Iowa Nutrient Research Center
Final Report

Project Title **Water Quality Evaluation of Prairie Strips across Iowa**

Project Investigator: Matt Helmers

Objectives: The greatly disproportionate benefits from incorporation of minimal acreage of tallgrass prairie vegetation into row-cropped agriculture has propelled the STRIPs team to develop the long-term goals of 1) implementing prairie strips on farmers' fields throughout Iowa and 2) evaluating the impacts of these systems over watersheds and landscapes. The overall objective of this prospectus was to evaluate and compare water quality benefits from sites with newly installed variable width prairie strips to those with no prairie strips and existing CRP CP-15 contour strips. The questions this project examined include:

- What are the effects of variable width prairie strips when compared to similar fields without contour strips?
- Are there differences in water quality benefits of CRP contour strips and variable width contour prairie strips relative to erosion and sediment, nitrogen, and phosphorus export?
- Are there modifications to the CRP contour strip practice that would make the practice more beneficial for reducing erosion and sediment, nitrogen, and phosphorus leaving fields?

Project Description: The STRIPS project (Science based Trials of Rowcrops Integrated with Prairie Strips) conducted at Neal Smith National Wildlife Refuge (NWR) near Prairie City, Iowa (http://prairiestrips.org) has documented water quality benefits as well as increased biodiversity across several taxa, achieved by integrating tallgrass prairie vegetation (prairie strips) into row-cropped watersheds. The experimental watersheds at Neal Smith NWR incorporating as little as 10% field acreage in prairie strips within no-till corn/soybean row crops reduced losses of sediment by 95%, nitrogen in runoff by 84%, phosphorus in runoff by 89%, and water runoff by 60% compared to watersheds without prairie strips (Helmers et al. 2012, Zhou et al. 2014). Field-level financial analysis suggests prairie strips provide these benefits in a cost-effective manner at an annual cost of $24-35 per treated acre (Tyndall et al. 2013). These studies have been conducted on small watersheds and as a result there is a need to evaluate the water quality benefits when implemented on a full-farm-field-scale. In the past 24 months, prairie strips have been installed on over 25 sites in Iowa (Figure 1). Some of these sites allow for detailed surface runoff water quality and quantity evaluation using a paired approach in which catchments with prairie strips are compared to catchments without prairie strips. The ISU team received funding from IDALS, USDA-FSA, USDA-NIFA, and the Iowa State University

College of Agriculture and Life Sciences to establish monitoring infrastructure at six of these prairie strips sites. The six sites with monitoring infrastructure are the paired comparison sites shown in Figure 1 and an example configuration of the prairie strips and location of the monitoring infrastructure are shown in Figure 2. With funding from the Iowa Nutrient Research Center, we partnered with the Iowa Soybean Association to monitor the site at Whiterock Conservancy. In addition, we have been and will be partnering with the Dickinson County Soil and Water Conservation District and the Iowa Lakeside Lab for monitoring another of these sites. However, to further the evaluation of the prairie strips conservation practice there is a need for additional water quality monitoring across a broader range of sites.

While buffer strip technology and use is well established throughout the Midwest, the prairie strips as designed and implemented for this project are unique in that the design specifically incorporates a variable width design. Baker et al. (2006) noted that ratio of contributing area to buffer area is a more critical design factor than filter strip width. This concept has been incorporated into indices for targeting placement of filter strips (Dosskey et al. 2011). This type of filter strip design would allow for greater filter strip area where there is greater surface flow. Conservation systems designed with consideration of the contributing area would be considered variable width buffers. In this project we would specifically evaluate prairie strips that have been designed using this variable width approach. This approach is also consistent with the design of the prairie strips at the NWR site. As part of this process we assess how a variable width approach may differ from a traditional uniform width approach relative to area of the prairie strip intercepting surface flow. This allows assessment of how the new design differs from current practice such that current practice standards for a CRP CP-15 could be modified accordingly to maximize the benefits.

Method/Approach: We evaluated the water quality benefits of prairie strips on six paired sites in Iowa (Figure 1). As part of this proposed project, through monitoring the six paired (field/watershed treatments with and without prairie strips) study sites, we assessed the effects of prairie strips on surface water quality. Paired watersheds at each site were chosen so that each treatment has similar slope, area, and soil properties (Table 1). For each watershed, a distinct surface flow outlet point was identified and an H-Flume was installed to monitor volume and quality of surface runoff. Each of these locations has been instrumented with an automated water sampler (Teledyne ISCO 6712) for obtaining flow measurements and collecting flow-proportional water samples. To quantify the impacts of prairie strips on nutrient and sediment export, water samples were (or will be) analyzed for nitrate, total nitrogen, ortho-phosphorus, total phosphorus and total suspended solids. The water sample concentration data was used with the flow data to calculate the export (i.e., load) of nutrients and sediment from watersheds with and without prairie strips. The flow data was also used to evaluate hydrologic impacts of the prairie strips. This methodology for monitoring has been used previously by Helmers et al. (2012) and Zhou et al. (2014). Samples were collected from all surface runoff events during the non-frozen period of each year.

