limits for nitrogen, phosphorus and sediment.

The Chesapeake Bay, in the Mid-Atlantic region of the United States, represents a meaningful test site for determining the impact of sensor network adoption. Currently, total maximum daily load (TMDL) limits are being implemented in the six states and Washington D.C., that make up this watershed. There are increasing regulations and fines associated with failing to implement nutrient reductions as part of the TMDL process. Although sensor networks cannot account for all of the necessary pollution reductions by themselves, they can be a tool that is used to meet the mandates set out in the TMDL policy. Although non-point pollution (farms, houses etc.) are not currently regulated as part of TMDL implementation, they can still be used as a tool to help reduce pollution loads. There is also a possibility that in time, regulations may be passed limiting non-point pollution such as sediment, nitrogen, and phosphorus coming from agriculture.

Since public benefits are dependent on the adoption rate of sensor networks, the impact of three different adoption rates for the Chesapeake Bay are shown in Table 8. Under then 100% adoption scenario, there is the potential for regional reductions of over 10,000 acre feet of water, almost 2,500 tons of CO_2, over 70 tons of N, and over 42 tons of P per year. All this can be accomplished with a technology that can also increase profitability.

Table 8. Reductions in resource use and emissions in the Chesapeake Bay Watershed associated with the use of WSIN technology for ornamental production, assuming various adoption rates. Reductions in water use and carbon dioxide (CO_2) emissions are based on a 50% reduction in the application of irrigation water. Reductions in nutrient emissions are based on the optimistic scenario (see Table 4).

Chesapeake watershed Reductions in:	**25% adoption rate**	**50% adoption rate**	**100% adoption rate**
Water use (million gal.)^x	858	1715	3431
Carbon emissions (ton)^y	617	1,234	2,468
Nitrogen discharge (lb)^z	35,475	70,947	141,894
Phosphorus discharge (lb)^z	21,017	42,035	84,069
^{x}1 gal.= 3.785412 L, ^{y}1 ton = 0.9071847 Mg, ^{z}1 lb = 0.4535924 Kg			

Majsztrik, J., D King, and E. Price. 2014. Understanding the public benefits of sensor networks. *In*: Managing Irrigation through Distributed Networks Knowledge Center, M. Chappell, P. Thomas, and J.D. Lea-Cox (Eds.). Published online at: https://myelms.umd.edu/courses/1110348 17p.

Based on the assumptions that were made, increasing adoption rates of sensor technology for ornamental production leads to reductions in water, carbon emissions, and N and P runoff, all of which will help meet TMDL requirements. It is likely that TMDL regulations will be implemented in other distressed watersheds, and sensor networks may be a way to reduce nutrient, sediment and water runoff to lower the impact of plant production on the environment.

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