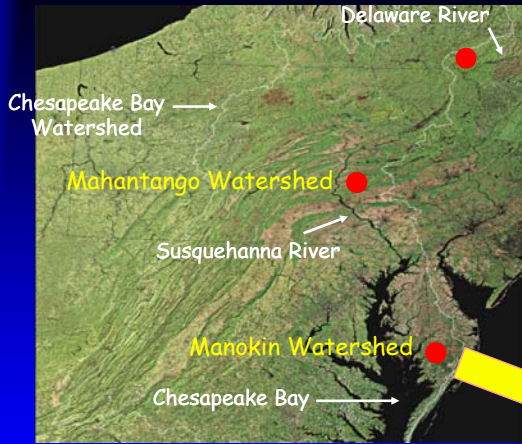
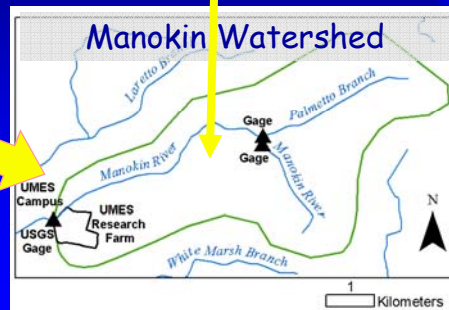


UMES Research Farm

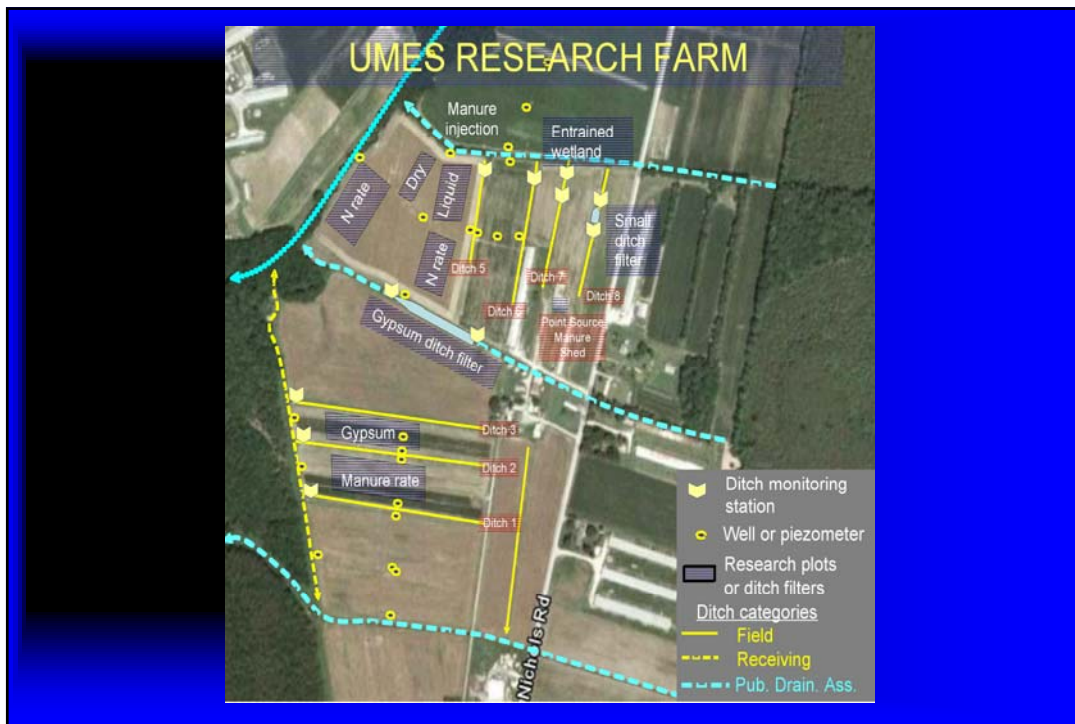


≈ 800,000 Broiler Chickens



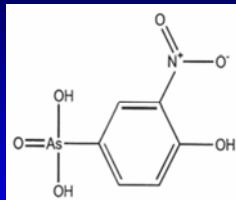
Manokin River Watershed





Why Arsenic ???

