Report on Nutrient Synoptic Surveys in the Corsica River Watershed, Queen Annes County, Maryland, April 2003 as part of the Watershed Restoration Action Strategy.

Maryland Department of Natural Resources
Watershed Services
Landscape and Watershed Analysis
Management Studies

November, 2003

Acknowledgements

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This work supports Department of Natural Resources Outcomes –
#2 Healthy Maryland watershed lands, streams, and non-tidal rivers.
#3 A natural resources stewardship ethic for Marylanders.
#4 Vibrant local communities in balance with natural systems.

Significant field collection assistance was provided by Jennifer Rusko Rebecca Zeiber, Matt Evans, and Kevin R. Coyne of MD Dept of Natural Resources, Watershed Services, Landscape and Watershed Analysis, Management Studies.

Cover photo: Upper Three Bridges Branch by Niles Primrose

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Executive Summary

A nutrient synoptic survey was conducted during April, 2003 in the Corsica River watershed as part of the Corsica River WRAS. Samples were collected at 41 sites throughout the watershed. Biological samples were collected at seven of the nutrient sites. Nitrate/nitrite concentrations were found to be excessive in four subwatersheds, high in sixteen, moderately elevated in seventeen others, and baseline in the remaining four subwatersheds. Nitrate/nitrite yields were found to be excessive in fourteen subwatersheds, high in five, moderately elevated in eleven, and baseline in the remaining twelve. Excessive concentrations of orthophosphate were found in fifteen subwatersheds, high concentrations in fifteen, moderate concentrations in eight, and the remaining two below baseline. Orthophosphate yields were found to be high in one subwatershed, and baseline in the remainder. The elevated nitrate/nitrite concentrations and/or yields appear to be associated with row crop agriculture and possibly residential developments on well and septic. The elevated orthophosphate concentrations and yields appear to be associated with systems that had fine suspended sediment loads lingering in the water column several days after rain events possibly due to drainage from ponds. No anomalies were found in the insitu measurements of dissolved oxygen, or temperature. One site showed an abnormally high conductivity and low pH. Benthic macroinvertebrate community Index of Biotic Integrity ranged from good to very poor at the six sites sampled. The degradation in the benthic community was attributed to degraded habitat associated with storm water flows. Fish communities at the seven sites sampled ranged from non-existent to good. Although habitat degradation plays a role in the poor fish communities, the reason for the absence of fish at one site may be due to lack of water.

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Introduction

A nutrient synoptic survey was conducted during April, 2003 in the Corsica River watershed as part of the Corsica River Watershed Restoration Action Strategy.

Nutrient synoptic sampling was scheduled for early spring to coincide with the period of maximum nitrogen concentrations in the free flowing fresh water streams. The major proportion of the nitrogen compounds are carried dissolved in the ground water rather than in surface runoff. The higher nitrogen concentrations in the late winter and early spring reflect the higher proportion of nitrogen rich shallow ground water present in the base flow at this time of year. Nitrogen concentrations are reduced in summer as the proportion of shallow ground water is reduced through plant uptake, and replaced by deeper ground water that may have lower nitrate concentrations, or has been denitrified through interaction with anoxic conditions in the soils below the streambed. Point sources can also contribute to in stream nitrate concentrations.

Orthophosphate is generally transported bound to suspended sediments in the water column. In stream orthophosphate concentrations can also be produced through mobilization of sediment bound phosphorus in anoxic water column and/or sediment conditions, sediment in surface runoff from areas having had surface applied phosphorus, ground water from phosphorus saturated soils, and point source discharges.

Ranges used for nutrient concentrations and yields (Table 1) were derived from work done by Frink (1991). The low end values are based on estimated nutrient exports from forested watersheds, and the high end values are based on estimated nutrient exports from intensively agricultural watersheds. As an additional benchmark, the Chesapeake Bay Program uses 1 mg/L total nitrogen as a threshold for indicating anthropogenic impact. The dissolved nitrogen fraction looked at in these synoptic surveys constitutes approximately 50% to 70% of the total nitrogen.

Table 1. Nutrient Ranges and Rating

Rating	NO2+NO3 Concentration mg/L	NO2+NO3 Yield Kg/ha/day	PO4 Concentration mg/L	PO4 Yield Kg/ha/day
Baseline	<1	<.01	<.005	<.0005
Moderate	1 to 3	.01 to .02	.005 to .01	.0005 to .001
High	3 to 5	.02 to .03	.01 to .015	.001 to .002
Excessive	>5	>.03	>.015	>.002

A Note of Caution

Estimates of annual dissolved nitrogen loads/yields from spring samples will result in inflated load estimates, but the relative contributions of subwatersheds should remain reasonably stable. More accurate nitrate/nitrite load/yield estimates need to include sampling during the growing season to account for potential lower concentrations and discharges. Storm flows can also significantly impact loads delivered to a watershed outlet.

The tendency of orthophosphate to be transported bound to sediments makes any estimates of annual orthophosphate loads/yields derived from base flow conditions very *conservative. More accurate estimates of orthophosphate loads/yields in a watershed must include samples from storm flows that carry the vast majority of the sediment load of a watershed. Residual suspended sediments from recent rains, or instream activities of livestock or construction can produce apparently elevated orthophosphate concentrations and yields at base flow.*

METHODS

Water Chemistry Sampling

Synoptic water chemistry samples were collected in early spring throughout the watershed. Sampling was halted for a minimum of 24 hours after rainfall events totaling more than .25 inches. Grab samples of whole water (500 ml) were collected just below the water surface at mid-stream and filtered using a 0.45 micron pore size (Gelman GF/C) filter. The samples were stored on ice and frozen on the day of collection. Filtered samples were analyzed by the Nutrient Analytical Services Laboratory at the University of Maryland's Chesapeake Biological Laboratory (CBL) for dissolved inorganic nitrogen (NO_3, NO_2), and dissolved inorganic phosphorus (PO_4). All analyses were conducted in accordance with U.S. Environmental Protection Agency (EPA) protocols. Stream discharge measurements were taken at the time of all water chemistry samples. Water temperature, dissolved oxygen, pH, and conductivity were measured in the field with a Hydrolab Surveyor II at selected sites at the time of water quality collections. Watershed areas used to calculate nutrient yields per unit area were determined from a digitized watershed map using Arcview software.

Where sites are nested in a watershed the mapped concentration data for the downstream site is shown only for the area between the sites. Yield calculations for a downstream site are based on the entire area upstream of the site, but are mapped showing just the area between sites. The downstream sites therefore illustrate the cumulative impact from all upstream activities.