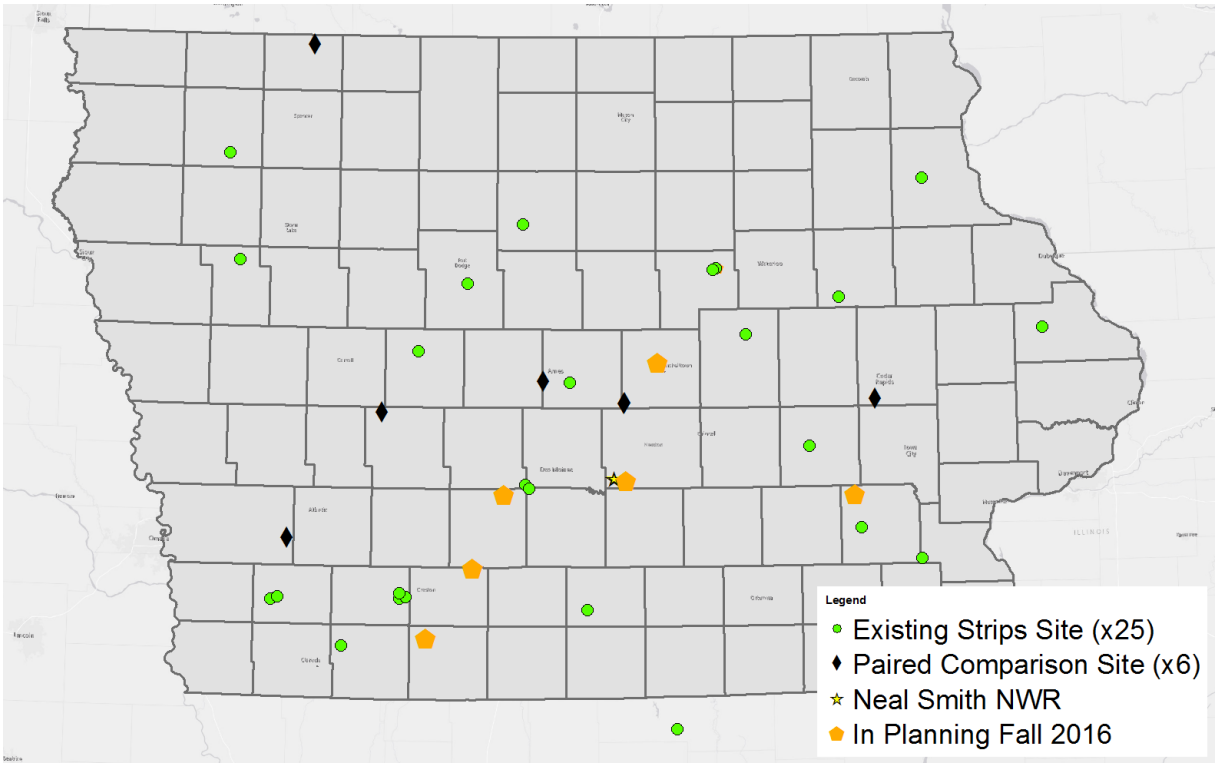

Figure 1. Prairie strips sites across Iowa.

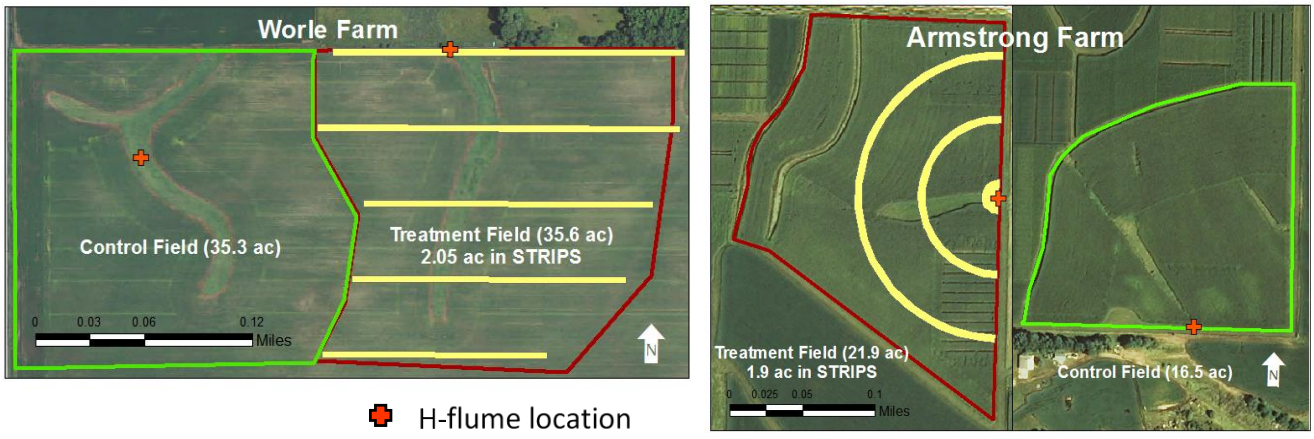

Figure 2. Edge-of-field monitoring configuration at two of the six sites

Preliminary Project Findings:

Our experimental sites, both in 2016 and 2017, experienced somewhat rare conditions in terms of a relatively few number of significant surface runoff-producing rain events. More runoff events occurred in 2018 and 2019, enabling us to collect a greater amount of surface runoff flow data as well as more samples for nutrient analyses. Graphs of rainfall and runoff (Figure 3),

nitrate (Figure 4), orthophosphate (Figure 5), and total suspended solids (Figure 6) represent a quick reference for comparing monitored site information from years 2016 to 2019. End of year totals for rain and runoff (Tables 2-5) and nutrient exports (Tables 6-9) are listed for these four years as well. We are continuing with the analyses of total nitrogen and total phosphorus. Our Marshalltown treatment site was the only site with CRP CP-15 contour strips. Unfortunately, the Marshalltown sites did not experience very many runoff sampling events. Therefore, meaningful comparison of the differences between the effects of variable width contour buffer strips and CRP CP-15 contour strips cannot be made.

Prairie strips seem to have reduced runoff volume (Tables 2-5), with the main exception being the McNay site. The field where prairie strips are located at McNay is noticeably wetter than the field without prairie strips due to side-slope seeps. We suspect the wet conditions reduce infiltration and therefore contribute to the higher amount of runoff in the treatment field compared to the control field. In addition, we noticed that in 2017, runoff in the control field was being diverted past the monitoring equipment by a significant “lip” on the edge of the grassed waterway. A small berm was constructed into the cropped area before the 2018 monitoring season to remedy this, however a small percentage of runoff continued to miss being measured. Furthermore, in 2019, runoff began to carve a new route around the control drainage’s grassed waterway and bypass the flume once again. A plan is made for the farm manager to perform a major overhaul on the grassed waterway in 2020 to address this issue.

Nutrient and sediment loss summaries (Tables 6-9) show variable results between the treatment and control fields. These will require further and deeper investigation to better understand, and will most likely require analysis on a single runoff event scale, not the entire monitoring season. Differences in measured benefits of prairie strips compared to the results at the NWR are likely due to other conservation practices (i.e., grassed waterways) already implemented in the fields.

