PA House of Representatives Environmental Resources & Energy Committee Hearing

On House Bill No. 1275

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Good morning Chairman Vitali, Chairman Causer, and honorable members of the committee. Thank you for the opportunity to speak with you this morning. My name is Matt Ehrhart, and I am the director of watershed restoration at Stroud Water Research Center. The Stroud Center is an independent, nonprofit research center established in Avondale, Pennsylvania in 1967 to focus on understanding and restoring our freshwater ecosystems. We seek to advance knowledge and stewardship of freshwater systems through global research, education, and watershed restoration. While we engage in research and collaboration across the nation and around the globe, the Stroud Center has an extensive history of research and watershed restoration implementation in the Chesapeake Bay and Delaware River watersheds.

My comments today will focus on the state of research on the functions and importance of riparian forest buffers, and the critical values they provide to our communities and the larger society. Riparian buffers, the corridors of land alongside our rivers and streams, occupy a very small piece of the landscape but provide critically important services to our communities and functions for our freshwater ecosystems. A 100 foot wide riparian forest buffer, on each side of the stream channel, occupies less than 10% of the landscape. Traditionally, our policies have addressed the roll and functionality of these forest buffers as a final filter for our larger landscape, capturing and treating pollution before it can enter our waterways. This perspective is accurate, but it provides only a partial accounting of the overall value of our forested buffers.

Figure 1 demonstrates the filtering capacity long associated with riparian forest buffers. The forest intercepts overland and sub-surface runoff, settles suspended particles, and begins to process and transform pollutants and natural compounds, including nitrogen, phosphorous, sediment, and other dissolved or particulate compounds. The carbon-rich layer on the forest floor provides the substrate and food for a diverse microbial community that helps to consume and process nutrients and organic compounds. Figure 2 highlights the importance of wider buffers in enabling sediment removal, with the fine particles, silts and clays being captured primarily after 35 to 50 feet. Preventing these small particles from entering our waterways is critical because they bond with other molecules such as phosphorous and herbicides, including atrazine, as highlighted in Figure 3. You may note that not only are wider buffers critical, but forested buffers significantly outperform grass buffers in treatment capacity. Some pathogens of public health concern, such a cryptosporidium spores and giardia, also behave as particles and may be captured in forest buffers before reaching our drinking water systems.

As Pennsylvania has strived to address non-point source water quality concerns over the past decades, we have had very limited success in creating enough improvement to remove our rivers and streams form the impaired waters list described in Section 303(d) of the Clean Water Act. Almost 33% of

Pennsylvania's river and stream miles remain impaired – 27,892 miles, according to the 2022 *Integrated Water Quality Report*. It's important to recognize that impaired streams have typically lost 90% of their biological components. Many more of our streams suffer from significant degradation that does not trigger the impairment status. This ongoing challenge in addressing impairment stems, in part, from a hyper focus on nitrogen, phosphorous, and sediment. In addition to the filtering functions previously described, riparian forest buffers provide additional functionality that is critical to improving the health of our rivers and streams.

Trees provide a variety of critical functions for our stream systems. Shade, and its impact on air and water temperatures, may be of the utmost importance. Stream temperature is often benchmarked by the needs of trout, Pennsylvania's primary recreational fish. Rising temperature adversely affects trout at 65 to 68 degrees Fahrenheit. You can see in Figure 4 that the loss of trees along a stream results in extended periods of time above 68 degrees, which may preclude healthy, or even viable, trout populations. Other thermally sensitive fish, aquatic insects, and aquatic organisms essential to the stream ecosystem exhibit similar stress responses. The occurrence of extended heat waves and drought conditions exacerbate this temperature challenge for our streams and their inhabitants, making forested buffers even more critical.

Healthy forested streams also provide essential ecosystem services. These streams become treatment systems with up to five times the organic processing capacity and two to nine times the nitrogen uptake of meadow streams. Figure 5 provides a depiction of the food web that leads to those performance outcomes. As our communities and larger society work to improve our local streams, avoid Total Maximum Daily Load limitations for impaired waters, and meet downstream goals for the Chesapeake Bay, these increased outcomes become critically important. The increased pollution processing is enabled by the temperature impacts previously mentioned, inputs of appropriate carbon as a food source, and an improved habitat structure. Forested streams have much more variable habitat structure within the stream channel. They create and maintain deep pools, wide shallow riffles, large woody habitat, and leaves that are a critical food source for our native stream fauna. Streams with wide forest buffers are generally two to four times wider than unforested streams. Figure 6 illustrates how, even along the same stream, unforested stream reaches are significantly more narrow than forested reaches. This is critical because the biological activity in streams occurs on and in the bottom substrate, so a wider stream provides proportionally more area for the stream to work for us, providing more efficient processing of dissolved and particulate materials. Additionally, trees provide the carbon source, or food, that drives a healthy stream's ecosystem in two ways. As seen in Figure 7, the direct inputs of leaf litter, twigs, and limbs provide approximately one-third of the stream's energy. Water infiltrating and seeping through the forest floor, like water flowing through a teabag, leaches carbon compounds, known as dissolved organic carbon, into the stream. This dissolved carbon provides almost two-thirds of the stream ecosystem's overall food and energy.