Benthic Macroinvertebrate Sampling

Aquatic macroinvertebrates were collected at the time of water chemistry samples during the spring to be within the MBSS spring index period. Macroinvertebrate collections were made over a $2m^2$ area of the best available habitat using a 0.3m wide dip net with a mesh size of 500 microns. The best available habitats include: gravel riffles, snags, submerged vegetation and root mats. Habitats were sampled in the proportion to their occurrence at the station. Samples were composited in a sieve bucket, fine sediments washed out, and large debris rinsed and discarded. The remaining sample was preserved in 70% ethanol and returned to the laboratory for subsampling. Subsampling was done using a gridded tray. Grids were chosen at random until the grid with the 100th organism had been completed. Organisms were identified to genus, recorded on a bench sheet, and archived for future reference. Insitu water quality data (dissolved oxygen, pH, conductivity, temperature) were collected during each sampling episode with a Hydrolab Surveyor II. A macroinvertebrate index of biotic integrity (IBI)(MD DNR, 1998) was calculated to facilitate ranking of site quality.

Fish Sampling

Fish were sampled during the summer to coincide with the MBSS index period for fish sampling. Backpack electroshockers were used for two passes through a 75 meter reach of stream with block nets at each end of the reach. All species were enumerated and weighed to obtain taxa richness and biomass estimates.

Results

A nutrient synoptic survey was conducted during April, 2003 in the Corsica River watershed as part of the Corsica River WRAS. Samples were collected at 41 sites throughout the watershed. Station locations are listed in Table 2 and mapped in Figure 1. The nutrient concentration and yield data is shown in Table 3.

Nitrate/nitrite concentrations were found to be excessive in four subwatersheds, high in sixteen, moderately elevated in seventeen others, and baseline in the remaining four subwatersheds (Figure 2). Nitrate/nitrite yields were found to be excessive in fourteen subwatersheds, high in five, moderately elevated in eleven, and baseline in the remaining twelve (Figure 3). Excessive concentrations of orthophosphate were found in fifteen subwatersheds, high concentrations in fifteen, moderate concentrations in eight, and the remaining two below baseline (Figure 4). Orthophosphate yields were found to be high in one subwatershed, and baseline in the remainder (Figure 5).

No anomalies were found in the insitu measurements of dissolved oxygen, or temperature (Table 4). One site showed an abnormally high conductivity (Figure 6) and low pH (Figure 7). Benthic macroinvertebrate community Index of Biotic Integrity ranged from good to very poor at the six sites sampled (Table 5). Fish communities at the seven sites sampled ranged from non-existent to good (Table 6).

Discussion

Two of the subwatersheds with excessive nitrate/nitrite concentrations (40, 46) appear to be associated with intense row crop operations. Possible associations for the excessive nitrate/nitrite concentrations in the two other subwatersheds (17, 24) are not as readily apparent. Subwatershed number 24 has some residential septic and the septic from the visitors center as possible sources. Riparian wetlands along the mainstem of Three Bridges Branch (17), due to an active flood plain and beaver activity, could also be a significant source of nitrate/nitrite at the time of sampling prior to leaf out. The subwatersheds with high nitrate/nitrite are dominated by row crop agriculture, but also have extensive riparian wetland complexes that could be contributing dissolved nutrients. Translating the nitrate/nitrite concentrations to yields produced considerably more subwatersheds in the excessive category. The jump to the excessive yield category occurs when the ratio of stream discharge to watershed area is low. When this ratio is high, low discharge to large area, the high concentration watersheds fall to baseline yields, as in subwatersheds number 24 and 46. The excessive yield subwatersheds in the Mill Stream Branch watershed are primarily row crop agriculture, with extensive riparian wetlands as mentioned above. The excessive yield subwatersheds in the Three Bridges Branch watershed, and subwatersheds 9 and 50, have a significant residential septic component along with row crop agriculture as probable sources for the nitrate/nitrite.

Table 2. Corsica River WRAS Nutrient Sunoptic Survey, April, 2003
Station Location

SITE_#	LOCATION	SAMPLE TYPE*	LATITUDE	LONGITUDE	NOTES
1	North Fork Emory Cr. at Spaniards Neck Rd.	N,F	39.09555	76.09426	
2	North Fork Emory Cr. at Coon Box Rd.	N	39.98060	76.09003	
3	South Fork Emory Cr. at Spaniards Neck Rd.	N,B,F	39.88150	76.09132	
7	UT to Corsica at Spaniards Neck Rd.	N	39.07470	76.07041	perched culvert
9	UT to Corsica at Spaniards Neck Rd.	N	39.07118	76.07005	perched culvert
10	UT to Corsica at Spaniards Neck Rd.	N	39.07118	76.07005	
13	UT to Corsica at Quail Run Dr.	N			
14	Three Bridges Branch at Rt 213	N,B	39.05419	76.05343	
15	UT to Three Bridges Br. at confluence	N	39.05459	76.04919	
16	UT to Three Bridges Br.at confluence	N	39.05401	76.04707	
17	Three Bridges Br.	N	39.05401	76.04707	
18	UT to Three Bridges Br.at confluence	N	39.05260	76.03207	
19	UT to Three Bridges Br.at confluence	N	39.05440	76.03250	
20	UT to Three Bridges Br. at confluence	N	39.05436	76.03280	
21	UT to Three Bridges Br. at confluence	N	39.05679	76.02257	
22	UT to Three Bridges Br. at confluence	N	39.05679	76.02257	
23	UT to Three Bridges Br. at Tanyard Rd.	N			
24	UT to Three Bridges Br. at Tanyard Rd.	N			
25	Three Bridges Br. at Rt 300	N			
26	Three Bridges Br. at Rt 301	N	39.04175	76.01283	
28	Grays Cr. at Rt 213	N			
29	Grays Cr. behind detention center	N	39.04336	76.05263	perched culvert
32	UT to Millstream Br. at Hibernia Rd.	N			
33	Millstream Br. above Rt 213	N	39.38380	76.70500	
34	UT to Millstream Br at confluence	N			
35	Millstreasm Br. at confluence	N,B,F			
36	UT to Millstream Br. at Taylor Mill Rd.	N			
37	Millstream Br. at Taylor Mill Rd	N			
39	UT to Millstream Br. at Rt 301	N	39.01500	76.06726	
40	UT to Millstream Br. at confluence	N			
41	Millstream Br at confluence	N			
42	UT to Millstream Br at Rt 301	N			
43	Millstream Br. at Rt 301	N,B,F			
45	Millstream Br. at Little Eagle Rd.	N			
46	Millstream Br. at Rt 304	N			
47	UT to Corsica at Rt 304	N,F			
48	UT to Corsica at Hibernia Rd.	N			perched culvert
49	UT to UT at Brownsville Rd.	N			perched culvert
50	Earle Cr at Fort Point Rd.	N			perched culvert
51	UT to Tilghman Cove	N	39.05765	76.11498	

