

Report for 2001NY1141B: Nitrogen, Phosphorus, and Sediment Attenuation Capacities of Wetland Plants within the Nanticoke Creek Corridor

- Articles in Refereed Scientific Journals:
 - Kao, J; JE Titus and W Zhu, Differential nitrogen and phosphorus accumulation by five wetland plant species, For submission to Wetlands, (manuscript in preparation)

Report Follows:

Problem and Research Objectives:

The problem is that nonpoint agricultural sources of nutrients may have detrimental influences on water quality in the upper reaches of the Nanticoke Creek watershed. The primary research objective was (a) to compare the abilities of different wetland plant species introduced along the bank of the creek to reduce nutrient inputs from a dairy farm into Nanticoke Creek by accumulating nitrogen (N) and phosphorus (P) in plant tissues and by promoting sedimentation differentially. We subsequently added two related objectives: (b) to determine rates of N and P loss from decomposing tissues, and (c) to monitor plant phenology (the seasonal timing of growth, flowering, and senescence). Both secondary objectives concern the timing of nutrient accumulation by and/or loss from wetland plants.

Methodology:

- (a) Eleven blocks of 900 cm² plots, one plot for each of five study species in each block, were planted along the creek in late April 2001. The plants were harvested near the time of peak standing crop (early August), and plant tissues were rinsed carefully, oven-dried, weighed, ground, and analyzed for N and P content with a Lachat QuikChem autoanalyzer after digestion in a sulfuric acid/hydrogen peroxide mixture. We deployed small-scale sediment traps to determine the effect of species on sedimentation, but 2001 was a drought year with no sedimentation event after plants became established.
- (b) Subsamples of shoots were air-dried and placed in litterbags in a local wetland for five months, with tissues analyzed after 60, 120, and 150 days to determine rates of N and P loss from decomposing tissues.
- (c) Phenological observations were made approximately three times weekly during the growing season.

Principal Findings and Significance:

- (a) Sparganium americanum accumulated significantly more N and more P in aboveground tissues than Scirpus cyperinus, with Phalaris arundinacea, Juncus effusus, and Calamagrostis canadensis at intermediate values. In contrast, Juncus accumulated the most N and Scirpus the most P in belowground tissues, with Sparganium accumulating the least N and P belowground. Thus different species accumulate N and P at different rates both aboveground and belowground, suggesting that some would attenuate nutrient inputs to the creek more effectively than others.
- (b) In the litterbag incubations, Phalaris lost both N and P at the highest (relative) rates. Scirpus lost N at the lowest rate.
- (c) Of 16 species monitored in the field, Juncus effusus was among the first to flower and cease growing, while Sparganium americanum was among the last to flower and cease growing. The overall significance is that different species can behave quite differently in three respects: in their relative accumulation of N and P aboveground vs. belowground, in their rates of N and P loss from decaying shoot material, and in the length of their active growth period. These are important considerations for selecting species to retain N and P from nonpoint agricultural sources, both on seasonal and longer-term bases.