Online Supplementary Material

Title: Sedimentation of prairie wetlands in a changing climate: the relative roles of landscape and precipitation

Submitted to Wetlands

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Supplemental Methods

Data Source Details

National Elevation Data (NED) <http://datagateway.nrcs.usda.gov>, 30-m resolution, 2.44 m overall root mean square error (RMSE) vertical accuracy 1.4 m RMSE local vertical accuracy (Gesch et al. 2002, Gesch 2007).

Land Cover Data for North and South Dakota were classified by the U.S. Fish and Wildlife Service Habitat and Population Evaluation Team (M. Estey, personal communication). Data for Iowa were obtained from the Iowa Department of Natural Resources, and data for Minnesota were classified by EarthSat Corp. <http://www.earthsat.com/> for the U.S. Fish and Wildlife Service.

Computational details for the Revised Universal Soil Loss Equation (RUSLE) and the Unit Stream Power Erosion Deposition model (USPED)

National Elevation Data at a 30-m resolution were used for computation of slope, aspect, flow direction (path of steepest descent), and flow accumulation (upslope contribution), which in turn were used to compute the RUSLE and USPED topographic factors (Fig. 1). For elevation model vintage, models that were produced from 1920–1959 were averaged to 1940; 1960–1979 averaged to 1970, and 1980–1999 averaged to 1990.

Comparison to empirical studies details

Gleason (2001) estimated sedimentation rates of seasonal and semipermanent wetlands across the Prairie Pothole Region (Montana, North Dakota, South Dakota, Minnesota, and Iowa). His sampled wetlands averaged 2.5 (±0.7 SE) ha in 6.1 (±2.1 SE) ha catchments. To compare with his findings, from our sample of 128,000 wetlands, we selected seasonal and semipermanent wetlands ranging in size from 1.6 to 40 ha (mean 1.9 ha) situated in catchments between 31 and 113 ha (mean 7.8 ha) for a total of 1730 cropland (average 67% of catchment area in crops) and 1621 grassland (average 68% grassed area) wetlands.

Preston et al. (2013) measured sedimentation rates of selected seasonal wetlands in cropland and native prairie located in the Missouri Coteau, Montana. Their sampled wetlands averaged 1.3 (± 0.3 SE; range 0.4-3.8) ha in 2.6 (±0.3 SE; range 1.5 – 4.8) ha catchments. For comparison, from our sample of 128,000 wetlands, we selected seasonal wetlands in croplands and grasslands of western North Dakota located in the Missouri Coteau. Our sample of wetlands ranged from 0.5 to 2.5 (mean 0.8) ha in 1.5 - 4.8 (mean 3.2) ha catchments for a total of 354 cropland (average 74% cropped area) and 596 grassland (average 76% grassed area) wetlands (Table 2).

Table S1. Mapping of National Resources Inventory (NRI) Land Use to National Land Cover (NLC) codes and determination of *C*-factor[a]

NRI Land Use		*C*-factor by State				NLC Code	Average *C*-factor	Land Area (%)
Code	Use	Iowa	Minnesota	North Dakota	South Dakota			
Cultivated								
11	Corn	0.2-0.25	0.22-0.36	0.24-0.34	0.18-0.32	82	0.22	60
13	Soybeans	0.2-0.25	0.22-0.38	0.24-0.37	0.18-0.31	82		
21	Sunflower			0.2-0.26	0.14-0.22	82		
111	Wheat		0.14-0.22	0.14-0.32	0.12-0.21	82		
Minimally cultivated								
142	Hay	0.02-0.20	0.02-0.24	0-0.12	0-0.03	81	0.02	20
170	Other/summer fallow			0.22-0.33	0.15-0.22	81		
211	Pasture grass	0-0.01	0-0.02	0-0.03	0-0.01	81		
Non-cultivated								
410	Other farm land/CRP		0-0.03	0-0.03	0.0.01	81		
250	Rangeland/ grassland					71	0.01	20

[a] *C*-factors for major land uses only. Average *C*-factor based on weighted average of land use by acreage in the category. Although grassland had an average *C*-factor of 0, it was assigned a small value (0.01) to distinguish it from non-eroding surfaces that also have a *C*-factor of 0 and to reflect the field evidence of some erosion from grasslands.

Table S2. Predicted loss of palustrine wetland basins by regime by 2100 due to sedimentation. Revised Universal Soil Loss Equation (RUSLE) models without a sediment delivery ratio was applied to subecoregions of the U.S. Prairie Pothole Region using nine averaged scenario-model combinations of projected climate change models.