*N = nutrients F = Fish B = benthic

Figure 1.
Corsica WRAS - Nutrient Synoptic, April, 2003
Sample Site Location

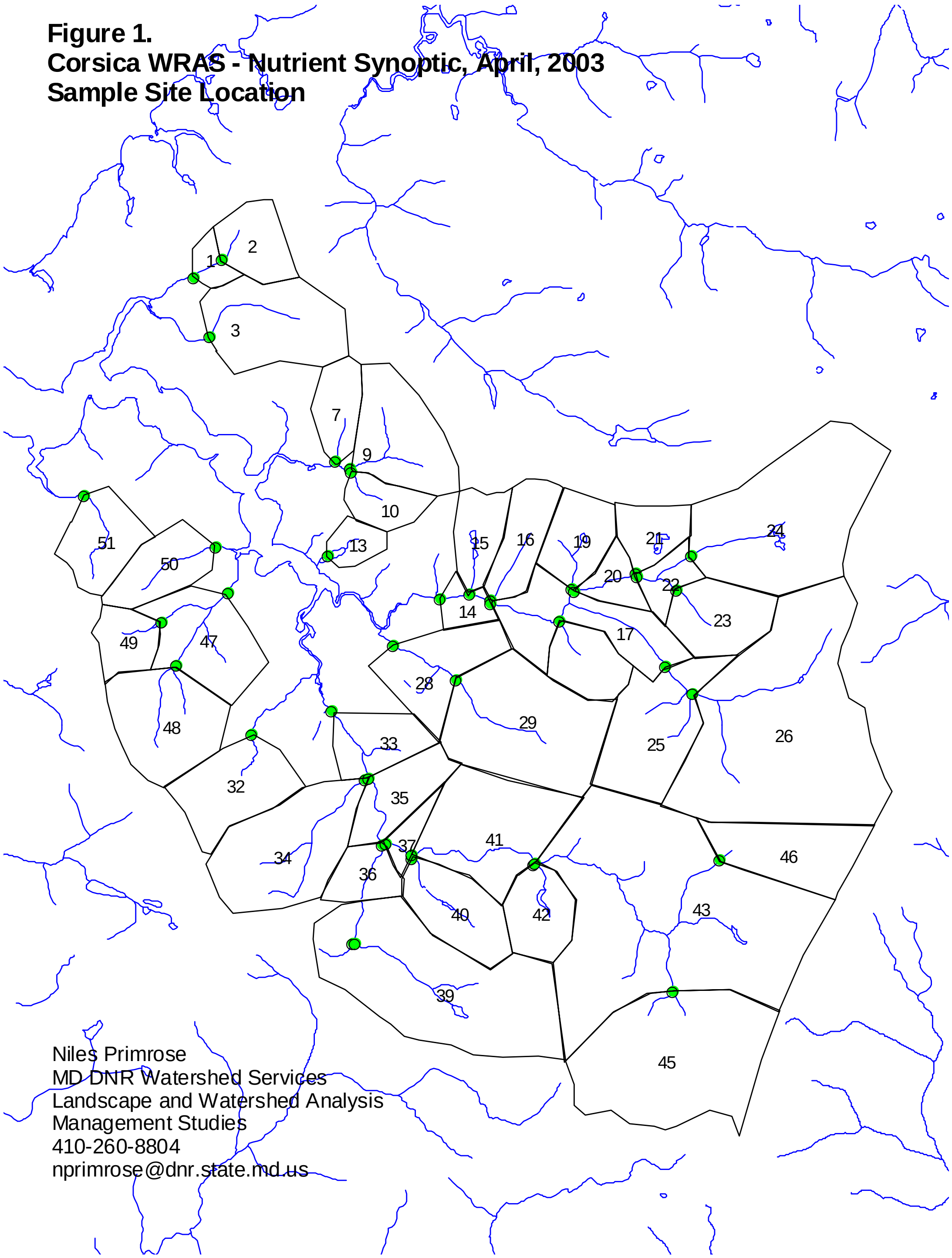

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Table 3. Corsica River Watershed WRAS Nutrient Synoptic Survey, April, 2003
Nutrient Concentrations and Yields

SITE #	DATE	TIME	PO_4 mg/L	$NO_2 + NO_3$ mg/L	DISCHARGE L/SEC	AREA_(H)	PO_4 KG/H/D	$NO_2 + NO_3$ KG/H/D
1	04/21/03	1100	0.007	0.42	6.29	140	0.000027	0.001638
2	04/21/03	1130	0.008	0.05	4.51	98	0.000032	0.000200
3	04/21/03	1145	0.004	0.13	20.08	240	0.000029	0.000945
7	04/24/03	1055	0.008	2.18	3.69	82	0.000031	0.008525
9	04/24/03	1120	0.010	4.36	19.12	192	0.000087	0.037721
10	04/24/03	1125	0.006	3.06	6.93	70	0.000052	0.026335
13	04/21/03	1200	0.002	2.67	1.84	44	0.000007	0.009703
14	04/24/03	945	0.011	3.03	199.17	3069	0.000062	0.017088
15	04/23/03	1153	0.010	3.08	3.32	86	0.000034	0.010333
17	04/23/03	1200	0.018	6.69	156.39	2838	0.000086	0.032036
16	04/23/03	1215	0.016	2.54	5.25	105	0.000070	0.011036
18	04/23/03	1020	0.014	2.30	6.58	96	0.000083	0.013699
19	04/23/03	1044	0.013	2.88	6.66	108	0.000070	0.015433
20	04/23/03	1048	0.019	2.60	123.99	813	0.000252	0.034459
21	04/23/03	930	0.018	2.59	79.37	78	0.001592	0.229024
22	04/23/03	920	0.020	2.45	6.90	683	0.000018	0.002150
23	04/22/03	1425	0.013	4.41	24.90	134	0.000210	0.071212
24	04/22/03	1445	0.009	5.59	0.63	437	0.000001	0.000700
25	04/22/03	1400	0.021	2.76	65.26	937	0.000127	0.016705
26	04/24/03	900	0.020	3.27	33.06	690	0.000083	0.013615
28	04/21/03	1245	0.007	2.49	37.18	496	0.000046	0.016220
29	04/23/03	1300	0.014	4.25	108.85	339	0.000391	0.118587
32	04/21/03	1400	0.013	4.62	10.25	172	0.000067	0.023925
33	04/23/03	1354	0.015	4.18	209.55	2841	0.000096	0.026792
34	04/22/03	930	0.007	4.91	65.64	274	0.000146	0.102216
35	04/22/03	940	0.016	3.90	104.40	2736	0.000053	0.012932
36	04/22/03	1030	0.022	2.31	86.20	570	0.000289	0.030357
37	04/22/03	1035	0.014	4.52	355.86	2053	0.000211	0.068085
39	04/24/03	1220	0.024	2.45	54.56	499	0.000228	0.023277
40	04/22/03	1110	0.010	8.44	45.17	145	0.000271	0.228465
41	04/22/03	1115	0.015	4.34	242.64	1874	0.000169	0.048832
42	04/22/03	1230	0.013	2.47	0.37	109	0.000004	0.000733
43	04/22/03	1240	0.020	3.83	230.39	1505	0.000266	0.050950
45	04/22/03	1330	0.012	0.64	39.91	448	0.000093	0.004954
46	04/22/03	1315	0.010	5.45	0.30	175	0.000001	0.000812
47	04/21/03	1315	0.013	1.68	57.09	468	0.000138	0.017809
48	04/21/03	1400	0.018	1.08	20.84	213	0.000153	0.009183
49	04/21/03	1415	0.035	4.61	4.29	74	0.000176	0.023197
50	04/21/03	1315	0.007	2.92	18.82	114	0.000100	0.041891
51	04/23/03	1450	0.014	1.50	7.87	123	0.000078	0.008343

