

CONSERVATION INNOVATION GRANTS

Final Progress Report

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| Grantee Name: Kosciusko County Soil & Water Conservation District | |
| Project Title: Cover Crops: Planting the Way to Nitrogen management at the Watershed Scale in a Combined conservation Approach | |
| Agreement Number: 68-3A75-12-217 | |
| Project Director: Darci Zolman | |
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| Period Covered by Report: 10/01/15 – 8/31/16 | |
| Project End Date: 8/31/15 *Project received a 1 year extension to 8/31/2016 | |

A) Summarize the work performed during the project period covered by this report:

- Notre Dame continued water monitoring on prescribed sampling regime.
- Presentation was given on the project at the Indiana Association of Conservation Districts annual conference in January, 2016.
- Presentation was given on the project at the Annual Meeting of the Kosciusko County Soil and Water Conservation District, February 17, 2016.
- Participant meeting was held 2/26/16 to assess progress and report on monitoring data.
- Ongoing meetings with County Surveyor to share results and discuss future 2-stage ditch implementation in this watershed.
- A Cover Crop field was held, 4/2/16
- Watershed tour for Senator Coats' staff, 3/10/16
- Watershed tour for Illinois Soybean Association, 8/24/16

B) Describe significant results, accomplishments, and lessons learned. Compare actual accomplishments to the project goals in your proposal:

- Water monitoring continued and data analyzed. (see attachment)
- Cover crops planting continued by farmers in the watershed.
- New two-stage ditch implementation scheduled for spring 2017, utilizing RCPP funding

C) Describe the work that you anticipate completing in the next six-month period:

- This CIG is over, however, work continues on cover crop and two-stage implementation in this watershed. Monitoring is also continuing through an RCPP.

D) Provide the following in accordance with the Environmental Quality Incentives Program (EQIP) and CIG grant agreement provisions:

Not applicable during this reporting period.

Cover Crops: Planting the Way to Nitrogen Management at the Watershed Scale in a Combined Conservation Approach

Progress Report 10-14-2016 -- University of Notre Dame

- *Overall Project Objectives:* Implement cover crops on 50% of acres in the Shatto-Cattel Watershed in Kosciusko County, IN.
- Monitor the impact of cover crop planting on tile drain nutrient and sediment export, as well as instream nutrient and sediment export.
- Determine the efficacy of combining in-stream and onfield management practices (two-stage ditch and cover crops) to improve water quality.
- Provide regional demonstration for farmers showing the benefits of combined best management practices.

CIG Year 1 – Pre-Cover Crops

During the pre-planting year, we measured inputs (tile drain) and outputs (stream) of inorganic nitrogen and phosphorus in the Shatto Ditch Watershed. This established baseline data prior to cover crop planting, which allowed us to quantify the impact of cover crops as a best management practice at the watershed scale.

Sampling Sites:

- Identified 10 longitudinally-distributed stream sites along the 5.6-mile ditch (~every half mile)
- Identified 48 tile drain

Sampling Frequency:

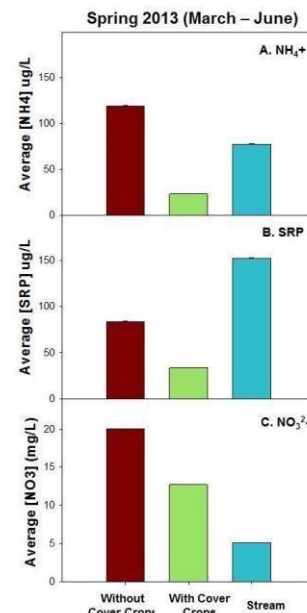
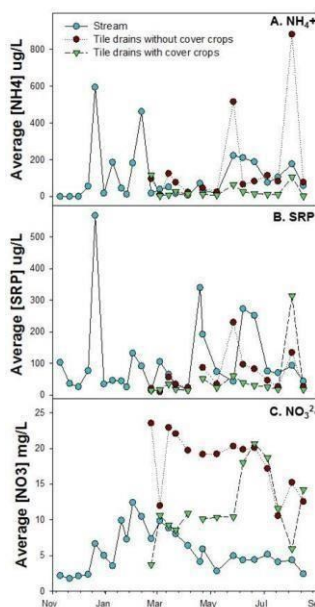
- We established a high-frequency sampling regime to collect water samples from 10 in-stream sites and 25 tile drain outlets (representative subset, ~2 per field) to characterize nutrient export throughout the watershed.

Year 1 – Preliminary Results

We collected water samples at in-stream sites throughout the watershed every 10-14 days beginning in Oct 2012 and analyzed all samples for nitrate (NO_3^-), ammonium (NH_4^+), and soluble reactive phosphorus (SRP). We identified and began sampling tile drain outlets every 14 days in Feb 2013.