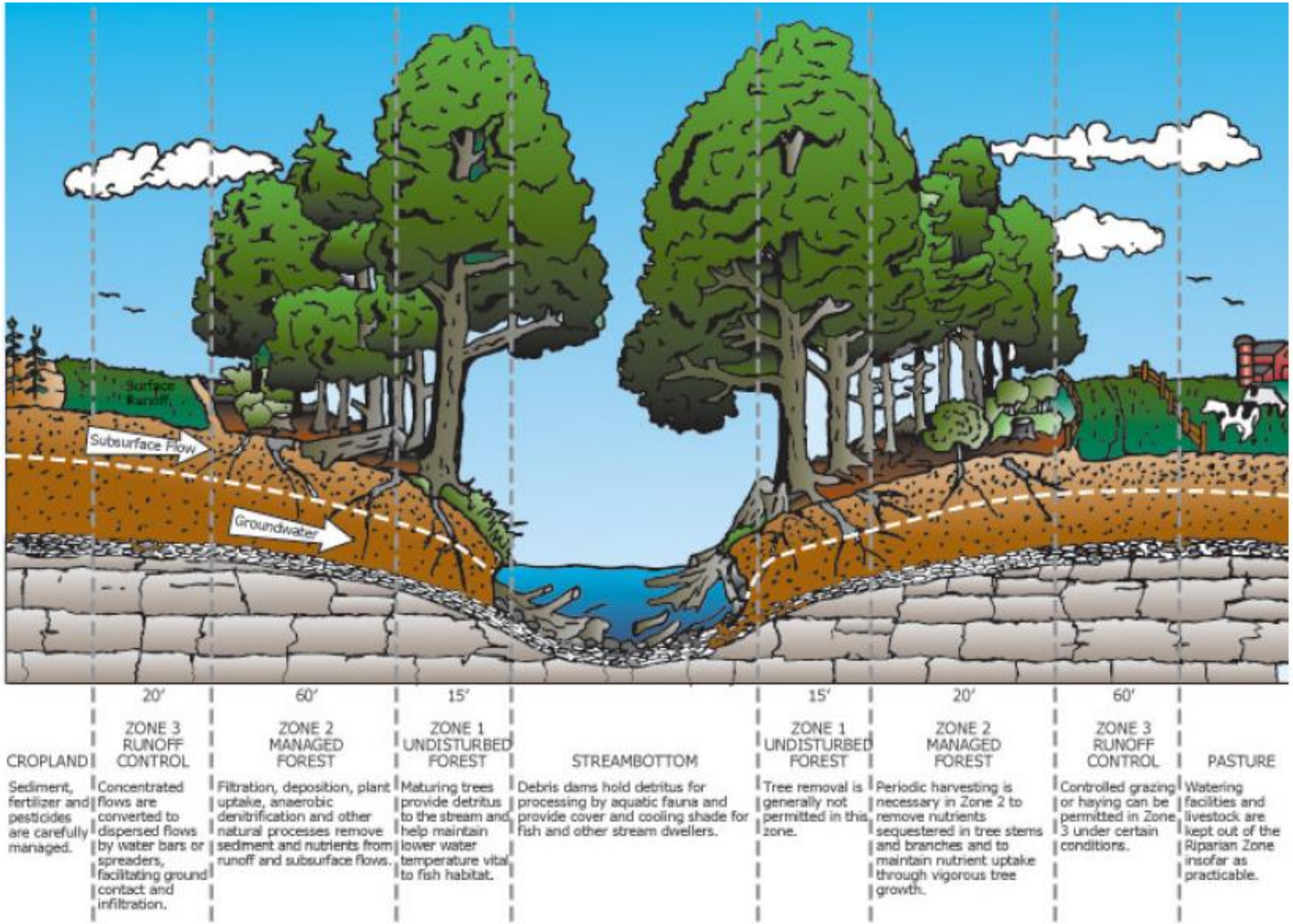
Riparian forest buffers also provide structural integrity and reduce erosion and meandering, as demonstrated in Figure 8. Large woody debris from the streamside forest is also instrumental in providing fish habitat, as well as structural and hydraulic variability as seen in Figure 9. Further, the forest buffer provides increased infiltration and precludes built infrastructure or other activities in the buffer zone that may be impacted by flood events.