As part of this project we were able to add additional monitoring sites beyond the original plan of three paired sites due to leveraging of funding from USDA-National Institute for Food and Agriculture, ISU College of Agriculture and Life Sciences and the USDA-Farm Service Agency to complete the monitoring at these sites. We also partnered with Dickinson County Soil and Water Conservation District and Lakeside Laboratory for monitoring at the Spirit Lake site. In addition, we partnered with the Iowa Soybean Association for monitoring at Whiterock with funding support from the USDA-Farm Service Agency. In addition to assessing surface water runoff and runoff water quality at these sites, with funding from the McKnight Foundation and USDA-AFRI we have been able to begin assessing the impacts of the prairie strips on sediment deposition; soil quality through measurements of particulate organic matter carbon and nitrogen, water stable aggregates, and soil bulk density; and shallow groundwater nitrate concentrations.

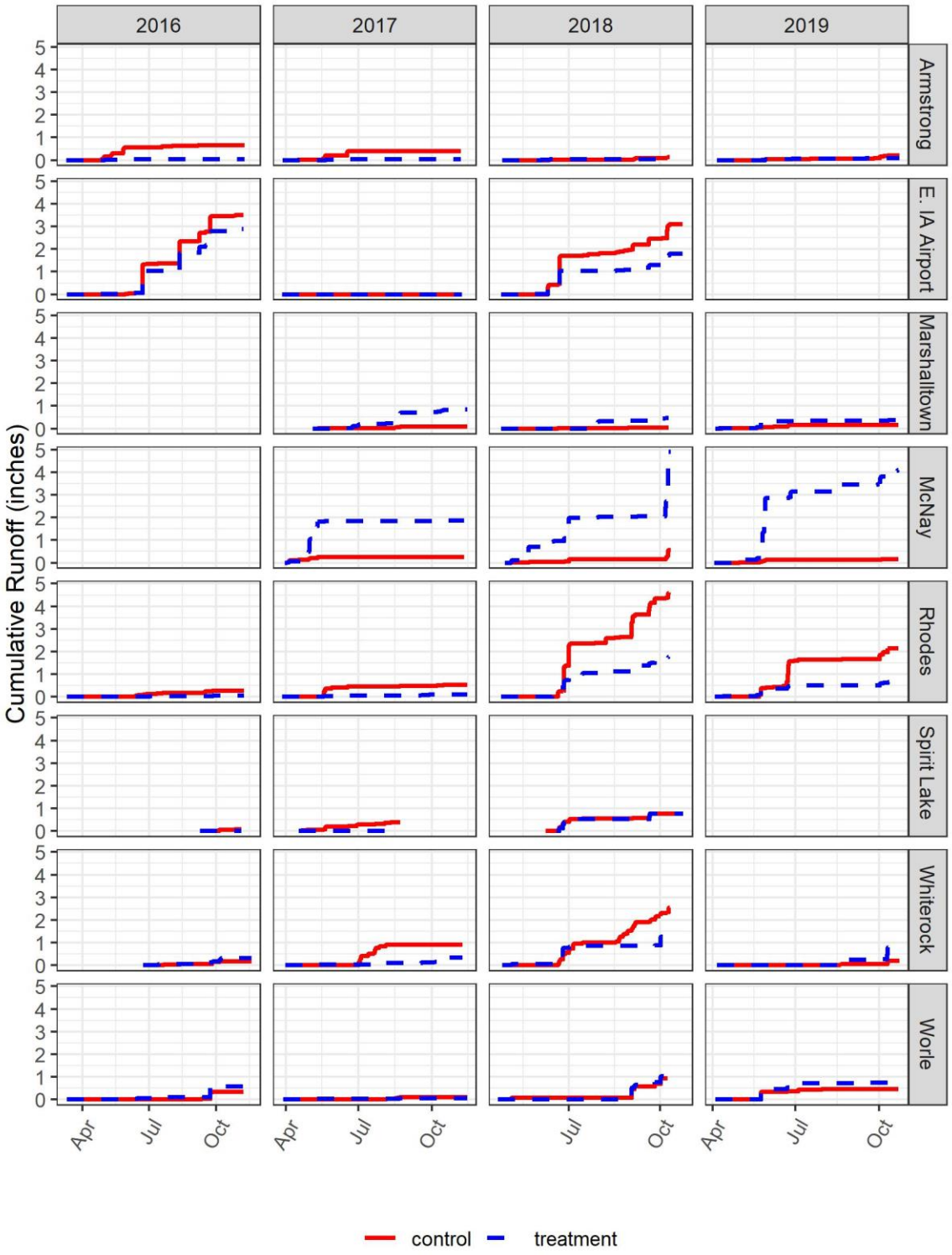

Figure 3: Rain and surface runoff summaries in inches from 2016-2019. Fields without prairie strips are the “control”, while fields with prairie strips are the “treatment”. There was a greater number of runoff events in 2018 and 2019 than the previous two years.

