

Uneven Nutrient Load and Potential Offsite Loss *S.D. Logsdon, USDA-ARS-NLAE*

Uneven nutrient load

- uneven application
- runoff, runoff
- erosion, sedimentation
- organic matter variation
- near to tiles, ditches, waterways

- South Fork watershed, field 1:
- grassed waterways
 - south green point runoff monitor
 - red transects: sampled, ~110 m
 - blue points: monitoring wells
 - gravel upslope
 - site with largest slopes
 - Soil Clarion
 - corn - corn - soybean
 - swine manure fall before corn

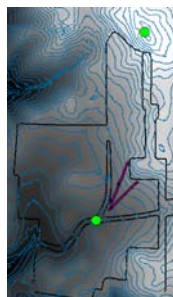


Table 1. South Fork field 1 transect properties: minimum, first quartile, median, third quartile, maximum.

Property	min	25	med	75	max
NO ₃ 0-0.15 mg/kg	4.2	8.0	13.8	26.6	136.5
NO ₃ 0.15-0.3 m	3.6	4.4	5.3	8.0	40.1
NH ₄ 0-0.15 mg/kg	3.1	4.1	5.2	7.6	124.3
NH ₄ 0.15-0.3	1.8	2.4	3.0	4.7	5.7
Ortho P 0-0.15 mg/kg	8	14	23	31	91
Ortho P 0.15-0.3	1	2	3	5	9
TN 0-0.15 g/100g	0.13	0.15	0.17	0.19	0.21
TN 0.15-0.3	0.11	0.13	0.14	0.15	0.17
C:N 0-0.15	9.4	10.4	11.0	11.6	12.7
C:N 0.15-0.3	8.8	10.1	10.5	11.2	15.1

Hypotheses: 1) P accumulates on low areas near waterways, 2) subsurface nitrate at low areas decreases due to leaching and denitrification.

- South Fork Field 2
- yellow points sampled
 - blue points wells
 - grassed waterway
 - transect 1 convergent
 - transect 2 divergent
 - transects ~110 m long
 - transect 1 Webster, Coland
 - transect 2 Clarion, Storden
 - subsurface sand lenses
 - beef manure periodically
 - corn -soybean

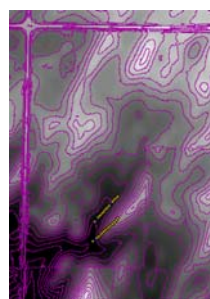


Table 2. South Fork field 2 transect properties: minimum, first quartile, median, third quartile, maximum.

Property	min	25	med	75	max
NO ₃ 0-0.15 mg/kg	4.1	5.2	10.0	16.0	32.1
NO ₃ 0.15-0.3 m	2.1	3.1	5.2	8.8	19.2
NH ₄ 0-0.15 mg/kg	2.0	3.0	3.6	4.1	6.1
NH ₄ 0.15-0.3	1.1	3.0	3.6	4.1	6.1
Ortho P 0-0.15 mg/kg	1	2	6.5	21	29
Ortho P 0.15-0.3	0	0	1.5	4	10
TN 0-0.15 g/100g	0.12	0.14	0.20	0.24	0.30
TN 0.15-0.3	0.06	0.09	0.18	0.21	0.26
C:N 0-0.15	8.6	10.3	11.7	12.5	15.2
C:N 0.15-0.3	6.1	8.9	11.6	12.4	13.7

Objective: Determine if high nutrient loads accumulate close to outlets, possibly contributing to offsite loss.

- Walnut Creek field
- site with least slope
 - transects ~115 m
 - green points sampled
 - orange points wells
 - not near tile or waterway
 - Clarion, Webster, Harps
 - subsurface sand lenses
 - corn - soybean

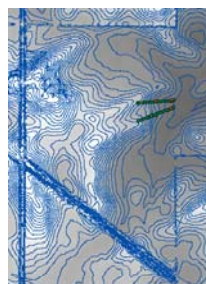


Table 3. Walnut Creek field transect properties: minimum, first quartile, median, third quartile, maximum.

