Scientists study impact of sediments and nutrients from Conowingo Dam on Chesapeake Bay

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University of Maryland Center for Environmental Science researchers have completed a study on the impact of Conowingo Dam on water quality in Chesapeake Bay. Scientists synthesized field observations, model results, and long-term monitoring data to better understand the potential impacts of nutrient pollution associated with sediment transported from behind the Dam to the Bay.

"This synthesis is important for bringing the best science to Bay management decisions by considering the entire Susquehanna-Conowingo-upper Bay system and integrating insights from several related studies," said Peter Goodwin, president of the University of Maryland Center for Environmental Science. "Since most rivers around the world are dammed, understanding potential impacts to adjacent estuaries is highly relevant to international scientific and management communities."

Dams initially starve downstream ecosystems of both sediments and particulate nutrients by trapping them in upstream reservoirs. Eventually, however, these reservoirs fill, increasing the delivery of sediment and nutrients to downstream ecosystems, especially during storm events when stored sediments can be scoured. Since its construction in 1928, Conowingo Dam has trapped most of the Susquehanna River watershed sediment and associated particulate nitrogen and phosphorus before they enter Chesapeake Bay. However, its storage capacity has significantly

decreased, raising questions of potential impacts to Bay ecosystems.

Scientists found that most sediment and particulate nutrient impacts to the Bay occur during high-flow events, such as during major storms, which occur less than 10% of the time. Loads delivered to the upper Chesapeake Bay during low flows have decreased since the late 1970s, while loads during large storm events have increased. Most of these materials are retained within the upper Bay but some can be transported to the mid-Bay during major storm events, where their nutrients could become bioavailable.

"While storm events can have major short-term impacts, the Bay is actually really resilient, which is remarkable," said the study's lead author Cindy Palinkas, associate professor at the University of Maryland Center for Environmental Science. "If we are doing all of the right things, it can handle the occasional big input of sediment."

Sediment and particulate nutrient loads have decreased since the late 1970s for normal river flows and increased for storm flows. During non-event flows, most sediment delivered past Conowingo comes from the Susquehanna watershed. Sediment and attached nutrient loads have declined since 1978 (first complete year of monitoring data) for non-event river flows. This decrease reflects efforts to reduce watershed loads through BMP installation.

During event flows, sediment and attached nutrient loads have increased over time, consistent with a decreasing scour threshold in the reservoir. This is also consistent with decreased trapping of watershed sediment as it passes through the Reservoir. Both a lower scour threshold and decreased trapping probably drive the observed increase.

The potential impact of reservoir sediments to Bay water quality are limited due to the low reactivity of scoured material, which decreases the

impact of total nutrient loading even in extreme storms. Most of this material would deposit in the low salinity waters of the upper Bay, where rates of nitrogen and phosphorus release from sediments into the water are low.

However, event flows can transport fine reservoir sediment to the mid-Bay region, where waters are saltier and lower in oxygen during summer. These conditions could allow for higher rates of nutrient releases from sediments.

Most sediments are deposited in the upper Bay with minimal transport to the mid-Bay possible only during storm events. Increased flows during major storm events can transport some material into the mid-Bay region, but these events are redistributed over longer time scales.

While large events can have significant short-term impacts, the Bay is resilient over the long run due to ongoing restoration and time gaps between events. Major storm events can deliver enormous amounts of sediment to the Bay, but they occur infrequently (less than 10% of the days since 1978). Sediment delivery to the mid-Bay region, where waters are saltier and more conducive to nutrient releases from sediment, is relatively small in magnitude, minimizing potential impacts to Bay water quality.

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More information: Cindy M. Palinkas et al, Influences of a River Dam on Delivery and Fate of Sediments and Particulate Nutrients to the Adjacent Estuary: Case Study of Conowingo Dam and Chesapeake Bay, *Estuaries and Coasts* (2019). DOI: 10.1007/s12237-019-00634-x

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