A forested stream corridor is more resilient in the face of changing rainfall patterns and land use, enabling the stream channel to adapt and respond to changing conditions. While the total percentage of forest in the overall watershed has been widely recognized as a good predictor of stream health, the Stroud Center's work indicates that the percentage of stream length with a 100-foot-wide forested buffer is almost as effective at predicting stream health. That relationship is a powerful statement about the importance of forested buffers in the landscape. The science of rivers and streams suggests that forests, and riparian forests in particular, will play a critical role in insuring the resilience of the Commonwealth's water resources to landscape and climate related changes.

I thank the Committee again for the opportunity to present this information and would be happy to answer any questions and provide any additional materials requested.

# Figure 1.

# US Forest Service
# Riparian Forest Buffer Diagram (Welch 1991)

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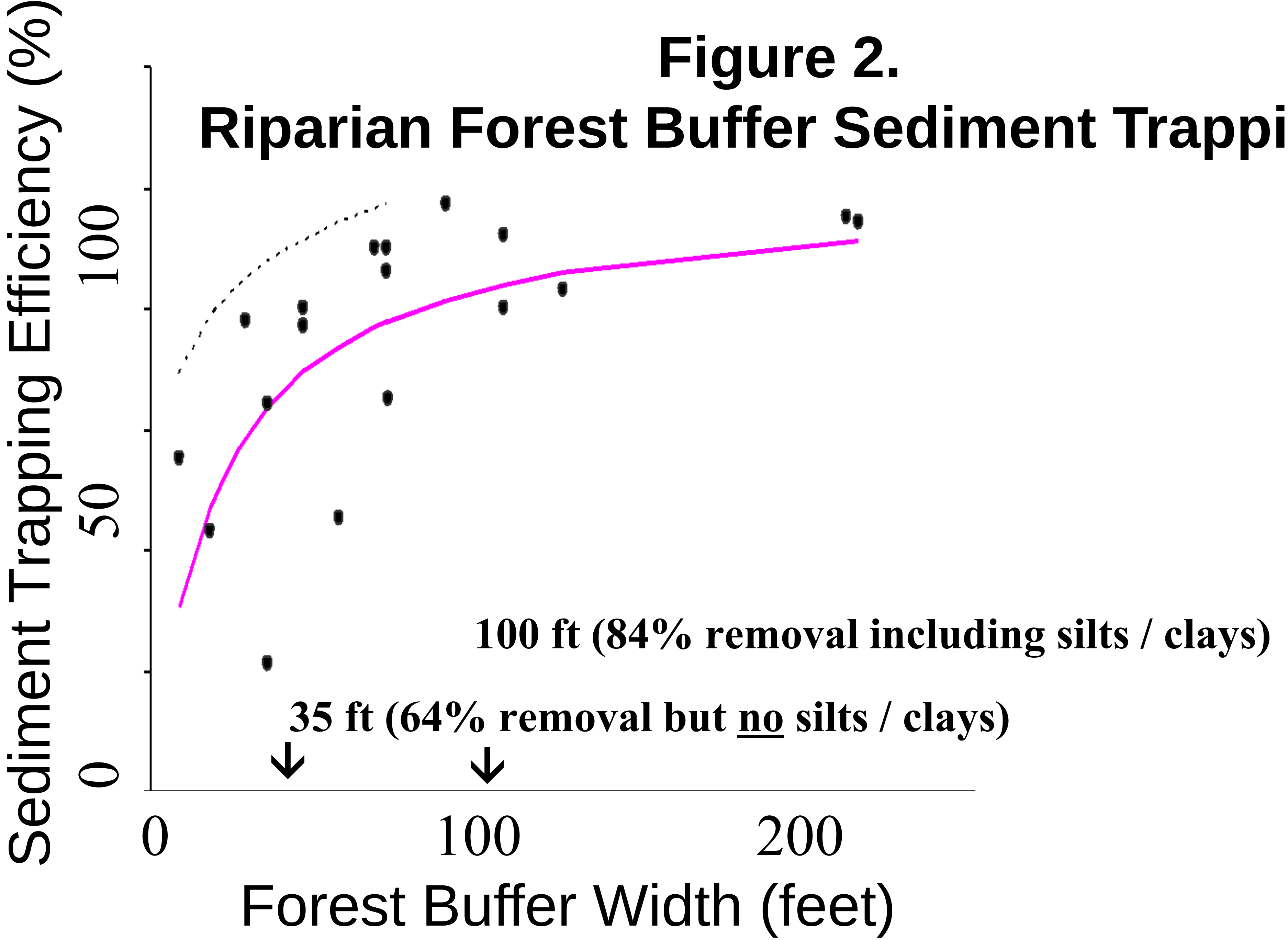
# Figure 2.
# Riparian Forest Buffer Sediment Trapping