Figure 2.
Corsica WRAS - Nutrient Synoptic, April, 2003
NO2+NO3 Conc. (mg/L)

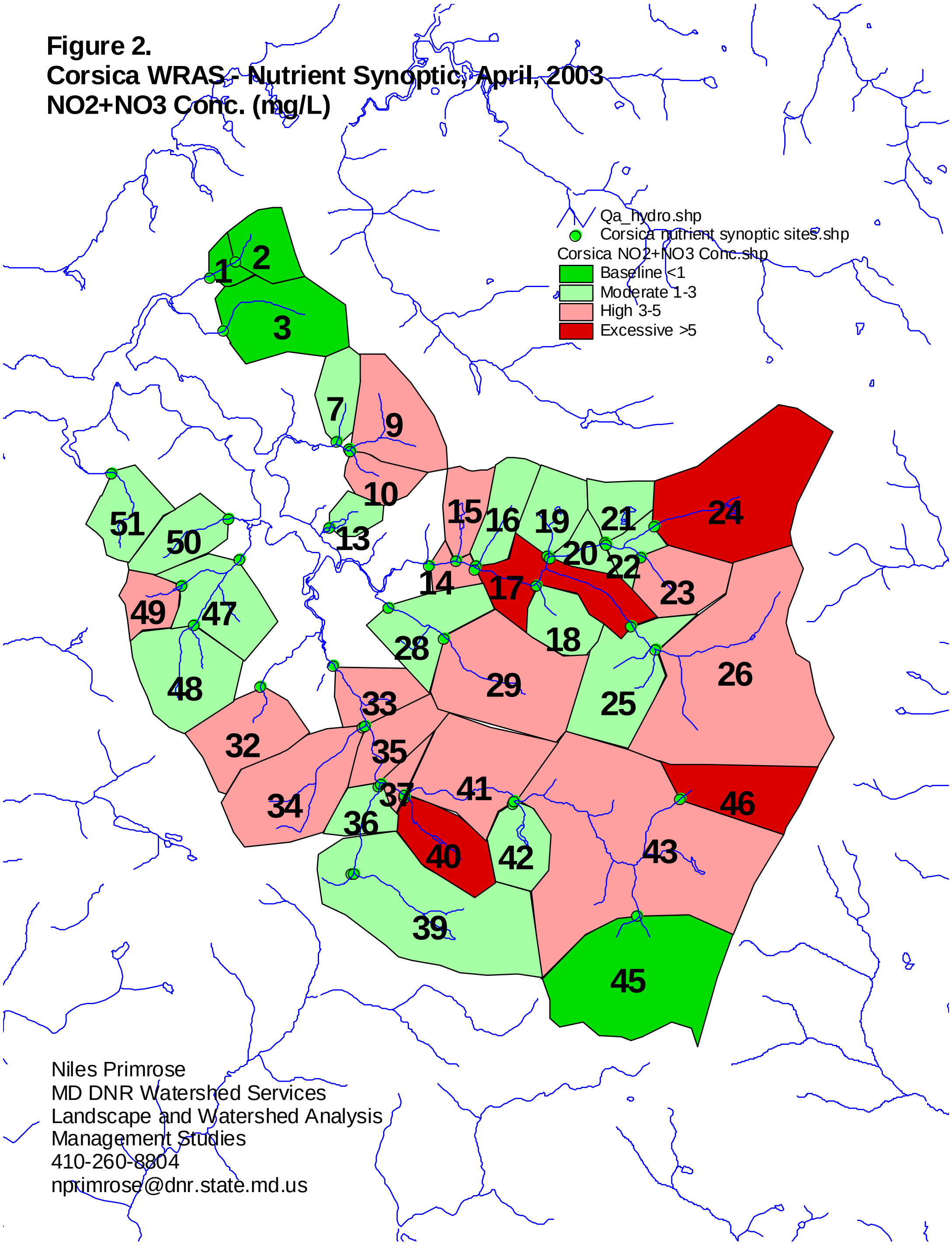

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Figure 3.
Corsica WRAS, Nutrient Synoptic, April, 2003
NO2+NO3 Yield (kg/h/day)