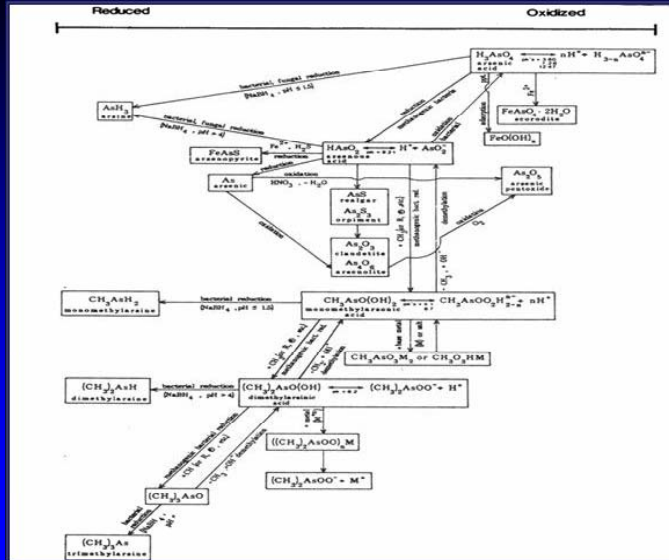
- ✓ As is fed to chickens in the form of Roxarsone



- ✓ 20-50 metric tons of arsenic per year is spread on the DelMarVa Penninsula



Chemistry of Arsenic



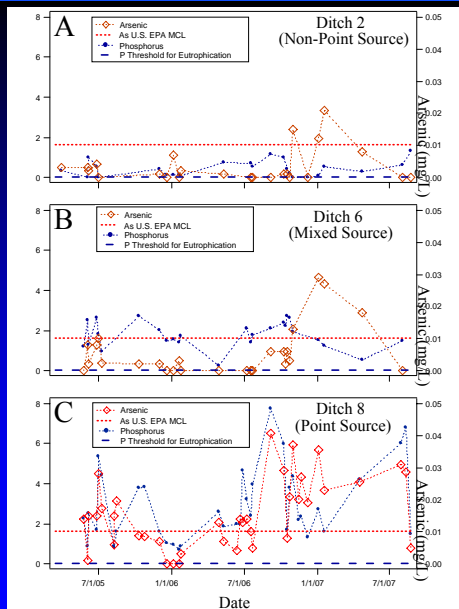
P and As Occurrence at UMES

Ditch	Probable As, P Sources	Watershed Area	Mehlich-3 P	Total As	Ditch flow		Average Concentration				Annual Loss			
					2005-2006	2006-2007	2005-2006		2006-2007		2005-2006		2006-2007	
			----- mg kg ⁻¹ -----		----- m ³ -----		----- mg L ⁻¹ -----				----- kg ha ⁻¹ -----			
1	Fields	2.74	421	0.29	6164	7880	0.004	0.19	0.005	0.363	0.004	0.33	0.033	1.62
2	Fields	1.77	447	0.37	11556	15341	0.002	0.31	0.005	0.448	0.011	2.16	0.059	3.46
3	Fields	2.00	449	0.31	12827	14138	0.002	0.36	0.004	0.209	0.007	1.85	0.040	1.19
5	Fields	1.10	467	0.26	3174	6857	0.002	0.71	0.003	1.005	0.006	1.52	0.027	5.48
6	Fields and 1 barn	1.04	457; 661	0.34; 0.65	1414	2149	0.002	2.02	0.009	1.880	0.004	2.34	0.024	3.23
7	barns	1.20	382	0.27	3450	6215	0.008	1.95	0.008	1.914	0.021	4.84	0.044	8.16
8	Fields, 2 barns,	0.82	466; 3113	0.44; 0.91	3345	4425	0.012	3.37	0.026	3.067	0.055	14.99	0.071	18.56
	litter storage shed													
Precipitation (mm)					922	1196	922	1196	922	1196	922	1196	922	1196

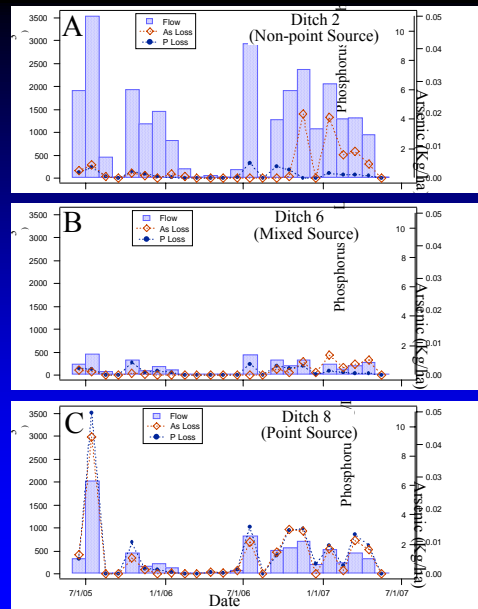
Second value applies to soil in immediate vicinity of poultry barn.
 Second value applies to soil in immediate vicinity of litter storage shed.

