**Land Use and Water Quality in the Lost River Watershed, WV**

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The expansion of the WV Potomac Headwater's poultry industry has created concerns over possible water quality impacts due to application of excess poultry litter to crop and hay/pasture land and due to improper storage. The Lost River watershed (headwaters of the Cacapon River) contains the greatest density of poultry houses in the Potomac Headwaters area - despite covering only 2% of the Headwaters drainage area, it contains 21% of the poultry houses. For this reason, Cacapon Institute chose twelve sites in the Lost River for a study to determine the nutrient and fecal bacterial characteristics of Potomac Headwater streams in relation to land use, with an emphasis on agricultural impacts in general and, specifically, poultry agriculture. The scope of the study later expanded to include two more watersheds and 22 additional sampling sites.

This brief report will compare nutrient levels at three Lost River study sites to describe how different land uses can impact water quality, and to illustrate the complexity of the questions being asked. Cacapon Institute's studies look for the two major nutrients in manure and fertilizer that are seen in rivers- nitrogen (in the form of nitrate) and phosphorus (as total phosphorus and reactive phosphorus). The information presented was taken from regularly scheduled sampling data and excludes focused storm sampling, unless otherwise noted. The three sites are:

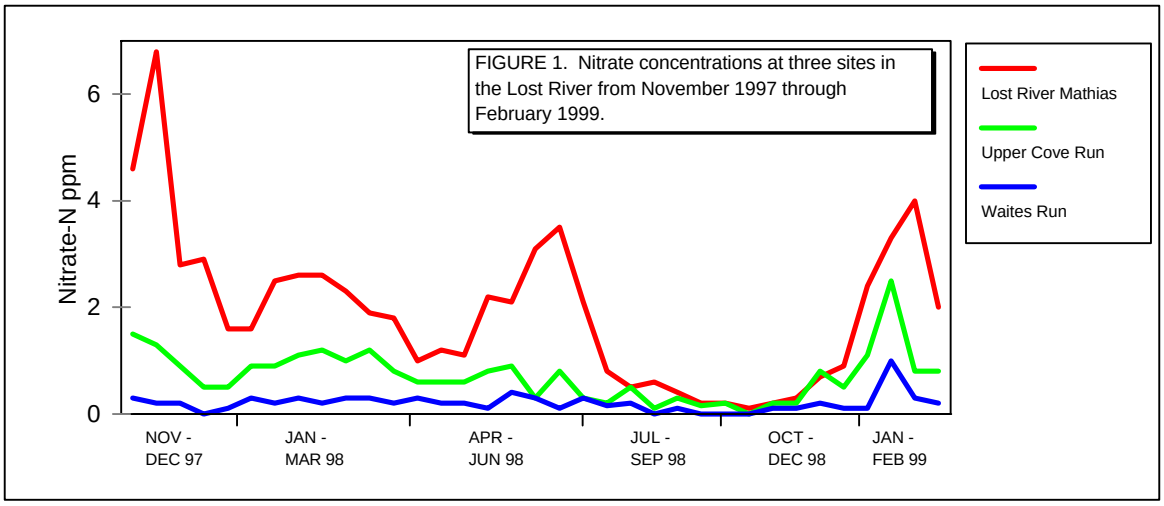
The **Lost River at Mathias** just upstream of Upper Cove Run. This site has 23 square miles (sq. mi.) of drainage area containing approximately 36 poultry houses; a substantial portion of the total area is floodplain land containing row crops and hayland fertilized using poultry litter. Crops and pasture usually extend to the river's edge.

**Upper Cove Run** just upstream of the Lost River. Twenty-nine poultry houses are found in UCR's 9 sq. mi. drainage area - the greatest density in the Lost River basin. Relatively little land is available for litter application.