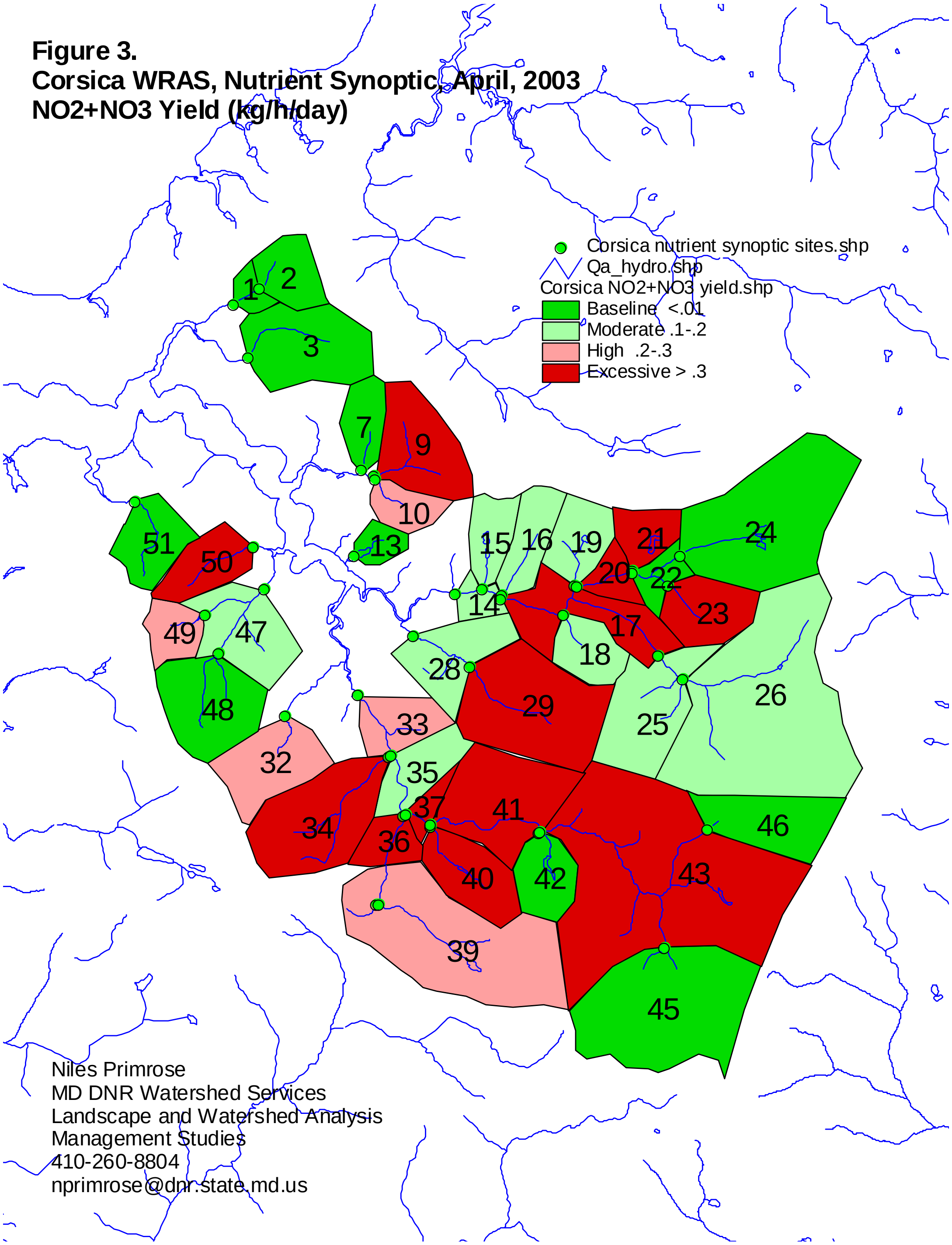

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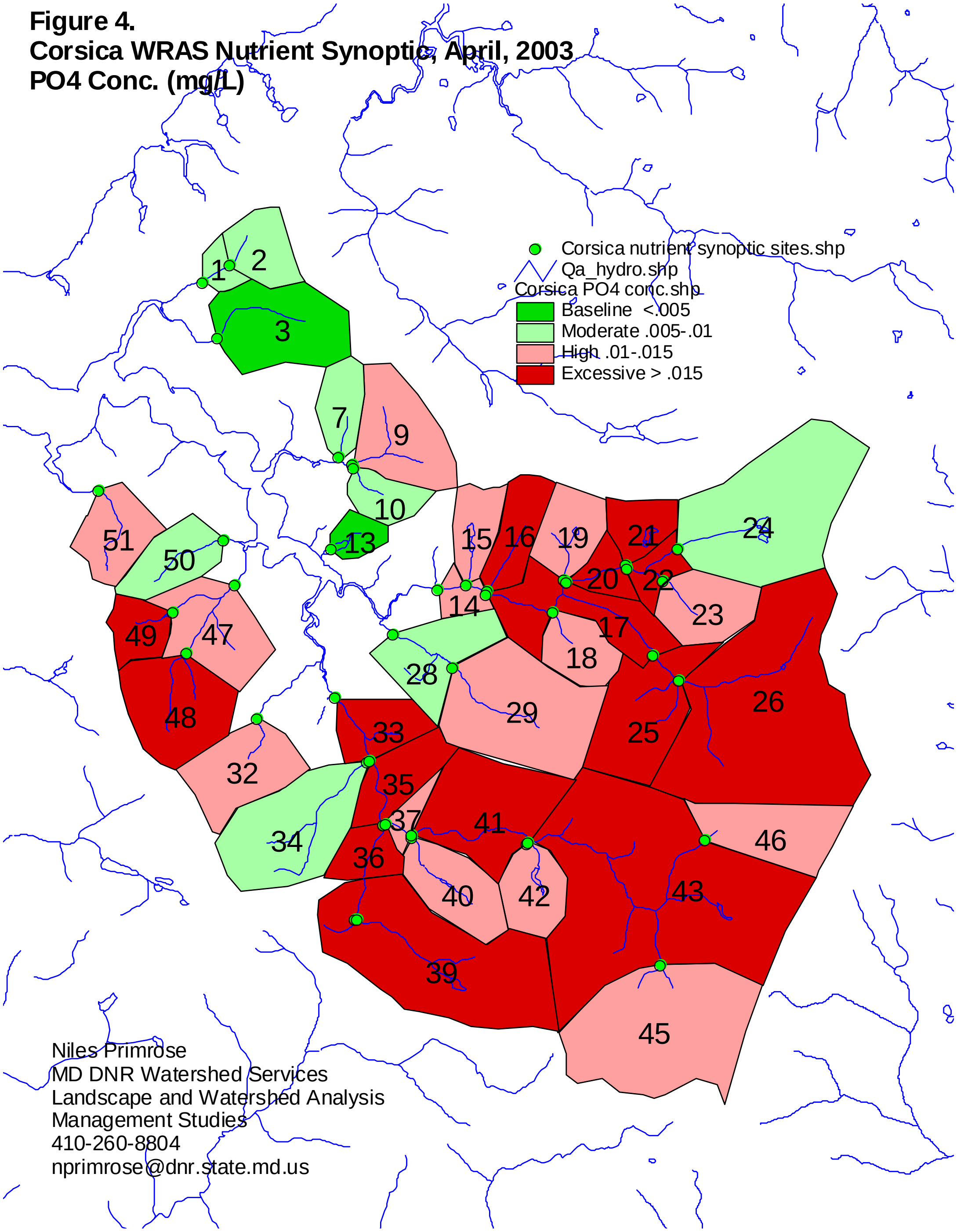
Figure 4.
Corsica WRAS Nutrient Synoptic, April, 2003
PO4 Conc. (mg/L)