Ditch Concentrations and Losses of Phosphorus and Arsenic 2006 and 2007 Water Years

As and P Concentrations

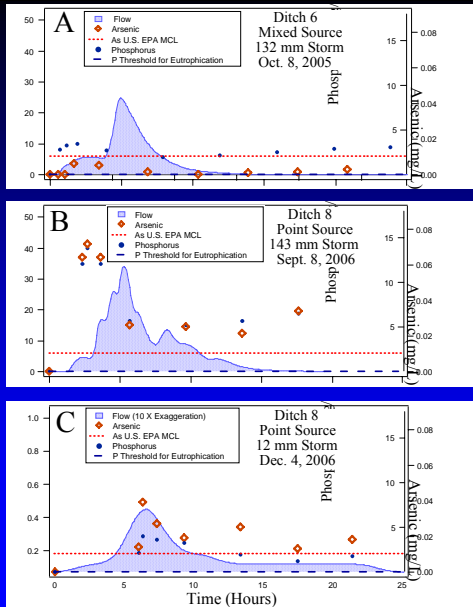


As and P Losses

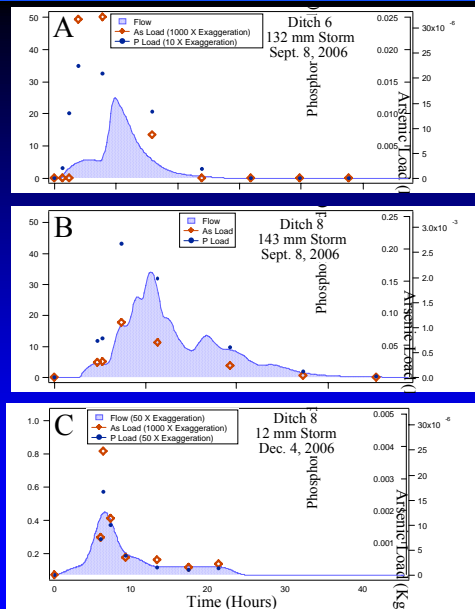


Concentrations and Losses of Phosphorus and Arsenic During Storm Events

Storm Hydro-Chemo-Graphs

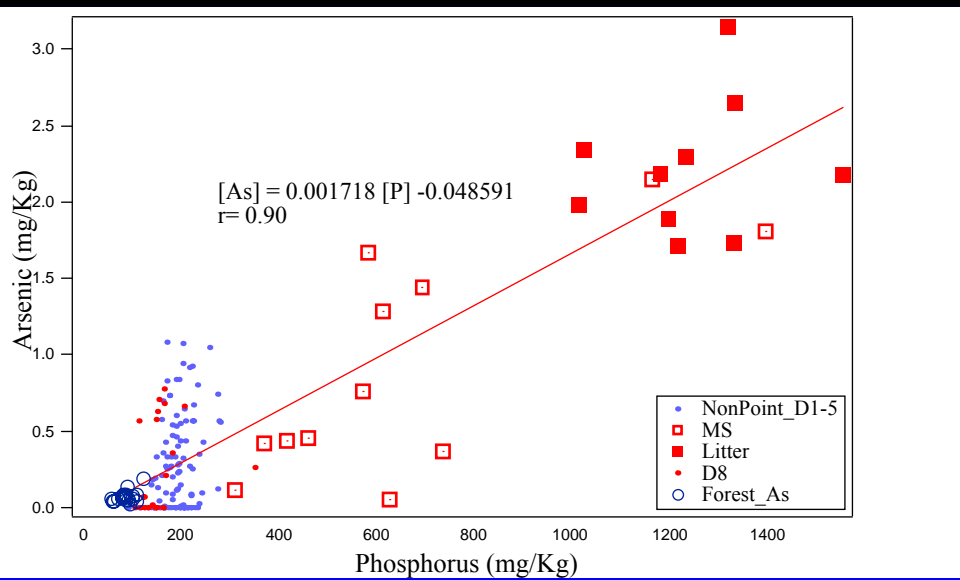


Storm Hydrograph-Losses

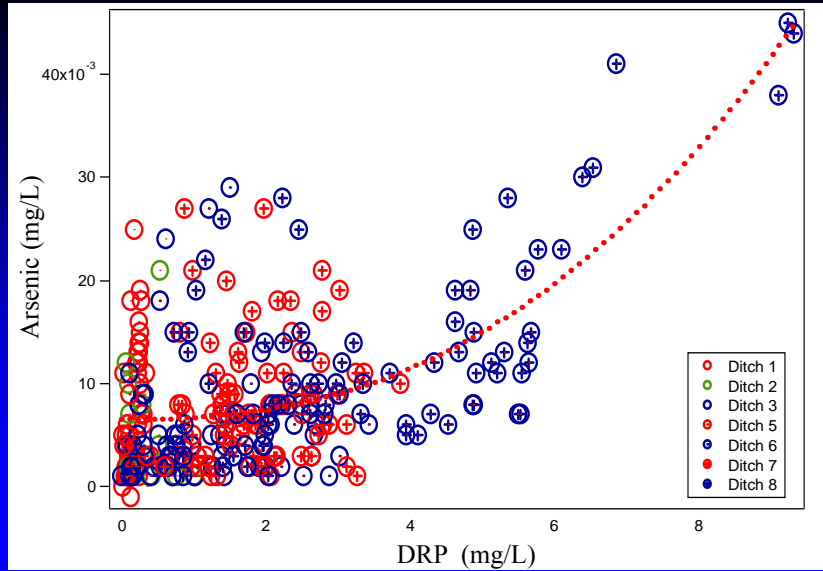


Correlations Between Phosphorus and Arsenic

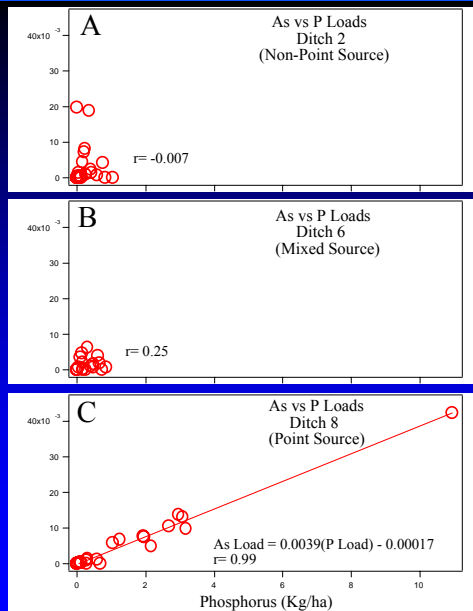
Concentrations in Soils and Litter



Concentrations in UMES Ditches



P and As Loads in Ditches



