Cropland diversity reduces nitrogen pollution

February 11 2009

LSU researchers have identified a link between the diversity of crops grown in farmlands and the pollution they create in lakes and rivers. In a *Frontiers in Ecology and the Environment* e-View paper, these ecologists show that when the biodiversity of crops is high, less dissolved nitrogen is found exiting the surrounding watersheds.

Whitney Broussard, who received a Ph.D. in oceanography and coastal sciences from LSU in August and is now at the University of Louisiana at Lafayette, and R. Eugene Turner of LSU, compiled data from the past 100 years on watersheds varying in size from the Illinois Cache River basin (400 square miles) to the Mississippi River Basin (more than a million square miles). The researchers compared this watershed data with land-use practices since the early 1900s.

Nitrogen from agricultural fertilizers leaches through soils to groundwater and runs off into rivers and lakes, increasing aquatic dissolved nitrate. Too much nitrate in the water can lead to prolific growth of aquatic algae, which can use up most of a water body's oxygen when they die and are decomposed, creating "dead zones" that cannot support life.

"These results are important because they highlight the need to address land use in order to reduce both the size of the low oxygen zone off Louisiana and the negative effect of nutrients on coastal wetland restoration efforts," said Turner.

The results show that since the beginning of the last century, the average

farm size in the United States has doubled and the number of farms has fallen by almost two-thirds. Broussard also says that a shift from farm animals and simple plows to the use of machines to till croplands has changed not only the culture but the environmental impact of farming.

"With the growing American farm comes the necessity to use more industrialized means of farming," said Broussard. "Our agricultural practices have always impacted water quality, but over the past century the mechanization of agriculture and the use of more potent fertilizers has caused a greater effect: the nitrogen leakage rate is higher."

Modern farms tend to produce fewer crop varieties; this lower crop biodiversity can negatively impact surrounding watersheds. According to the study, within a given area, a higher biodiversity of crops led to less dissolved nitrogen in surrounding water bodies. The explanation for this phenomenon, Broussard said, is difficult to discern.

"Diverse farms tend to have smaller fields with more edges, which can mean there's a greater buffering effect on nitrogen runoff by surrounding grasslands or woodlands," he said.

The researchers' results also showed that since 1906, the average aquatic nitrate concentration increased threefold in the entire United States and tenfold in the Iowa, Des Moines and Minnesota Rivers, all of which fall in heavily tilled agricultural areas.

In areas where farming is scarce or absent, however, the authors found no perceptible change in dissolved nitrogen concentrations since the early 1900s. Broussard thinks this indicates that the impacts might be reversible if policy changes included incentives for farmers to rotate more crops, decrease their field size, increase the edges of fields and sizes of buffering zones, and incorporate more native perennial grasses into farms and in between fields.

"There has been great progress made to reduce the footprint of agriculture, but there is still room for improvement," said Broussard. "The American farmer is caught in a mode of production that has tremendous momentum and cannot be changed on the farm - it's a policy question now."

Source: Louisiana State University