



Curriculum Units by Fellows of the Yale-New Haven Teachers Institute  
2017 Volume II: Watershed Science

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## Introduction

A watershed is an area of land where all the rainfall and streams drain to a common point. Watersheds are determined by elevation and the contours of land, which determine the direction that water moves once it hits land as it forced by gravity back to the sea. Ridges and mountains and other high elevation points can often be the divide, separating one watershed from another. Watersheds can be small, such as those sustaining a headwater stream or small pond, or very large, when hundreds of small watersheds and their streams combine to form a river and its associated watershed.

Watershed science is a combination of applied and basic research. One strength of watershed science is leveraging the watershed unit. Since the boundaries of a watershed are clear it allows one to perform accurate budgets for things like water and pollutants. One simply needs to determine the amount of a pollutant coming in with rainfall and the amount going out with streamflow and important insights can be gained. Furthermore, one can compare watersheds with different disturbance to try and constrain how these disturbances impact a pollutant. Comparing two neighboring watersheds with very different densities of suburban houses, for instance, can help with the management of watershed.

Water is also considered a human right and an important part of watershed science is trying to understand how to manage and improve the amount and quality of water draining watersheds. Many cities, for example, obtain their water from watersheds that drain into reservoirs. Understanding how to manage watersheds to improve water quality is therefore critical for human wellbeing and the economy. Finally, all other organisms also depend on water and how we manage watersheds is an important ecological consideration.

This seminar was an introduction to watershed science. The reading list heavily utilized the *Encyclopedia of Inland Waters*, and occasionally the primary literature. We started by going over some of the consideration of the watershed as a spatial unit and leveraging watersheds to do budgets. Particular attention was paid to the processes that impact the water budget and understanding how scientists estimate watershed water budgets. We then also spent time discussing watersheds, lakes and streams as ecological systems. The next part of our seminar focused on the cycles of different elements and compounds in watersheds. In addition to water, the seminar focused on nitrogen, phosphorus, and trace metals. We spent considerable time talking about how some forms of land management (e.g., agriculture) lead to excess pollutants in and impacts on inland waters. Finally we ended by reviewing and discussing different ways inland waters can be managed to protect against deleterious impacts.

The Fellows used this knowledge to pursue a range of topics. Some focused on the budget aspects of watersheds. Terry Bella focused his unit on evapotranspiration, an amazing way in which plants shape watershed water budgets. Carol Boynton followed a molecule of water through the complete water cycle.

Kaitlyn Wuetrich leveraged watershed budgets to teach concepts in statistics. Michael Petrescu focused on both the cycles of water and carbon within a watershed. Jason Ward's unit was on how water can create landforms. Others focused more on some of the impacts of humans on watersheds and water quality. Raphael Varnado looked at the cycling of nutrients and how they impact the Long Island Sound. Others looked at how watersheds and water quality can impact the ecology of inland waters. Laura Carroll-Koch focused on the interaction between watersheds and migratory fish of Connecticut. Larissa Spreng looked at factors that influenced the Long Island Sound lobster die-off. Andrea Zullo produced a unit on the impact of water quality on human health. Many of the Fellows used this as an opportunity to educate on local systems. This was also exemplified in Amanda Weires's unit that focused on the issues associated with the watersheds of New Haven.

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