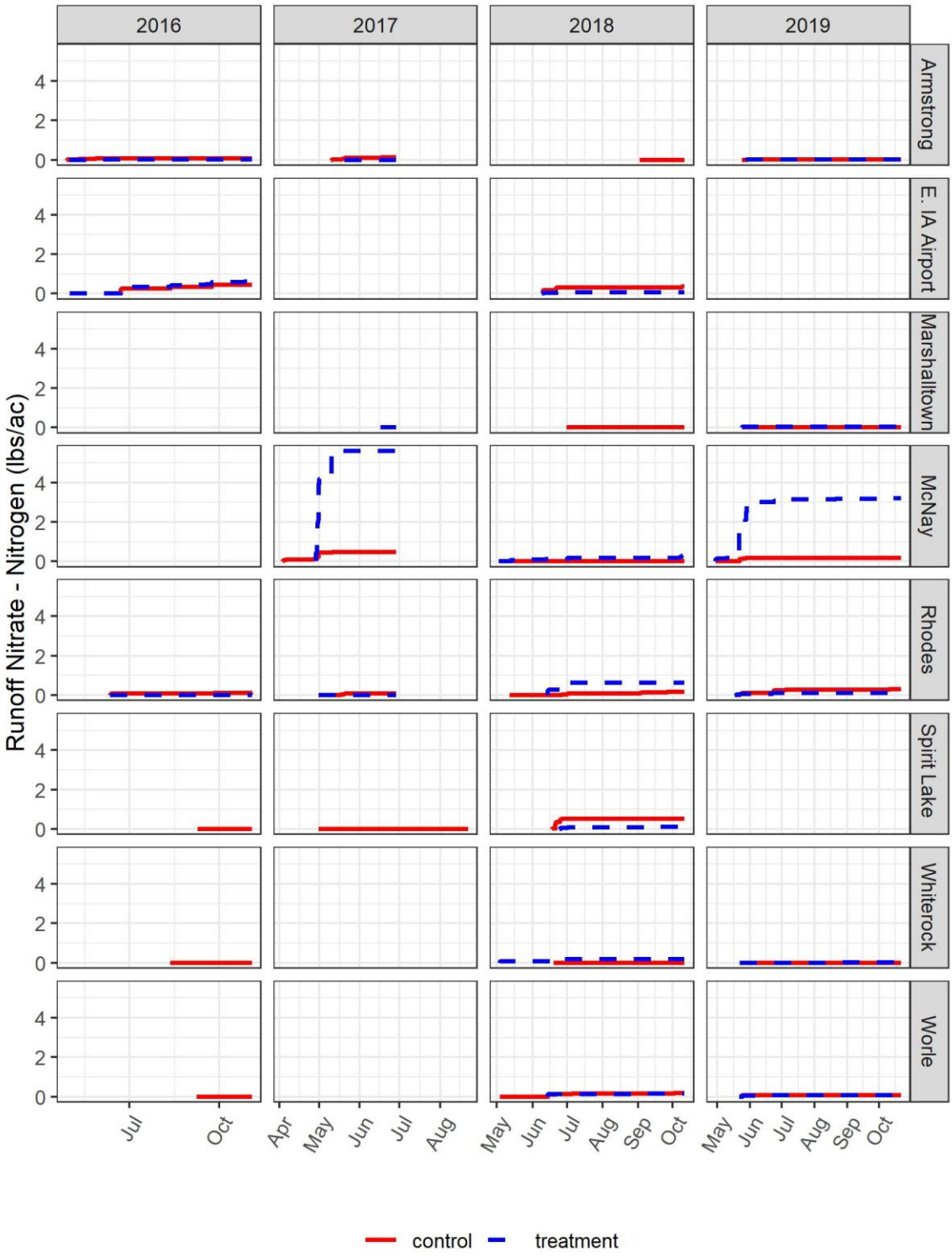

Figure 4: Nitrate export estimates via surface runoff in pounds per acre. Fields without prairie strips are the “control”, while fields with prairie strips are the “treatment”. Between-treatment results vary among sites.

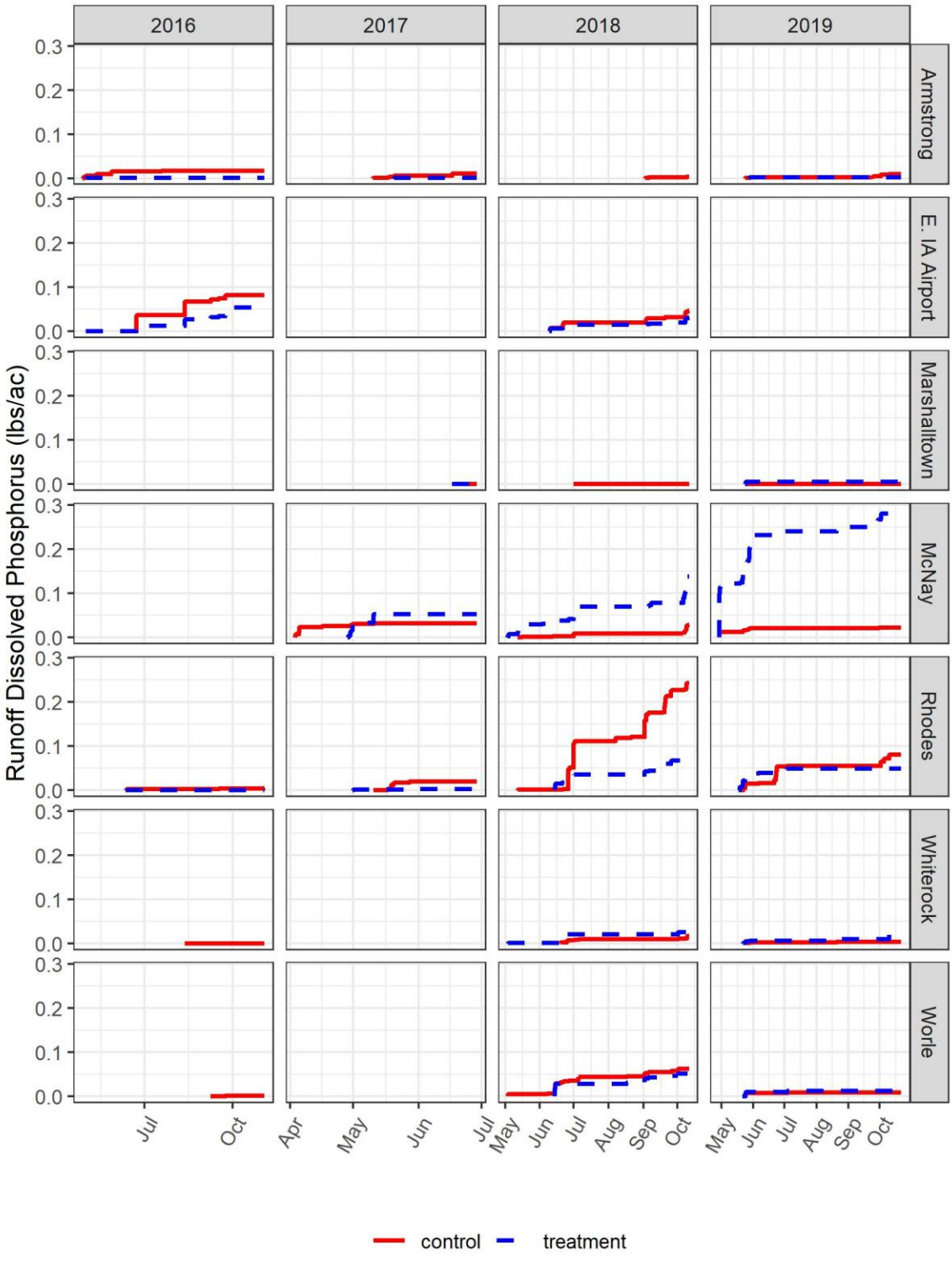

Figure 5: Orthophosphate export estimates via surface runoff in pounds per acre. Fields without prairie strips are the “control”, while fields with prairie strips are the “treatment”. Between-treatment results vary among sites.