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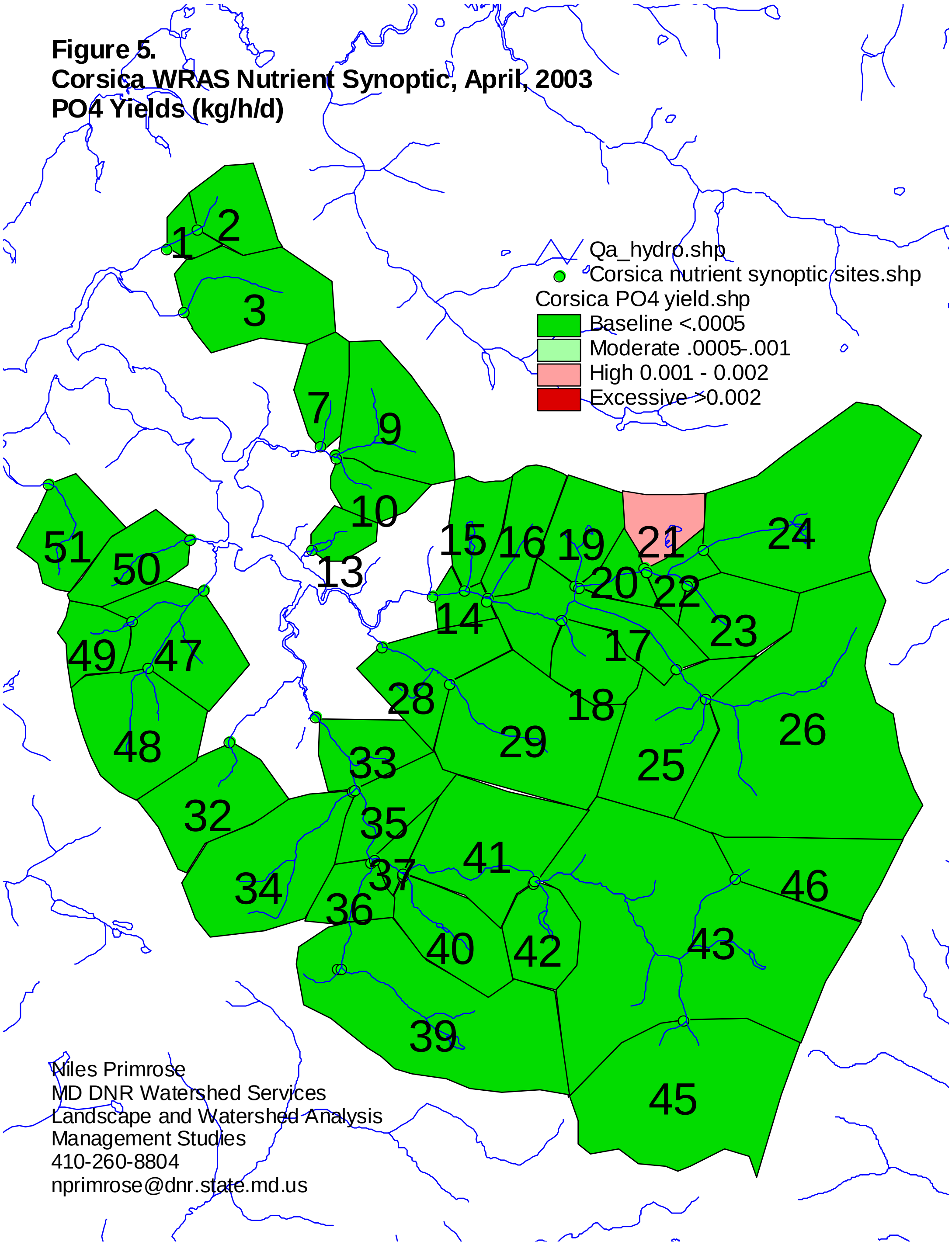

Figure 5.
Corsica WRAS Nutrient Synoptic, April, 2003
PO4 Yields (kg/h/d)
Qa_hydro.shp
Corsica nutrient synoptic sites.shp
Corsica PO4 yield.shp
Baseline <.0005
Moderate .0005-.001
High 0.001 - 0.002
Excessive >0.002
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Table 4. Corsica River WRAS Synoptic Survey, April, 2003
Insitu Water Quality

SITE #	DATE	TIME	TEMP C^o	pH	COND ms/mm	DO mg/L
1	04/21/03	1100	11.72	6.43	0.075	11.60
2	04/21/03	1130	12.49	6.10	0.061	10.98
3	04/21/03	1145	12.33	6.38	0.062	11.63
7	04/24/03	1055	9.64	7.61	0.111	11.21
9	04/24/03	1120	11.84	7.30	0.196	12.14
10	04/24/03	1125	12.13	7.28	0.196	11.50
13	04/21/03	1200	16.01	5.96	0.607	8.14
14	04/24/03	945	10.19	7.58	0.227	10.80
15	04/23/03	1153	13.50	7.86	0.279	12.76
17	04/23/03	1200	12.83	7.88	0.198	11.90
16	04/23/03	1215	13.35	7.83	0.218	13.06
18	04/23/03	1020	11.89	7.51	0.255	12.17
19	04/23/03	1044	11.95	7.29	0.178	11.41
20	04/23/03	1048	12.14	7.45	0.210	12.15
21	04/23/03	930	9.85	7.43	0.192	11.84
22	04/23/03	920	10.71	7.44	0.281	12.05
23	04/22/03	1425	17.05	7.76	0.263	12.52
24	04/22/03	1445	17.20	7.20	0.148	7.28
25	04/22/03	1400	16.41	7.36	0.250	14.19
26	04/24/03	900	8.94	7.46	0.251	11.21
28	04/21/03	1245	15.71	6.76	0.209	11.21
29	04/23/03	1300	13.13	7.99	0.162	14.08
32	04/21/03	1400	14.93	7.16	0.256	11.45
33	04/23/03	1354	14.64	7.65	0.219	10.96
34	04/22/03	930	13.75	7.40	0.272	10.88
35	04/22/03	940	14.30	7.39	0.228	10.31
36	04/22/03	1030	15.08	7.55	0.243	11.03
37	04/22/03	1035	14.42	7.52	0.205	9.18
39	04/24/03	1220	14.40	7.46	0.240	11.67
40	04/22/03	1110	15.70	7.19	0.280	11.10
41	04/22/03	1115	16.10	7.14	0.201	10.22
42	04/22/03	1230	15.90	6.68	0.238	4.40
43	04/22/03	1240	18.00	6.72	0.189	9.98
45	04/22/03	1330	17.96	7.10	0.096	10.01
46	04/22/03	1315	16.03	7.24	0.241	13.99
47	04/21/03	1315	14.24	7.38	0.124	14.21
48	04/21/03	1400	14.39	7.82	0.174	14.92
49	04/21/03	1415	16.76	7.29	0.251	9.75
50	04/21/03	1315	14.60	7.03	0.168	11.43
51	04/23/03	1450	13.40	7.49	0.172	11.82