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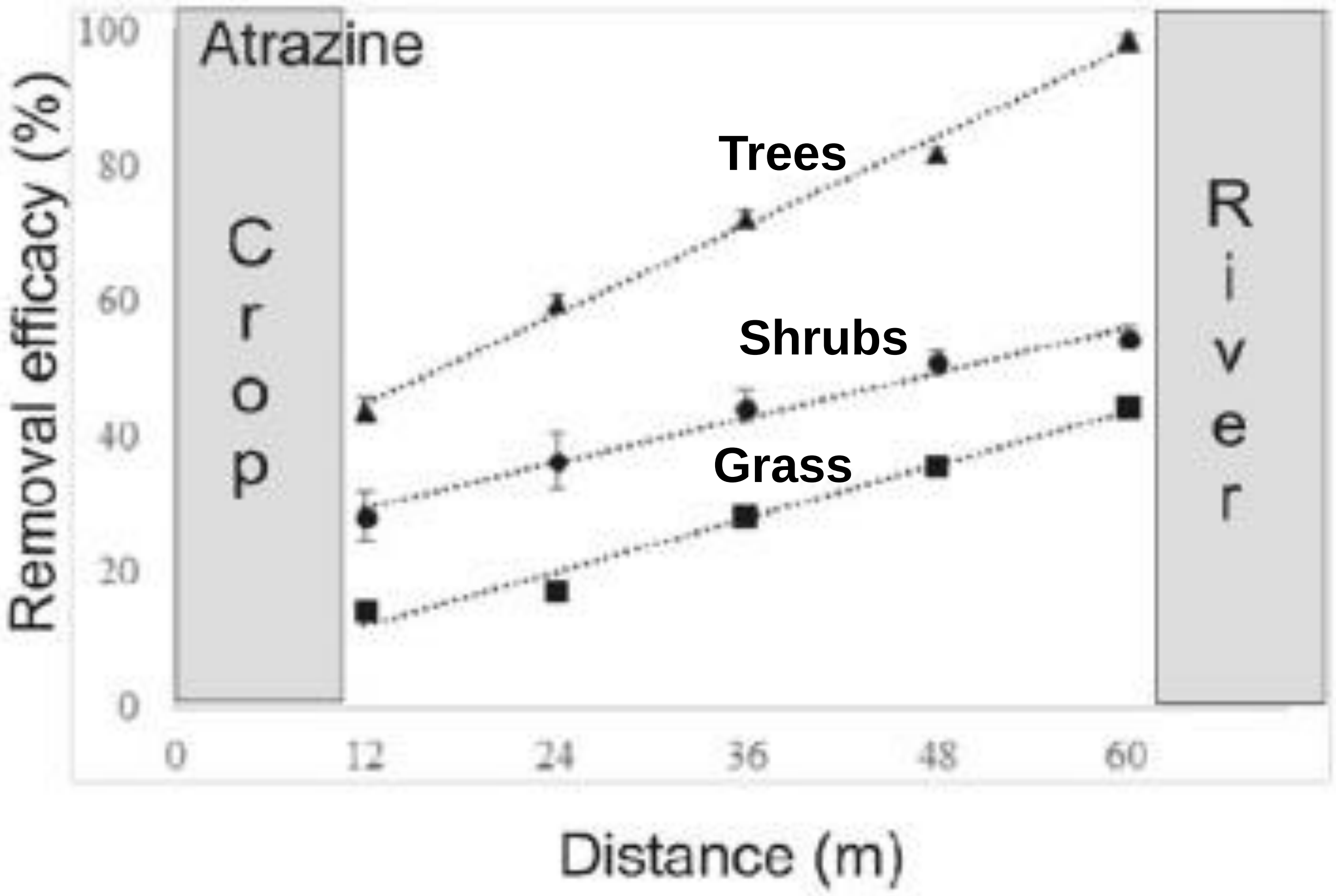