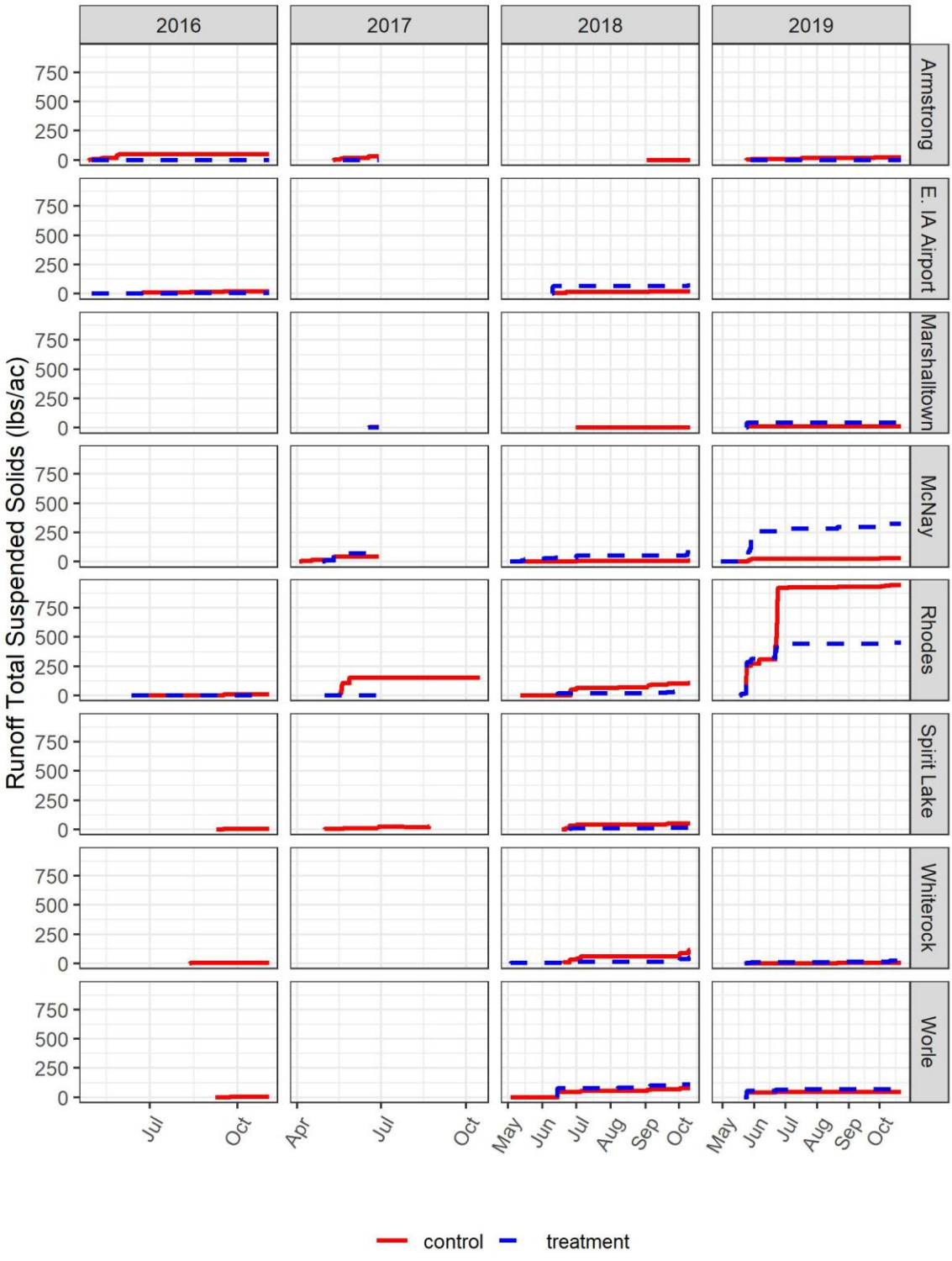

Figure 6: Total suspended solids export estimates via surface runoff in pounds per acre. Fields without prairie strips are the “control”, while fields with prairie strips are the “treatment”. Between-treatment results vary among sites.

Table 1. Size and slope of monitoring areas.

Site	Area (acres)	Slope (%)
Armstrong CTL	16.5	6.5
Armstrong TRT	17.8	6.6
EIA CTL	11.2	5.1
EIA TRT	23.3	4.9
McNay CTL	24.1	2.9
McNay TRT	6.1	4.4
Rhodes CTL	6.75	4.7
Rhodes TRT	8.27	4.6
Spirit Lake CTL	21.8	4.8
Spirit Lake TRT	33.7	4.3
Whiterock CTL	13.9	8.5
Whiterock TRT	11.1	10.2
Worle CTL	13.43	3.3
Worle TRT	14.09	3.9

Table 2: 2016 Rain and surface runoff end-of-year totals for each monitored site. Fields without prairie strips are the “Control”, while fields with prairie strips are the “Treatment”.

2016		Runoff (in.)	
Site	**Rain (in.)**	**Control**	**Treatment**
Armstrong	27.44	0.65	0.03
E. IA Airport	31.54	3.49	2.88
Rhodes	17.95	0.19	0.05
Spirit Lake	3.98	0.07	0.00
Whiterock	15.04	0.17	0.31
Worle	24.49	0.33	0.57

Table 3: 2017 Rain and surface runoff end-of-year totals for each monitored site. Fields without prairie strips are the “Control”, while fields with prairie strips are the “Treatment”. Treatment fields tend to have less runoff than the Control fields with the exception of McNay, which has side-slope seeps in the Treatment field and had issues with runoff being diverted around the monitoring equipment.