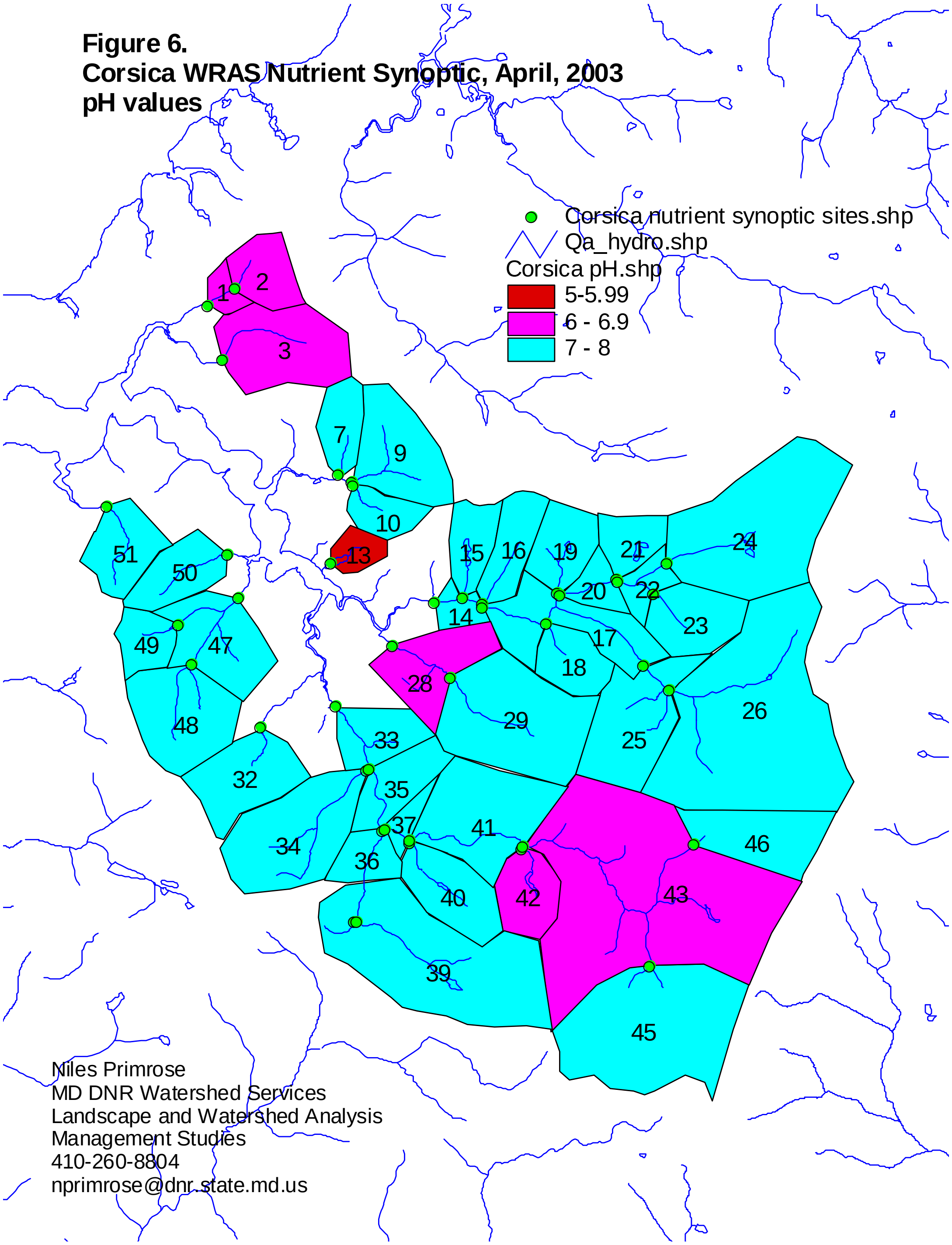
Figure 6.
Corsica WRAS Nutrient Synoptic, April, 2003
pH values
Corsica nutrient synoptic sites.shp
Qa_hydro.shp
Corsica pH.shp
5-5.99
6 - 6.9
7 - 8
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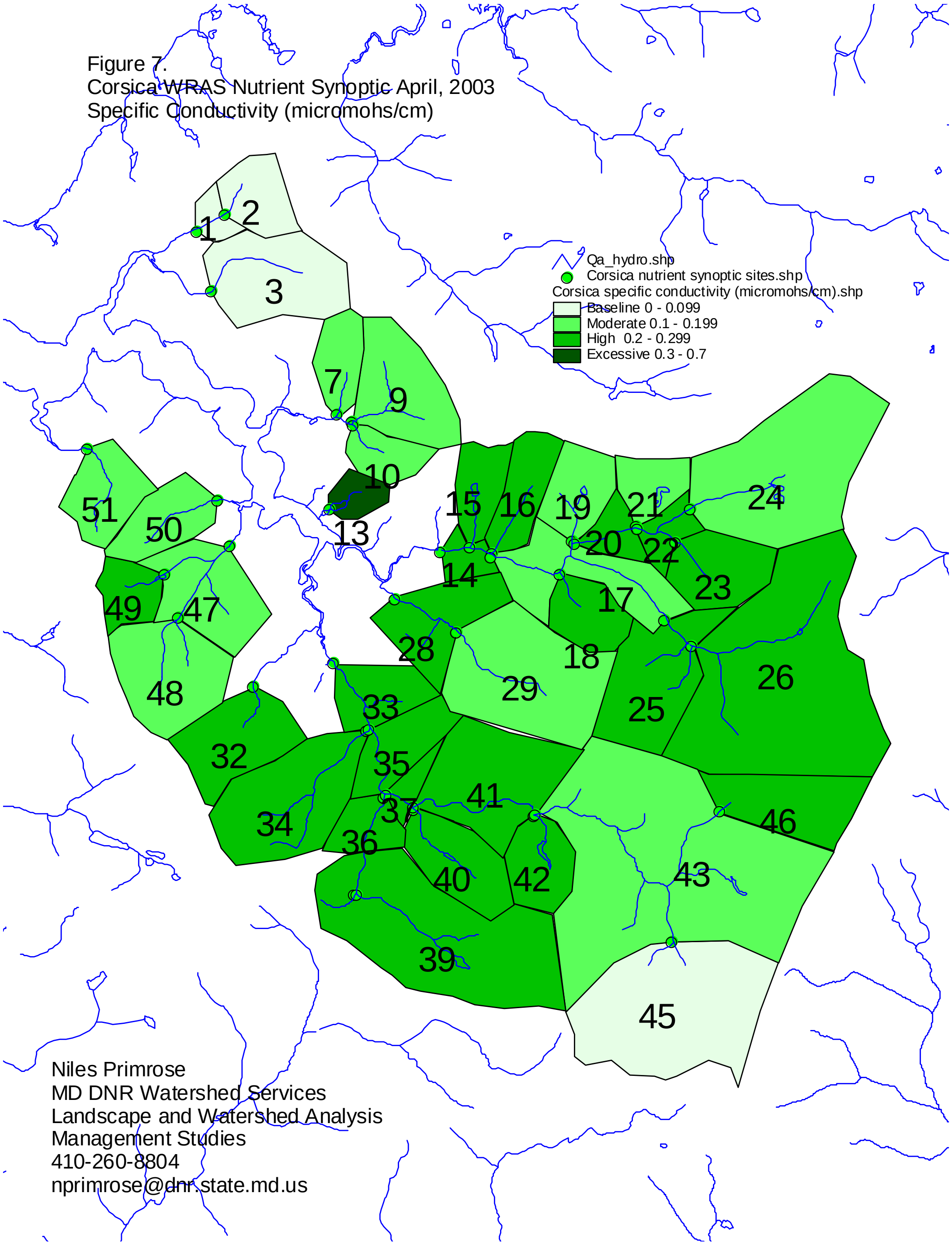

