

Small Ponds are Water Quality Sentinels in Agricultural Landscapes

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Synthesis

- Man-made ponds have replaced wetlands as a dominant landscape filter
 - Ponds are numerous in the landscape
 - Ponds are heterogeneous and understudied
- Man-made ponds and lakes are tremendous accumulators and transformers of materials
- Planning, construction, and management can maximize material storage and transformation

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Percent wetland loss by state:

Dodds and Whiles 2012



















Zoom in on eastern Oklahoma







But how do all these lakes influence water quality?



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Estimating ecosystem phosphorus storage:

- 1. Direct measurement (mass balance)
- 2. Hydrologic retention models
 - Areal water load
 - Water residence time

Table 3. Six retention models tested here. q_s -Areal water load (m·yr⁻¹), τ -water residence time (yr).

Formula	Reference		
$\overline{R_1 = 10/(10 + q_s)}$	Vollenweider 1975		
$R_2 = 13.2/(13.2 + q_s)$	Dillon and		
	Kirchner 1975		
$R_3 = 16/(16 + q_s)$	Chapra 1975		
$R_4 = 24/(30 + q_s)$	Ostrofsky 1978a		
$R_5 = 0.426 \exp(-0.271 q_s)$	Kirchner and		
$+0.574 \exp(-0.00949q_s)$	Dillon 1975		
$R_6 = 1/(1 + 1/\sqrt{\tau})$	Larsen and		
	Mercier 1976		









Median Lake Size (km2)

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Watershed delineated into 1-5 km2 subbasins (278 total)



142 subbasins

Identified as priority based on high landscape position Curve numbers developed from soil and landuse

West Fork Soils NRCS SSURGO layer http://www.nrcs.usda.gov/wps/portal/nrcs/ detail/soils/survey/?cid=nrcs142p2_053627

West Fork Landuse 2006 NLCD http://www.mrlc.gov/nlcd2006.php **Curve Number**

	HYDROLOGIC SOIL GROUP			
LANDUSE CATEGORY	Α	В	С	D
Developed - Open Spaces	72	82	87	89
Developed - Low Impact	76	85	89	91
Developed - Medium Impact	83	89	92	93
Pasture	68	79	86	89
Deciduous Forest	32	58	72	79





Pond Demonstration Project



WALTON FAMILY FOUNDATION



Discharge above and below proposed pond location



Month

Total phosphorus load during storm event sampling



Continuing work



Pond construction



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Microcystis aeruginosa

- Growth rates decreased by ~40% under most N-deficient condition
- Growth rate predicted microcystin production in N-limited conditions
- Microcystin production was magnified by N-rich conditions







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Acknowledgements:





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