2017		Runoff (in.)	
Site	**Rain (in.)**	**Control**	**Treatment**
Armstrong	24.41	0.39	0.04
E. IA Airport	11.14	0.00	0.00
Marshalltown	17.80	0.09	0.84
McNay	13.31	0.26	1.87
Rhodes	19.13	0.54	0.10
Spirit Lake	7.83	0.38	0.00
Whiterock	19.49	0.90	0.33
Worle	15.28	0.10	0.05

Table 4: 2018 Rain and surface runoff end-of-year totals for each monitored site. Fields without prairie strips are the “Control”, while fields with prairie strips are the “Treatment”. Treatment fields tend to have less runoff than the Control fields with the exception of McNay, which has side-slope seeps in the Treatment field and had issues with runoff being diverted around the monitoring equipment.

2018		Runoff (in.)	
Site	**Rain (in.)**	**Control**	**Treatment**
Armstrong	26.50	0.14	0.05
E. IA Airport	31.26	3.10	1.79
Marshalltown	14.21	0.04	0.46
McNay	16.89	0.56	4.87
Rhodes	31.54	4.60	1.76
Spirit Lake	11.85	0.58	0.55
Whiterock	23.86	2.54	1.62
Worle	28.58	3.41	2.49

Table 5: 2019 Rain and surface runoff end-of-year totals for each monitored site. Fields without prairie strips are the “Control”, while fields with prairie strips are the “Treatment”. Treatment fields tend to have less runoff than the Control fields with the exception of McNay, which has side-slope seeps in the Treatment field and had issues with runoff being diverted around the monitoring equipment.

2019		Runoff (in.)	
Site	**Rain (in.)**	**Control**	**Treatment**
Armstrong	28.82	0.20	0.09
Marshalltown	22.38	0.15	0.41
McNay	22.01	0.14	4.08
Rhodes	22.48	2.15	0.65
Whiterock	23.66	0.20	0.80
Worle	25.16	0.46	0.75

Table 6: 2016 Nutrient loss end-of-year totals for each monitored site. Fields without prairie strips are the “Control”, while fields with prairie strips are the “Treatment”.

2016	**Nitrate (lbs/ac)**		**Orthophosphate (lbs/ac)**		**Total Suspended Solids (lbs/ac)**	
Site	**Control**	**Treatment**	**Control**	**Treatment**	**Control**	**Treatment**
Armstrong	0.07	0.00	0.02	0.00	48.02	0.17
E. IA Airport	0.45	0.65	0.08	0.05	20.40	7.01
Rhodes	0.11	0.00	0.00	0.00	2.01	0.18
Spirit Lake	0.00	NA	NA	NA	6.49	NA
Whiterock	0.00	NA	0.00	NA	3.14	NA
Worle	0.00	NA	0.00	NA	3.40	NA

Table 7: 2017 Nutrient loss end-of-year totals for each monitored site. Fields without prairie strips are the “Control”, while fields with prairie strips are the “Treatment”. Due to no significant runoff events at E. IA Airport, there were no runoff samples collected, and therefore no data for nutrient export estimates.

2017	Nitrate (lbs/ac)		Orthophosphate (lbs/ac)		Total Suspended Solids (lbs/ac)	
Site	**Control**	**Treatment**	**Control**	**Treatment**	**Control**	**Treatment**
Armstrong	0.12	0.00	0.01	0.00	30.69	0.16
Marshalltown	0.00	0.00	0.00	0.00	4.59	0.41
McNay	0.48	5.60	0.03	0.05	41.74	69.96
Rhodes	0.08	0.01	0.02	0.00	150.98	2.44
Spirit Lake	0.01	NA	NA	NA	19.00	NA

Table 8: 2018 Nutrient loss end-of-year totals for each monitored site. Fields without prairie strips are the “Control”, while fields with prairie strips are the “Treatment”. There are inconsistent results based on the entire season’s totals. Further investigation is needed at the single runoff event scale.

2018	Nitrate (lbs/ac)		Orthophosphate (lbs/ac)		Total Suspended Solids (lbs/ac)	
Site	**Control**	**Treatment**	**Control**	**Treatment**	**Control**	**Treatment**
Armstrong	0.00	NA	0.00	NA	0.43	NA
E. IA Airport	0.36	0.06	0.05	0.03	22.77	69.47
Marshalltown	0.00	NA	0.00	NA	0.06	NA
McNay	0.02	0.26	0.03	0.13	8.99	107.81
Rhodes	0.17	0.64	0.24	0.07	106.95	33.88
Spirit Lake	0.52	0.08	NA	NA	42.54	9.80
Whiterock	0.00	0.19	0.02	0.03	113.54	48.04
Worle	0.17	0.16	0.06	0.05	74.70	110.40

Table 9: 2019 Nutrient loss end-of-year totals for each monitored site. Fields without prairie strips are the “Control”, while fields with prairie strips are the “Treatment”. There are inconsistent results based on the entire season’s totals. Further investigation is needed at the single runoff event scale.

2019	Nitrate (lbs/ac)		Orthophosphate (lbs/ac)		Total Suspended Solids (lbs/ac)	
Site	**Control**	**Treatment**	**Control**	**Treatment**	**Control**	**Treatment**
Armstrong	0.01	0.01	0.01	0.00	22.26	0.39
Marshalltown	0.00	0.04	0.00	0.01	11.32	42.51
McNay	0.17	3.20	0.02	0.29	26.67	321.77
Rhodes	0.30	0.11	0.08	0.05	945.30	452.29
Whiterock	0.00	0.02	0.00	0.02	3.97	23.00
Worle	0.06	0.08	0.01	0.01	43.33	70.06