		Temporary		Seasonal		Semipermanent		All Palustrine Wetlands	
Subecoregion	Method	Total Wetlands	Wetlands Filled (%)	Total Wetlands	Wetlands Filled (%)	Total Wetlands	Wetlands Filled (%)	Total Wetlands	Wetlands Filled (%)
Drift Prairie, ND	RUSLE	166,302	71,905 (43)	250,962	108,726 (43)	42,581	15,603 (37)	459,845	196,233 (43)
Drift Prairie, MN	RUSLE	44,934	23,796 (53)	104,209	63,172 (61)	38,357	20,471 (53)	187,500	107,440 (57)
Drift Prairie, IA	RUSLE	8,656	5,586 (65)	10,191	7,802 (77)	2,991	2,028 (68)	21,838	15,415 (70)
Drift Prairie, SD	RUSLE	145,660	57,017 (39)	94,286	32,588 (35)	23,688	8,130 (34)	263,634	97,735 (37)
Prairie Coteau	RUSLE	42,589	21,496 (51)	57,900	25,249 (44)	30,720	10,396 (34)	131,209	57,141 (44)
Missouri Coteau Slope	RUSLE	6,013	2,621 (44)	5,910	2,529 (43)	2,054	1,039 (51)	13,977	6,189 (45)
Missouri Coteau	RUSLE	138,743	56,137 (41)	285,325	107,513 (38)	66,146	21,686 (33)	490,214	185,335 (38)
All subecoregions	RUSLE	552,897	238,557 (44)	808,783	347,578 (43)	206,537	79,352 (39)	1,568,217	665,488 (43)

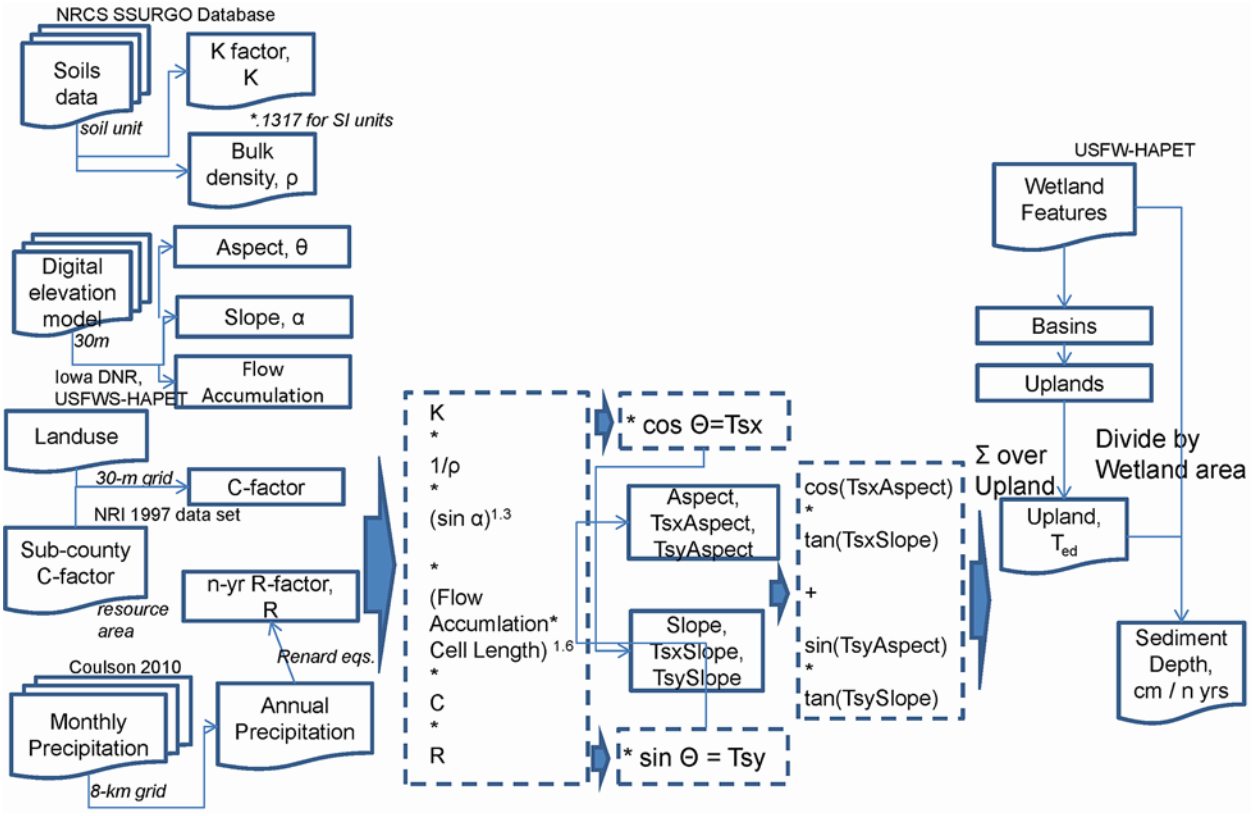

Fig. S1 Data processing flow for the Unit Stream Power Erosion Deposition model (USPED) adapted from Mitasova et al. (2003)

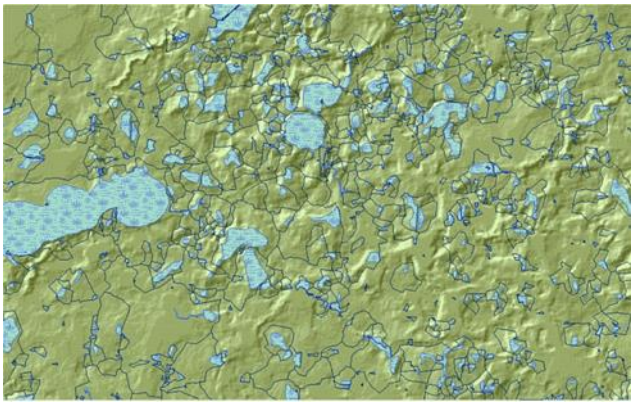

Fig. S2 Catchment delineation based on National Wetlands Inventory (NWI) wetland basins and the ArcGIS watershed tool