Removal of Arsenic and Phosphorus Using Industrial Materials

Industrial by-products



Acid mine drainage treatment residuals



Bauxite mining and production waste (red mud)



Steel slag waste



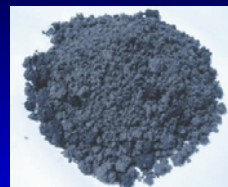
Drinking water treatment residuals



Fly ash

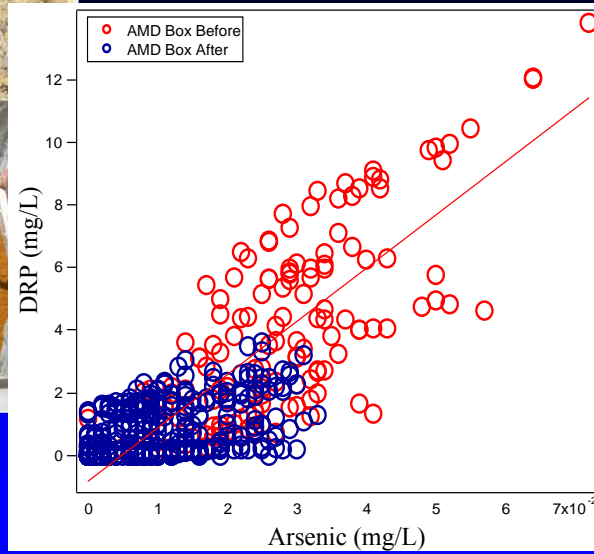


Waste recycled gypsum

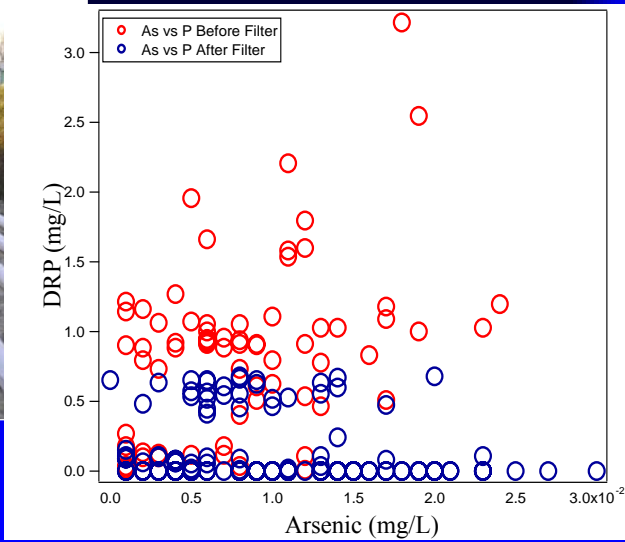


Paper mill waste

Removal of P and As by AMD Filter



Removal of P and As(??) by Gypsum Filter



Contact Info

Clinton D. Church
USDA-ARS
Ph: 814-863-8760
Email: Clinton.Church@ars.usda.gov