Property	min	25	med	75	max
NO ₃ 0-0.15 mg/kg	5.8	9.5	11.0	16.7	36.7
NO ₃ 0.15-0.3 m	3.1	4.4	6.5	10.1	22.2
NH ₄ 0-0.15 mg/kg	2.7	4.0	5.1	5.5	7.5
NH ₄ 0.15-0.3	1.1	2.0	2.7	3.2	7.5
Ortho P 0-0.15 mg/kg	3	5	10.5	18	33
Ortho P 0.15-0.3	2	2	3	3	12
TN 0-0.15 g/100g	0.12	0.19	0.29	0.34	0.38
TN 0.15-0.3	0.12	0.15	0.18	0.25	0.28
C:N 0-0.15	10.8	11.7	12.1	12.9	13.4
C:N 0.15-0.3	9.2	11.5	12.5	13.5	16.8

Methods

- Three fields, 30 points within 2 transects
- LiDAR 1-m elevation data slope, profile and plan curvatures (for landscape position)
- Sample to ~ 2 m deep
- Three monitoring wells at each site
- Describe soil, texture by feel but sieve sand
- 0-0.15 and 0.15-0.3 m analyzed
 - Nitrate+ ammonium
 - Total carbon and nitrogen
 - Inorganic carbon when needed
 - Olsen extraction for P

Results

Table 4. Soil properties at well sites. SF is South Fork watershed, WC is Walnut Creek watershed, elev. is elevation, dist. is distance.

Site	Elev.	Mollic	Buried dark	Sand depth	Dist. waterway	Dist. tile	Land position
	m	m	m	m	m	m	
SF1 well 1	334.9	0.53	--	0.88-1.04	20	24	BS-FS
SF1 well 2	333.4	0.41	--	--	7	12	BS-FS-d
SF1 well 3	333.0	0.27	--	--	16	20	FS-c
SF2 well 1	348.6	0.67	1.48-1.88	1.65-1.98	52	8	FS
SF2 well 2	348.0	0.96	1.17-1.26	1.26-2.2	16	7	FS-c
SF2 well 3	347.8	0.39	--	--	7	7	FS-d
WC well1	312.8	0.67	--	0.90-1.73	--	83	TS
WC well 2	312.4	0.63	--	0.72-0.90	--	42	TS
WC well 3	312.3	0.82	1.15-1.26	1.26-1.60	--	24	TS

BS is backslope, FS is footslope, TS is toeslope, d id divergent, c is convergent..

Table 5. Nitrate concentrations (mg/kg) in well samples: minimum, first quartile, median, third quartile, maximum.

Site	min	25	med	75	max
SF1 well 1	7.6	12.8	17.2	20.4	24.1
SF1 well 2	10.4	13.8	15.4	16.9	19.2
SF1 well 3	0.7	8.0	10.1	13.4	20.8
SF2 well 1	6.0	12.8	14.4	17.0	30.1
SF2 well 2	15.2	20.9	30.9	43.0	47.3
SF2 well 3	23.1	32.9	40.8	43.6	49.7
WC well1	2.7	10.5	12.6	14.7	23.1
WC well 2	1.0	6.5	11.2	14.2	22.6
WC well 3	0.6	1.8	8.0	12.0	29.6

Summary

- South Fork field 1 uneven manure application (Table 1): nutrient spikes at well 1 (oP 91, NO₃ 129 mg/kg) October 2012
- South Fork field 1: P runoff loss depend on rain timing after application, first none-snow-melt runoff May 2013
- Some well sites: buried sand lenses (Table 4)
- Two wells SF2 field : continual high nitrate in groundwater: lateral addition? (Table 5)
- Only five of the nine wells show seasonal decline in groundwater nitrate concentrations (Table 5) to uphold hypothesis 2.
- Sites with high soil P more related to management than landscape, not support hypothesis 1 for SF1.