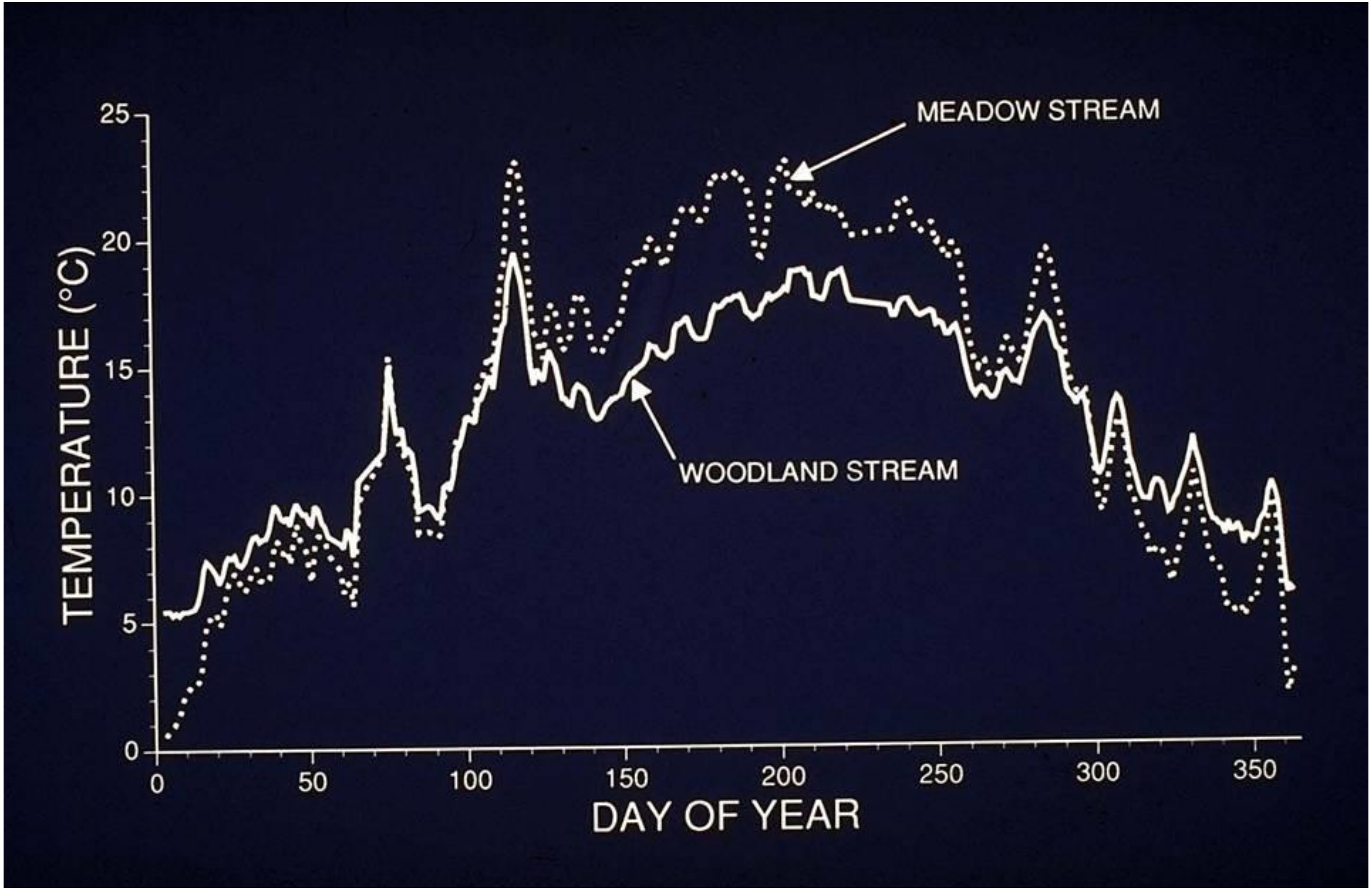
# Figure 3.
# Atrazine Removal