Outreach Activities

Presenters	Meeting Name	Meeting Location	Month	Day	Year
Schulte Moore, L. and R. Benedict	Iowa Prairie Conference	Council Bluffs, IA	07	14	2017
Heaton, E., L.A., Schulte MooreMoore, I. Gronstal Anderson, T. Richards, and D. Muth	USDA	Washington, DC	07	14	2017
Schulte Moore, L	Saving Our Iowa Legacy (SOIL) Conference at Drake University	Des Moines, IA	07	27	2017
Kordbacheh, F	Ecological Society of American Annual Meeting	Portland, OR	08	08	2017
Schulte Moore, L	Department of Biology seminar	Duluth, MN	09	08	2017
O'Neal, M. and L.A., Schulte MooreMoore	Department of Entomology seminar	Ames, IA	09	25	2017
Dale, J., M. Stephenson, C. Labuzzetta, L.A., Schulte MooreMoore, B. Klaver, A. Janke	Annual Conference of The Wildlife Society	Alberquerque, NM	09	26	2017
Schulte Moore, L	USDA National Institute for Food and Agriculture Project Directors' Meeting	Tampa, FL	10	10	2017
Schulte Moore, L	School of the Environment seminar	Ste-Anne de Bellevue, Quebec	10	19	2017
Schulte Moore, L	Master Conservationist program (Video Presentation)	Online	10	20	2017
Youngquist, T	Ingleside Society meeting	Sac Co, IA	11	01	2017
Liebman, M	American Society of Agronomy–Soil Science Society of America, education webinar for Cultivating Sustainability: A Training Curriculum for Agronomy	Madison, WI	11	08	2017
Youngquist, T	Galena Art Center	Galena, IL	11	15	2017
Youngquist, T	Integrated Crop Management Conference	Ames, IA	11	30	2017
Youngquist, T	Integrated Crop Management Conference	Ames, IA	11	30	2017
Youngquist, T	What are prairie strips and how do they work? Friendship Force International Meeting	Ames, IA	08	20	2018
Schulte Moore, L	My Career as an Environmental Scientist. One Earth Lab (ENSP 036) Drake University	Des Moines, IA	08	28	2018
Youngquist, T	Soil movement as measured with mesh pads in fields with prairie strips. Leopold Center Re-imagined event, ReACT Gallery, Christian Peterson Art Museum, Iowa State Univeristy	Ames, IA	08	28	2018
Schulte Moore, L. and STRIPS team	STRIPS research updates. Iowa State University Field Extension and Education Laboratory for the ISU Extension Crops Team	Boone, IA	09	18	2018

Youngquist, T.	Improving water quality with prairie strips - Watershed Academy ISU Armstrong Farm	Lewis, IA	09	16	2018
Helmers, M.	Water quality evaluation of prairie strips in Iowa - State Soil Conservation Committee meeting	Des Moines, IA	11	01	2018
Schulte Moore, L.	Reconnecting with Iowa's native prairie - Lisle Corporation for Leadership Iowa	Clarinda, IA	11	02	2018
Schulte Moore, L. and STRIPS team	Prairie strips as an innovative agroecosystem practice to enhance ecosystem services from farmers' fields - American Society of Agronomy and Crop-Science Society of America annual meeting	Baltimore, MD	11	07	2018
Schulte Moore L. and STRIPS team	Science-based Trails of Rowcrops Integrated with Prairie Strips (STRIPS) for the Environmental Defense Fund	Ames, IA	11	27	2018
Helmers, M.	What is the payoff on water quality goals? - Wisconsin Discovery Farms Annual Conference	Wisconsin Dells, WI	12	12	2018
Schulte Moore, L. and STRIPS team	Prairie strips as an innovative agroecosystem practice to enhance ecosystem services from farmers' fields - USDA NIFA	Washington, DC	12	06	2018
Schulte Moore, L. and STRIPS team	Prairie strips as an innovative agroecosystem practice to enhance ecosystem services from farmers' fields - Wright County Extension Office	Clarion, IA	12	11	2018
Youngquist, T. and Seth Watkins	Installing and maintaining prairie strips practical farmers of Iowa webinar	Ames, IA	01	08	2019
Tyndall, J	Prairie STRIPS: An elegant Best Management Practice for complex environmental challenges: Greater Des Moines Botanical Garden “Learn on Saturdays” Lecture series	Des Moines, IA	01	26	2019
de Kok-Mercado, O.	Young Natural Resource Professionals Discussing Careers in Iowa, Iowa Prairie Network Seminar	Ames, IA	01	26	2019
Schulte Moore, L.A.	Practical Farmers of Iowa Conference - Leaving the Land Better: Measuring Your Impact.	Ames, IA	01	19	2019
McQuown, M	Practical Farmers of Iowa Conference	Ames, IA	01	19	2019
Stephenson, M.	Midwest Fish and Wildlife Conference - Reptile and Small Mammal Occupancy in Prairie Strips Integrated in an Agricultural Landscape	Cleveland, Ohio	01	29	2019
de Kok-Mercado, O. M. Stephenson, A. Kittle, T. Smith, R. Stout. J. Kramer	Iowa Water Conference - On-farm experiences with prairie and crops: Farmers talk about Prairie Strips Program and Prairie on Farms	Ames, IA	03	12	2019

Arbuckle, J.	Iowa Water Conference -Social science research on conservation practice adoption	Ames, IA	03	12	2019
Morris, C.	Iowa Water Conference - Do conservation plans make a difference in conservation adoption?	Ames, IA	03	12	2019
Arbuckle, J.	Iowa Water Conference - Social values and rented agricultural land: Are landlords from Mars and tenants from Venus?	Ames, IA	03	12	2019
Janke, A.	Iowa Water Conference - Back to by-products: promises and opportunities for layering benefits of water-resource conservation to restore wildlife in rural Iowa	Ames, IA	03	13	2019
O'Neal, M., Giese, J.	Iowa Water Conference - Birds, pollinators, and other wildlife: new findings from prairie strips biodiversity research	Ames, IA	03	13	2019
Helmers, M.	Iowa Water Conference - Integrating prairie strips with other BMPs for greater impact on water quality	Ames, IA	03	13	2019
Liebman, M., Youngquist, T.	Iowa Water Conference - Prairie strips establishment and the crucial first three years	Ames, IA	03	13	2019
Ficenec, C.	Partnership for Ag Resource Management - Sand County Foundation - The Pillars of Great Pollinator Habitat Design and Management	Webinar	03	14	2019
Stephenson, M.	Fragments of a once great plains or islands in a sea? NREM Ignite Talk	Ames, IA	03	08	2019
Stephenson, M.	Are prairie strips suitable wildlife habitat? Fisheries and Wildlife Biology Club. Iowa State University	Ames, IA	03	28	2019
de Kok-Mercado, O.	Prairie Strips - what are they and how do they work? Scott County Watershed forum	Davenport, IA	04	16	2019
O'Neal, M., J., Meissen, L., Jackson, D., Sloan, D., Wolfe	Overcoming Barriers to Ecological Restoration on Farms for Soil, Water, and Wildlife in the Upper Midwest: 11th Society for Ecological Restoration MIDWEST-GREAT LAKES CHAPTER MEETING	Pella, IA	04	12	2019
Youngquist, T.	Leopold and Agriculture – “What are Prairie Strips and How do they Work?”	Burlington, IA	04	16	2019
Youngquist, T.	World Food Prize – Worle Farm Tour	Ames, IA	04	29	2019
Youngquist, T.	Music and Monarchs	Elkader, IA	05	11	2019
Youngquist, T.	Wartburg University Student Tour – Neal Smith NWR	Prairie City, IA	05	14	2019
de Kok-Mercado, O.	Furman University Student Tour - Neal Smith NWR	Prairie City, IA	05	23	2019
de Kok-Mercado, O. A. Kittle, L. Jackson, J. Miessen	Tour of Prairie Strips at Roadman Farm with USDA-NRCS National Biologist, Danielle Flynn	Cedar Falls,	06	06	2019