Water Chemistry Trends

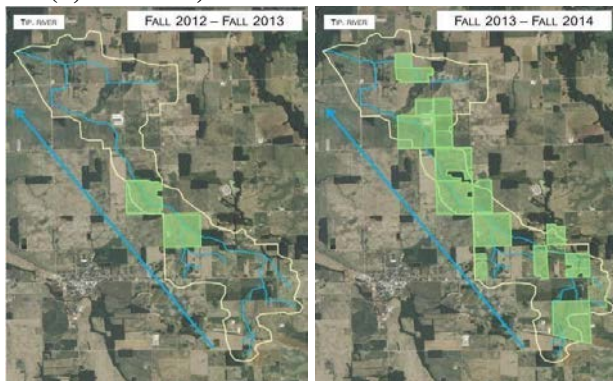
- Nutrient concentrations were higher in tile drain outlets than in the stream.
- Tile drain nutrient concentrations were fieldspecific highlighting the importance of on-field management practices to reduce nutrient export
- Notably, nutrient concentrations in tile drains from fields with cover crops were significantly lower than nutrient concentrations from fields without cover crops during Spring 2013, demonstrating **the potential for cover crops to reduce nutrient export.**



Communication of the science:

- Established open dialogue between Kosciusko County Soil and Water Conservation District, the Nature Conservancy, and University of Notre Dame researchers, which has been key to success of year 1 data collection.
- We presented year 1 preliminary results to ~15 farmers and members of the NRCS and TNC at a community meeting on 12/11/13.
- With help from our partners at the NRCS, we created and distributed a survey to the farmers in order to obtain key land use information that informs our research; received 100% responses.
- We presented our research at a meeting with key members of Indiana NRCS on March 21, 2014. We also presented our research at Water Quality Monitoring Forum to a group of ~50 conservation leaders at the NRCS state office in Indianapolis, IN on April 11, 2014.
- We presented to staff from Indiana NRCS, Kosciusko County SWCD, and local producers at a field day (06/14).
- Dr. Sheila Christopher presented at the Soil and Water Conservation Society Annual Meeting (07/14).
- We met with **Senator Joe Donnelly** on 8/11/14 to showcase our project and promote conservation practices like the two-stage ditch and cover crops.
 - In Summer 2014, we partnered with the SWCD in Jasper County to apply for the USDA Regional Conservation Partnership Program (RCPP) to replicate the SDW study demonstrating cover crops benefits in other parts of Indiana.
- **Our RCPP proposal was successful;** as a result, we began expanding our research on the benefits of cover crops to two other watersheds in Indiana.

CIG Year 2 – Year 1 of Cover Crop Planting During our pre-treatment year, ~12% of acres were planted in cover crops. **We significantly increased cover crop acres in Fall 2013 when cover crops were planted on 64% (1,610 acres) of farmable acres in SDW.**



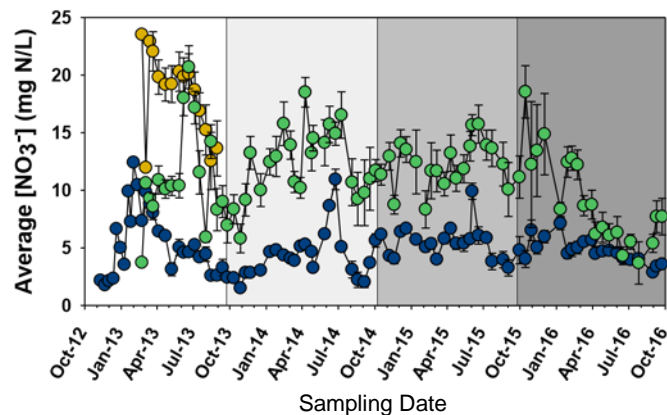
- We maintained the same sampling sites and sampling frequency to quantify any changes in tile drain or stream nutrient concentrations as a result of watershed-scale cover crop planting.
- We also received a complementary grant through the Indiana Water Resources Research Center in January 2014 to continue research on the connection between soil nutrient concentrations and tile drain nutrient export in spring and summer 2014. Sampling for this project began in April 2014 and continued during 2015-2016.

Year 2 – Preliminary Results - In Spring 2013, we found that nutrient concentrations in tile drains from fields with “long term” cover crops were lower than fields without cover crops.

- Additionally, we find a significant decrease in nutrient export when we compare seasonal NO_3^- concentrations and flux in 2014 to NO_3^- from fields without cover crops in 2013 (Fig 2).

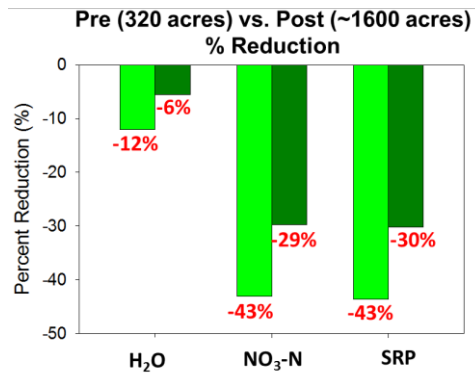
Year 3 and 4 – Preliminary Results

- Average NO_3^- concentrations from tile drains with cover crops in all years are lower than tile drains without cover crops in pre-treatment year.
- Average seasonal NO_3^- flux from tile drains with cover crops in all years show a similar pattern with the most notable reductions during Spring.



