Wetland Ecosystem Services in Agricultural Landscapes

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"Landscape thinking" has transformed the science and management of agricultural nonpoint-source pollution over the past few decades. Perhaps the most critical driver of this transformation has been the realization that riparian wetlands have the capacity to prevent the movement of nutrients from upland agricultural land uses into streams (Jacobs & Gilliam 1985; Lowrance et al. 1984; Peterjohn & Correll 1984). Interest in the ability of all types of wetlands to provide nutrient removal "services" in agricultural landscapes has grown and programs to protect, restore and create wetlands to improve the environmental performance of agricultural landscapes are active in many areas of the world (Zedler 2003).

As the use of wetlands to absorb agricultural pollutants has increased, interests and concerns about other ecosystem services and "disservices" have emerged (Bennett et al. 2009). While wetlands in agricultural landscapes can provide important and useful services related to wildlife habitat, recreation and carbon sequestration, they can also be "hotspots" for greenhouse gas production and exposure of wildlife to contaminants (Groffman et al. 2011). There is a great need to quantify ecosystem services and disservices in agricultural landscapes so that tradeoffs can be evaluated and landscape performance can be optimized (Wainger et al. 2010)

In this paper, we first review the development of ideas about ecosystem services and how wetlands came to be used to improve the environmental performance of agricultural landscapes. We then go on to describe the emergence of ideas about ecosystem disservices and the need to balance pollutant removal services with greenhouse gas emissions and other potential disservices associated with wetlands in agricultural landscapes. Ongoing work in the Chickasheen watershed in Rhode Island USA is used to illustrate these ideas (Kellogg et al. 2010). Researchers in this watershed have identified sources and diverse sinks for nitrogen with the goal of minimizing nitrogen delivery to coastal waters. As the assessment of nitrogen sinks has progressed, concerns about greenhouse gases and other disservices have emerged. The work is linked to the development of decision support tools that have great potential to incorporate ecosystem services and disservices to optimize landscape performance.

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