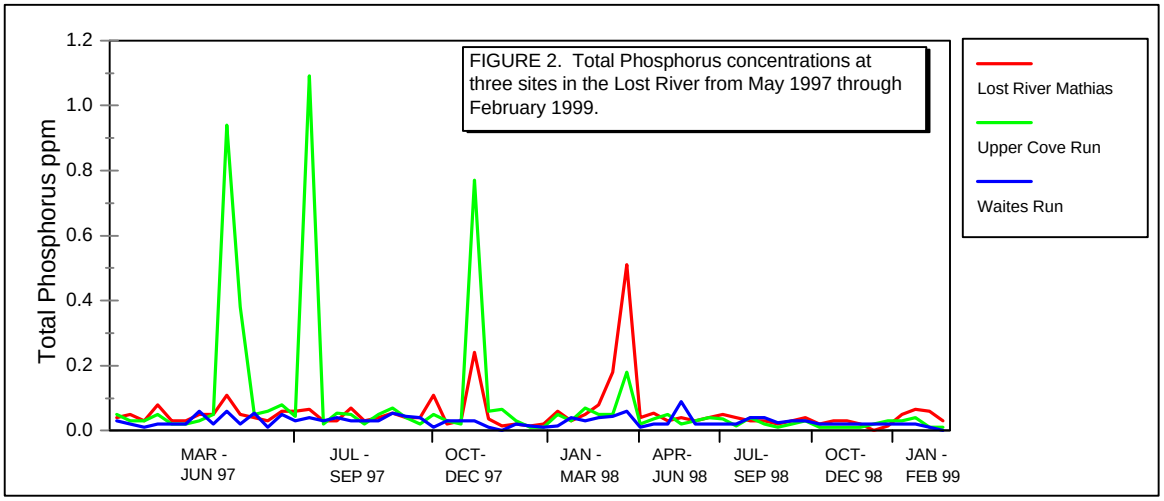
**Waites Run** flows into the Cacapon River at Wardensville. Largely forested, this site's 16 sq. mi. drainage area contains only four poultry houses, all located some distance from the stream. Little land is available for litter application in this watershed and the riverside (riparian) forest is largely intact.

**Nitrate**. The three sites had significantly different nitrate levels (Figure 1). Nitrate levels were lowest at Waites Run (mostly forested), higher in Upper Cove Run (concentrated poultry, little land application of litter) and highest in the Lost River at Mathias (agricultural floodplain). The differences were persistent throughout the study except during a period of extended drought in 1998.

The stream site at the Lost River at Mathias showed a large and sustained increase in nitrate levels following periods of saturating rainfall; the mostly forested site at Waites Run showed virtually no long term rainfall effect. Saturating rainfall increases nitrogen levels in agricultural area streams by moving surface applied nitrogen into the groundwater and from there into the river - a very slow release when compared to the rush of surface runoff during storms. The ability of nitrate to move through soils make it a very useful indicator of nutrient loadings on the land.




**Phosphorus**. Phosporus levels were typically low at all sites except during storms (Figure 2). Other researchers have noted that over 90% of a watershed's annual phosphorus load can wash into the river during a small number of severe storms. Our data confirmed that peak loads of phosphorus in the Lost River occurred only during major storms and were detected in the water column for only a few hours. Because phosphorus concentrations are high only during storm events and return to low levels quickly, tracking sources of phosphorus is difficult. The episodic nature of phosphorus losses from the land and a variety of sources (see **UCR BOX**) make it difficult to use this substance to indicate nutrient loadings on the land.




Subtle differences in phosphorus levels at low flow did occur. For example, during periods of extremely low flow, Waites Run had slightly elevated levels of reactive phosphorus associated with a spring that seeps into the stream at the sampling site. The Lost River at Mathias also had somewhat elevated levels of reactive phosphorus at low flow, but only following periods of substantial rainfall - this implies that a surface source of phosphorus was mobilized by precipitation and was seeping into the stream.

**Upper Cove Run—** The difficulty in trying to determine the source of nutrients in a stream is well-illustrated by Upper Cove Run, selected for sampling due the large concentration of poultry houses in the watershed. Early in the study, high phosphorus levels from storm runoff were detected in the Lost River and several tributaries, particularly Upper Cove Run. Poultry waste was at first considered likely to be the dominant source. Later sampling found the majority of the phosphorus in Upper Cove Run was not coming from poultry waste, but from a construction site located well upstream. A substantial flow of nutrients from the main poultry site was also detected but was dwarfed in comparison to that from the construction site. Construction activities had exposed soils naturally high in phosphorus. Inadequate erosion control measures, later corrected, allowed this phosphorus, along with heavy sediment loads, to reach the stream.

Nitrate sources are also hard to track. Nitrate levels at an upstream Upper Cove Run site (not shown on the graph) were unexpectedly high during the 1998 drought; this nitrate was traced to the point where a perennial spring emerged from the ground prior to flowing past a large concentration of poultry houses.

These stories from Upper Cove Run demonstrate how difficult it can be to pinpoint nutrient sources and, more importantly, that landowner cooperation in allowing access to streams where needed is the key to accurate interpretation of data.

Agricultural Best Management Practice (BMP) implementation is under way on many farms in the Lost River watershed. Much of this work started in 1998, more began in 1999. Our study will help determine the water quality impacts of these Lost River BMPs.

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