de Kok-Mercado, O.	10 years of prairie strips research, 2018 farm bill, and potential markets (EPA, tribal leaders, DNR) - Neal Smith NWR	Prairie City, IA	06	11	2019
English, L.	North American Prairie Conference	Houston, TX	06	03	2019
Youngquist, T.	CCA Training - "Spreading Prairie Strips to Iowa Farms for increased soil retention, water filtration, and wildlife"	Crawfordsville, IA	06	20	2019
Youngquist, T.	SERF Field Day - "What are Prairie Strips and How Do They Work?"	Crawfordsville, IA	06	20	2019
Youngquist, T.	Land Institute - Ecospheric Iowa Workshop, Conrad Environmental Research Center	Grinnell, IA	06	22	2019
Youngquist, T. M., Stephenson	Badger Creek Watershed - Prairie Strips Field Day	Winterset, IA	06	21	2019
Giese, J.	NREM Ignite Talk - "Habitat Use and Winter Movements of Ring-necked Pheasants at STRIPS Farms in Central Iowa"	Ames, IA	03	08	2019
Giese, J.	American Ornithological Society - "Estimating the Effect of Prairie Strips on Grassland Birds"	Anchorage, AK	06	26	2019
Giese, J.	American Ornithological Society - "Prairie Strips for Birds: Increasing Biodiversity Alongside Agriculture"	Tuscon, AZ	04	13	2018
Giese, J.	Loess Hills Audubon Society - "Prairie Strips for Birds: Increasing Biodiversity Alongside Agriculture:	Sioux City, IA	11	01	2018
Giese, J.	Iowa Cooperative Fish and Wildlife Research Unit Coordinating Meeting - "Avian Response to Establishment of Prairie Strips"	Ames, IA	06	18	2019
Davenport, D.	Praire Strips Adair County Soil and Water Conservation District	Greenfield, IA	04	11	2019
Davenport, D.	Praire Strips Clarke County Soil and Water Conservation District	Osceola, IA	04	10	2019
Davenport, D.	Praire Strips Decatur County Soil and Water Conservation District	Leon, IA	04	11	2019
Davenport, D.	Praire Strips Jasper County Soil and Water Conservation District	Newton, IA	06	11	2019
Davenport, D.	Praire Strips Madison County Soil and Water Conservation District	Winterset, IA	05	15	2019
Davenport, D.	Praire Strips Mills County Soil and Water Conservation District	Malvern, IA	05	15	2019
Davenport, D.	Praire Strips Montgomery County Soil and Water Conservation District	Red Oak, IA	05	09	2019
Davenport, D.	Praire Strips Page County Soil and Water Conservation District	Clarinda, IA	05	16	2019

Davenport, D.	Praire Strips Union County Soil and Water Conservation District	Creston, IA	03	20	2019
Davenport, D.	Praire Strips Wayne County Soil and Water Conservation District	Corydon, IA	04	09	2019
Youngquist, T.	PFI Field Day - Farmland Owner Legacy Award + On-farm Conservation Event	Slater, IA	07	10	2019
Youngquist, T.	AGRON 594 course Crop and Soil Ecology Tour	Ames, IA	07	17	2019
Schulte Moore, L.A.	Prairie strips and other edge-of-field conservation practices: Iowa Chapter of The Nature Conservancy series Conversations on Conservation, Des Moines Botanical Garden	Des Moines, IA	05	15	2019
Heaton, E, and L.A., Schulte Moore	Strategically integrating perennials to grow the sustainable Midwestern bioeconomy: Midwestern Low Carbon Fuel Standard meeting hosted by the Great Plains Institute and University of Minnesota, St. Paul	St. Paul, MN	05	29	2019
Giese, J.C., L.A. Schulte, and R.W. Klaver	Avian response to establishment of prairie strips: Iowa Cooperative Fish and Wildlife Research Unit Annual Board Meeting, Iowa State University	Ames, IA	06	18	2019
O'Neal, M., R., Cass. M., Hall. G., Guthrie	North Central IPM Center IPM4Bees Midwest Working group (8 states represented)	Ames, IA	07	26	2019

Cited Literature:

Baker, J.L., M.J. Helmers, and J.M. Laflen. 2006. Water management practices: rain-fed cropland. Chapter 2 *in* Evaluating the Environmental Benefits of Agricultural Conservation Practices—the Status of our Knowledge. Soil and Water Conservation Society, Ankeny, IA.

Dosskey, M.G., Z. Qiu, M.J. Helmers, and D.E. Eisenhauer. 2011. Improved indexes for targeting placement of buffers of Hortonian runoff. Journal of Soil and Water Conservation 66:362-372.

Helmers, M.J., X. Zhou, H. Asbjornsen, R. Kolka, M.D. Tomer, and R. Cruse. 2012. Sediment removal by perennial filter strips in row-cropped ephemeral watersheds. Journal of Environmental Quality 41(5): 1531-1539.

Tyndall, J., L.A. Schulte, M. Liebman, and M. Helmers. 2013. Field-level financial assessment of contour prairie strips for enhancement of environmental quality. Environmental Management 52:736-747.

Zhou, X., M.J. Helmers, H. Asbjornsen, R. Kolka, M. Tomer, and R. Cruse. 2014. Nutrient removal by prairie filter strips in agricultural landscape. Journal of Soil and Water Conservation 69(1): 54-64