USDA-CSREES 2007 National Water Quality Conference

Quantifying Soil-Stream Nutrient Linkages in Coastal Temperate Rainforest Watersheds

The Northern Pacific coastal rainforest, extending from Northern California to South Central Alaska, is an important ecosystem type where the distribution of highly productive salmon fisheries and some of the world's most productive forests overlap. The major challenge of forest management in the region is the maintenance and restoration of ecosystem functions that support these valuable resources in the face of local economic needs and a changing climate. The goal of this project is to provide managers with better predictions of the impact of human and natural disturbances on the terrestrial and aquatic processes that control nutrient dynamics and ecosystem productivity. Temperate rainforest watersheds are a mosaic of landforms, soils and streams, which vary widely in their extent and position in response to valley morphology and local climate conditions. Within the Tongass National Forest, wetlands and poorly-drained soils comprise an average of 30% of the land area. Superimposed on the lower reaches of this mosaic is an annual input of nutrients in the form of dead spawning salmon. Large areas have been intensively logged and the region is experiencing warming with potentially profound impacts on soil processes, forest structure, stream productivity, and salmon runs. We are quantifying nutrient cycling and export within soils of the dominant landscape units so that different watershed responses can be modeled by aggregating landscape units in appropriate combinations to reflect regional watershed variation. Early results confirm that major landform/soil associations have distinct seasonal and storm patterns in their export to adjacent streams. There is a close association between seasonal chemical dynamics within soils, groundwater, surface water draining the landscape units and nutrient dynamics within receiving streams. Both peat bogs and forested wetlands are important drivers of stream nutrient dynamics. During spawning runs salmon also influence nutrient cycles lower in the drainage. Within the 17 million acre Tongass National Forest alone there are hundreds of watersheds and thousands of salmon-bearing stream reaches. Predicting the effects of timber harvest or restoration in the face of huge natural variation in watershed characteristics is a daunting task. By creating a scaleable, landform-based process understanding of basin nutrient cycling we can provide more accurate predictions of watershed responses that will lead to better informed management of these critical resources.

Author: Rick T. Edwards
University Affliation: United States Department of Agriculture
Co-Author(s): Dave D'Amore and Eran Hood