Figure 7.
Corsica WRAS Nutrient Synoptic April, 2003
Specific Conductivity (micromohs/cm)

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Table 5. Corsica River WRAS Synoptic Survey, April 2003
Macroinvertebrate Index of Biotic Integrity

Station	# of Taxa	# of EPT	% Ephemoptera	% Tanytarsini of Chironomids	Becks Index	# of Scrapers	% Clingers	IBI Calc***	IBI Score
3	14*/3**	3/3	0/1	0/1	5/3	2/3	0/1	15/7	2.1
14	16/3	2/1	9/3	2/3	3/1	3/3	0/1	15/7	2.1
20	17/3	4/3	15/5	0/1	6/3	4/3	2/1	19/7	2.7
29	11/3	3/3	25/5	0/1	4/3	1/3	0/1	19/7	2.7
35	14/3	0/1	0/1	10/3	0/1	1/3	0/1	13/7	1.9
43	20/3	7/5	16/5	0/1	10/3	3/3	0/1	12/7	3

* value
** score
***Total score/# of metrics

Table 6. Corsica River WRAS Synoptic Survey
Fish Species Totals by Site

Common name	Genus	species	Site #1	Site # 3	Site # 20	Site # 26	Site # 29	Site # 43	Site # 47
Leastbrook lamprey	*Lampetra*	*aepyptera*	-	-	49	3	38	6	6
American eel	*Anguilla*	*rostrata*	-	-	31	19	17	25	17
Golden Shiner	*Notemigonus*	*crysoleucas*	-	-	-	1	36	-	33
Fallfish	*Semotilus*	*corporalis*	-	-	43	6	13	23	-
Rosyside dace	*Clinostomas*	*funduloides*	-	-	-	-	-	27	-
Swallowtail shiner	*Notropis*	*procne*	-	-	-	-	-	-	12
Banded killifish	*Fundulus*	*diaphanus*	-	-	-	-	-	-	20
Eastern mudminnow	*Umbra*	*pygmaea*	-	23	1	12	25	3	9
Pirate perch	*Aphredoderus*	*sayanus*	-	-	3	8	1	1	-
Redfin pickerel	*Esox*	*americanus*	-	13	2	5	-	10	1
Yellow bullhead	*Ameiurus*	*natalis*	-	-	-	-	-	-	-
Brown bullhead	*Ameiurus*	*nebulosus*	-	-	-	1	1	-	4
Margined madtom	*Noturus*	*insignis*	-	-	1	-	-	14	-
White sucker	*Catatomous*	*commersoni*	-	-	-	-	-	1	1
Creek Chubsucker	*Erimyzon*	*oblongus*	-	-	-	6	1	11	47
Largemouth bass	*Micropterus*	*salmoides*	-	1	-	-	-	2	2
White crappie	*Pomoxis*	*annularis*	-	-	-	1	-	-	-
Redbreast sunfish	*Lepomis*	*auritis*	-	-	-	-	-	12	-
Pumpkinseed	*Lepomis*	*gibbosus*	-	-	2	14	-	2	3
Bluegill	*Lepomis*	*macrochirus*	-	10	2	25	1	15	10
Yellow perch	*Perca*	*flavences*	-	-	-	-	-	-	6
Tessellated Darter	*Etheostoma*	*olmstedi*	-	-	91	176	117	86	79

The high number of subwatersheds with excessive and high orthophosphate concentrations is associated with the very wet spring and the resultant suspended sediment in the water column at the time of sampling. Although sampling was generally done at least 24 hours after significant rain events, the prevalence of riparian wetlands and ponds that would continue to discharge muddy water days after rain events contributed to the elevated orthophosphate concentrations. The one subwatershed with a high orthophosphate yield had a combination of large ponds and active residential construction as probable sediment sources.

The average nutrient concentrations found in the Corsica watershed are similar to other agricultural watersheds in the coastal plain and piedmont (Table 7). As noted previously, there are seasonal cycles for the dissolved nutrients concentrations. Nitrate/nitrite concentrations would be expected to fall during the growing season in response to plant uptake and lower inputs from groundwater.

Table 7. Annual & Spring Average Nutrient Concentrations from Other Nutrient Synoptic Surveys

Mg/L	Piney	German Br.	Pocomoke	**Corsica River**	Breton Bay	Upper Patuxent	Choptank	Liberty
NO2+NO3 Spring	3.742	3.832	3.734	**3.11**	0.223	0.439	2.892	3.410
NO2+NO3 Annual	4.823	4.704	2.384					
PO4 Spring	0.800	0.043	0.028	**0.013**	0.004	0.012	0.023	0.004
PO4 Annual	1.177	0.067	0.022					

The anomalies of low pH and high specific conductivity from one small subwatershed (13) were attributed to drainage from estuarine dredge spoils disposed of in the watershed.

The limited biological sampling was divided among the major subwatersheds in the Corsica to provide an estimate of the living resource quality in each. The macroinvertebrate and fish communities in the Emory Creek watershed were disappointing considering the large forested area of the watershed. The instream habitat was noted as having significant storm water impacts. These streams also had low discharges and could be going dry on a regular basis during normal and low precipitation years. The poor macroinvertebrate communities at the two Three Bridges Branch sites (14, 20), and the one Mill Stream Branch sites (35) are due to poor habitat quality rather than poor water quality. Site 14 happened to fall immediately below a large beaver dam, and the sampling area had been severely scoured due to flooding over and around the dam from high flows (Figure 8). The scouring had removed almost all woody debris and destroyed or severely compromised the riffle habitat important to macroinvertebrates within the sample reach. The habitat at site 20 was dominated by continually shifting sand that covered much of the suitable riffle and woody debris macroinvertebrate habitat. Site 35 was dominated by deep pools and runs with limited macroinvertebrate habitat. Site 43 had relatively good habitat diversity and quality, although storm water damage was evident. The fish communities at the five remaining fish sites, while relatively species rich, were dominated by species that prefer sand and/or mud habitats (least brook lamprey, mudminnows, and tessellated darters). This dominance attests to the prevalence of this type of substrate within the systems sampled.

Figure 8. Beaver dam at Site # 14.


Conclusions

Elevated nitrate/nitrite concentrations and yields are one of the major water quality impairment within the Corsica watershed. Sources of the nutrients appear to be strongly associated with row crop agriculture and concentrations of residential septic systems. Although suspended sediment was not measured directly, evidence from the orthophosphate results and observations of instream habitat indicate that sediment movement is impacting the quality of the biota. The prevalence of well buffered riparian areas throughout the Corsica watershed points to erosion caused by uncontrolled storm water from impervious surfaces such as Rt. 301 and other major roads, parking lots, and high density residential areas would be considered the major sediment source.

Literature Cited

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