Updates and Data Analyses:

- We have completed data collection and processing from Year 3, and have begun statistical analyses of water chemistry trends from all years of the project.
- We used water chemistry and discharge data in SDW from 2012-2015 to calculate annual N export from the watershed before and after cover crops.
- We found significant reductions in both N and P export at the watershed scale. We are working to improve the accuracy of these calculations and will perform statistical analyses
- We have quantified N and P export during storm events, which has been a “frequently asked question” during many of our presentations. We found storms do contribute significantly to N and P export; however, cover crops greatly reduced the amount of N and P export during storms.
- Local producers voluntarily planted additional acres in cover crops showing “buy-in”.
- **Final Data Updates:**
- We recently finished analyzing all of the water chemistry samples collected during water year 2016, which coincides with the 4th year of this project
- We are working to calculate annual export from the watershed during 2016 year; we have completed this analysis for 2013, 2014, and 2015
- A manuscript for this project is in preparation for submission to Environmental Science & Technology, which will allow the results of this project to reach a large audience



Communication of the Science:

- We met with producers and other partners (TNC, SWCD, NRCS) on 2/3/15 in order to discuss the project and distribute another survey.
- Dr. Jennifer Tank and Brittany Hanrahan (graduate student) presented results from this project at the

Society for Freshwater Science Annual Meeting in Milwaukee, WI in May 2015 in a session titled “Nutrient and Sediment Management”. Both presentations were extremely well-received and generated a considerable amount of discussion among the >75 audience members.

- Dr. Tank completed the production of an NBC television Ad titled “Fighting for Clean Water” on the cover crop project which was aired during halftime of the Notre Dame vs. Georgia Tech game (9/19/15) and has been viewed >1,500 times on the University of

Notre Dame’s YouTube channel.

- The team participated in a site visit and meeting with Janet Perry, from USDA NRCS in Washington DC, along with Indianapolis NRCS staff and local SWCD partners at the SDW to describe the project.
- We participated in a “Meet and Greet” with Congresswoman Jackie Waloriski of Indiana 2nd district organized by Kosciusko Co. SWCD staff in 8/15, which included a site visit to SDW.
- Dr. Jennifer Tank, Dr. Sheila Christopher, Brittany Hanrahan and Matt Trentman (graduate students) participated in a Soil Health Field Day held at Mike Long Family Farms in the SDW as part of his participation in the Soil Health Partnership in 9/15.
- We hosted a field visit at the SDW in 10/15 with Nick Goeser, Manager of Soil Health and

Sustainability, with the National Corn Growers Association. He currently serves as the Director for the Soil Health Partnership and is interested in water quality benefits of cover crops.

- Dr. Sheila Christopher and Brittany Hanrahan were invited speakers at the Soil and Water Conservation Society’s Edge of Field Monitoring Conference in Memphis, TN in 12/15.
- Brittany Hanrahan presented at the Indiana Soil and Water Conservation District Annual Meeting in Indianapolis (1/16) to a group of >200 including SWCD and NRCS staff and producers.
- Dr. Jennifer Tank spoke at the Marshall County Soil and Water Conservation District Annual Meeting (1/16) to a group of ~50 including SWCD staff, board members, local producers and FFA members.
- Brittany Hanrahan presented at the Scott Family

Farms Cover Crop Workshop (4/16) to approximately 75 local producers in Kosciusko County, IN

- Dr. Jennifer Tank, Dr. Sheila Christopher, Brittany Hanrahan, and Matt Trentman presented at the Jasper County Field Day to promote participation in the RCPP project in the Kirkpatrick Ditch Watershed
- Dr. Jennifer Tank and Matt Trentman presented at the Society for Freshwater Science Annual Meeting in Sacramento, CA (5/16)
- Dr. Sheila Christopher and graduate students, Brittany Hanrahan and Matt Trentman, presented at the Indiana Water Resources Association Annual Meeting in Angola, IN (6/16)
- Dr. Jennifer Tank and team hosted Tony Kramer (NRCS Deputy Chief for Programs) and Jerry Roach (Asst. Indiana State Conservationist) for a field day at the Shatto Ditch (6/16)
- Matt Trentman presented at the Manure Expo in London, OH (8/16) and at the National Non-Point Source Conference in Salt Lake City, UT (8/16)
- Brittany Hanrahan will be presenting results from the project at the International Water Association Meeting in Dublin, Ireland (10/16)

Future Directions

- **We continue to sample the Shatto Ditch Watershed** using the same regime as years 1-4. We have expanded the SDW project to the Kirkpatrick Ditch watershed in Jasper County via our recently funded USDA RCPP project in winter 2015.
- With the beginning of the RCPP project in the Shatto Ditch Watershed, USGS has installed a gauge at the bottom of the watershed in order to accurately daily discharge measurements. **This partnership will greatly benefit the CIG project and improve our ability to quantify changes in N and P export at the watershed scale.**