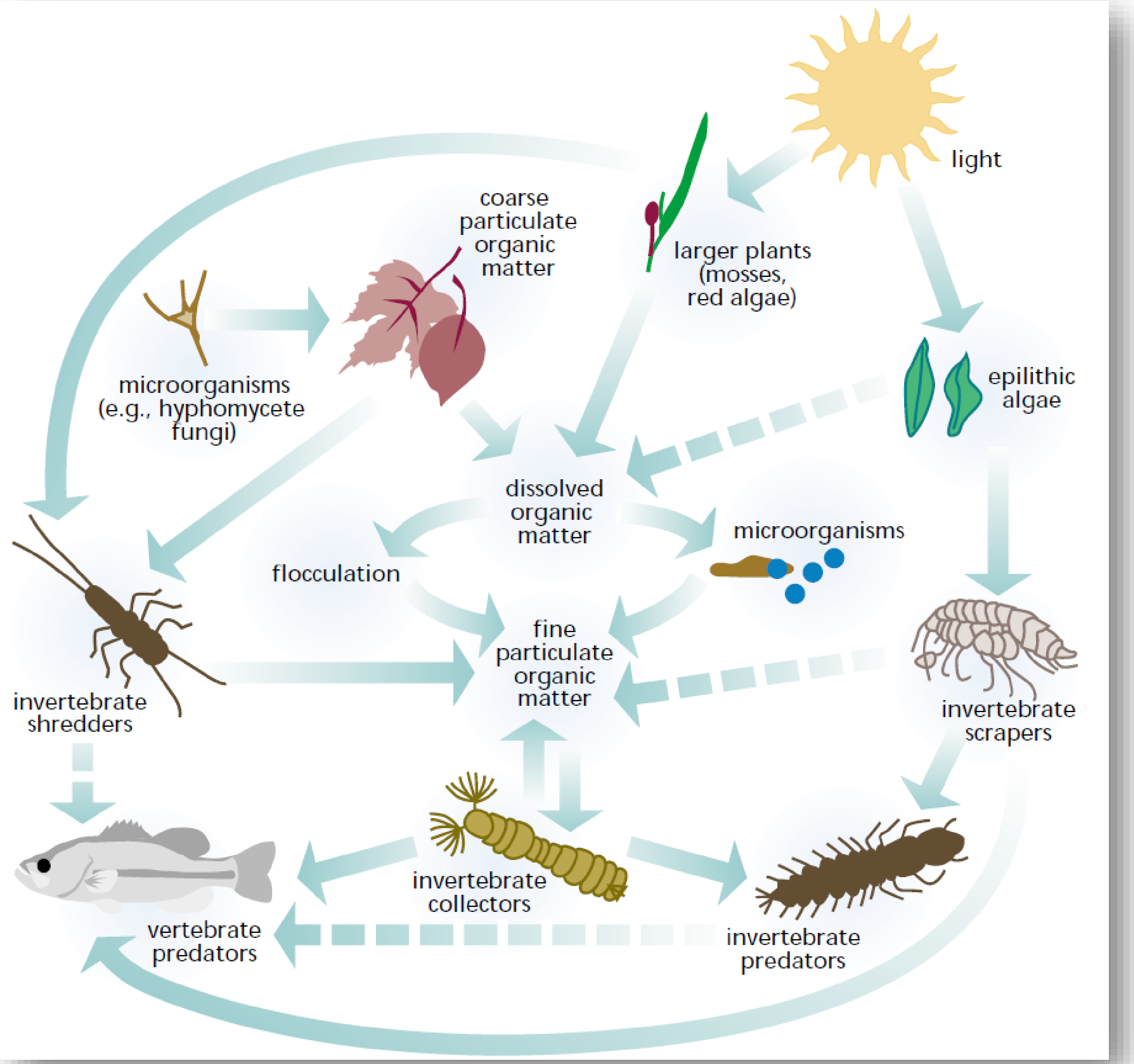



**Aguiar Jr., T. R., F. R. Bortolozo, F. A. Hansel, K. Rasera, and M. T. Ferreira. 2016. Riparian buffer zones as pesticide filters of no-till crops. Environ Sci Pollut Res 22:10618–10626.**

# Figure 4.  Forest Impact on Stream Temperature



# Figure 5. Healthy Forested Streams Do More Work




Up to 5x more processing of organic matter

2-9x more nitrogen uptake

than deforested streams

(Sweeney et al., 2004)

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# Figure 6.
# Forested Streams are Wider

These photographs are taken immediately upstream and downstream from fencerow in Chester County, Pennsylvania.

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# Figure 7.  Trees Provide Carbon as a Food Source

# Figure 8.  Tree Roots Stabilize Forested Streambanks

# Figure 9.
# Large Woody Debris Provides Critical Habitat and Structure

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