INREC Data Collection of In-Field Agricultural Practices

Background:

The Iowa Nutrient Reduction Strategy (INRS) calls for the development of a public-private reporting system capable of documenting the use of nutrient management and conservation practices within the state for calculating nutrient load reductions stemming from the measured levels of practice adoption. Elements of this system include a private sector system to measure the scale of practice adoption and provide aggregate information to the Iowa State University nutrient science assessment team for making nutrient load calculations.

The inherent need for progress tracking is to create a system able to provide near-term assessments of the impact of efforts being carried out to implement the INRS. The INRS recognizes the need for a practice-based measurement approach for tracking progress, paired with utilizing the science on water quality performance of various conservation practices to reliably and accurately quantify the impact of practices across Iowa in terms of mass load reductions of nutrient losses. The INREC approach provides a measurement system that is not confounded by weather variability and other temporal and spatial scale factors which stream water quality monitoring is highly susceptible to, as documented by the INRS supplemental document "Stream Water-Quality Monitoring Conducted in Support of the Iowa Nutrient Reduction Strategy". It also provides a system capable of tracking adoption of practices regardless of whether cost-share support was provided or not. While cost-share datasets can help tell part of the story, it is inherently a complicated and tedious process to consolidate and reconcile cost-share practice information from multiple state and federal agencies that provide that support. Beyond those complexities, cost-share data also lacks the ability to provide information regarding practices adopted by farmers that didn't utilize cost-share. As such, the INREC survey is a superior tool for meeting the needs of the INRS practice-based tracking system.

In 2015, SF494 was enacted to provide funding support for a pilot project to develop the public-private system to enhance the state's ability to track its progress in reducing the transport of nutrients to water from nonpoint sources in Iowa. Below is the relevant language from section 18 of Senate File 494 passed by the Iowa General Assembly and signed by Governor Terry E. Branstad.

The three-year project shall be used to do all of the following:

a. *Enhance this state's ability to track its progress reducing the transport of nutrients to water from nonpoint sources within watersheds in accordance with the latest revision of the document entitled "Iowa Nutrient Reduction Strategy" initially presented in November 2012 by the department of agriculture and land stewardship, the department of natural resources, and Iowa state university of science and technology.*

b. *Develop a database of in-field agricultural practices and analyze the impact of those practices in the aggregate. An agricultural practice includes but is not limited to soil and water conservation practices, structures, technologies, and agricultural inputs and outputs. The college may also provide for the measurement of other impacts associated with agricultural production. The finding of the pilot project shall be used to develop a system to be implemented within a broader range of watersheds that measures existing agricultural practices and the impact of different nutrient management decisions.*

Through a competitive process, ISU selected INREC as the private-sector partner to provide data collection and handling services. Over the course of the pilot project INREC collaborated with ISU College of Ag and Life Sciences (ISU CALS) and the ISU Center for Survey Statistics and Methodology (ISU CSSM) to successfully develop the procedure and instrument for collecting a statistically representative sample of fields across the state, resulting in a fully randomized and representative sample of in-field practices that will be conducted on a crop year basis and aggregated and shared with ISU to calculate the impact of in-field practice adoption levels on nutrient loads for the state of Iowa.

Executive Summary of Pilot Project Accomplishments:

- This effort has resulted in developing and establishing a first-of-its-kind statistically-based, scientifically credible measurement of farmer progress to adopt nutrient management and conservation practices. Paired with the INRS science, this system provides Iowa with the ability to quantitatively determine nutrient mass load reductions to Iowa waters on an annual basis. Iowa is the leading state in the U.S. to achieve this level of progress assessment, which also fulfills enactment of the public-private partnership called for by the INRS, utilizing ag retailer and crop advisor records for progress measurement.

- Achieved methods to accumulate the data as needed for determinations of nutrient load reductions to Iowa waters by the ISU Nutrient Science Team. This system fulfills the need for practice-based progress measurement rather than downstream ambient WQ monitoring, to provide comprehensive near-term measurement of outcomes not compromised by weather variability and other spatial and temporal factors. The data collection questions (Appendix C) were coordinated on with the ISU Nutrient Science team and designed to focus on collecting information about practices from the INRS science assessment, thereby providing the ability to calculate the water quality performance.

- Achieved utilization of ag retailer/crop advisor records for tracking practice adoption with the advantages of:

    a. High accuracy resulting from customer transaction-based records

    b. Detailed historical records of purchased crop inputs/services available

    c. Better understanding at the crop adviser level of practices such as phosphorus applications.

    d. Numerous locations statewide to draw a random, representative sample from (Appendix B)

- Achieved a workable solution to the challenge that ag retailers and crop advisors across Iowa use dissimilar record-keeping systems and software. Rather than complex software and data transitions, the solution achieved is a simple web-based fill-in form approach, which has worked extremely well given the variability in source data formats.

- Achieved exceptional data security – Both the physical and cyber-security of the private server provide military-grade security for housing the information collected through the system.

Protocols provide additional security features by software design and databases which separate the data source from the actual farmer data.

- Developed and utilized statistical randomization design by the ISU Statistics Department (Appendix A), to assure science credibility of the randomized survey outcomes to credibly correspond to the actual progress by farmers across Iowa.
- Achieved engagement of ag retailers and crop advisers to accomplish the surveys.
    a. Established four part-time regional liaisons to aid retailers and crop advisers in completing the surveys and necessary farmer consent.
    b. Determined timing of the surveys necessary under the extreme crop-seasonal workloads of retailers, crop advisers, and their farmer customers.
    c. Developed farmer consent procedures for use of their data in the aggregate, achieving widespread farmer consent (Appendix D).

As detailed in the ISU CALS final report on the pilot project to the Iowa legislature, it is recommended that this system be utilized into the future as the official system for measuring, documenting, and quantifying progress under the INRS.

INREC Data Collection of In-Field Agricultural Practices – 2017 Crop Year Report

Survey Overview:

- INREC collects survey information on all the in-field N and P management practices listed in the INRS Nonpoint Source Science Assessment (NSSA). See Appendix C for questions asked.
- 150 ag retailer locations are randomly selected across Iowa each year to collect survey information from utilizing their farmer customer records on in-field management practices. These records include information from sales transactions, field notes, and other information maintained by retailers on their farmer customers on a field by field basis.
- The randomly selected locations are stratified across the eight Major Land Resource Areas (MLRAs) of the state based on each MLRA area's percentage of row crop acres to ensure a properly apportioned representative sample from all areas of the state.
- At each retailer location 10 farmers are randomly selected to survey, and for each farmer one farm field is randomly selected to collect survey info on.
- INREC utilizes four regional liaisons to meet in person with the ag retailers and carry out the random selection protocols and collect the survey information by inputting it into an online survey form maintained on a private, secure server by INREC.
- The average time spent at each retailer location to carry out the random selection protocol and collect the information is approximately 1 hour.
- INREC provides an aggregate dataset of the compiled responses to ISU for statistical processing to extrapolate practice usage information to statewide scale. ISU utilizes that information to estimate the impacts of practice adoption levels on N and P nutrient load export based on the INRS NSSA and associated practice performance numbers.
- The assessment of current status of practices is compared to the 1980-1996 baseline status of practices and nutrient export estimates to show how much nutrient loads have decreased or increased since the 1980-1996 baseline - which is the starting point for measuring Iowa's progress towards the goals of the Iowa Nutrient Reduction Strategy.

Sampling Protocol:

The INREC survey sampling protocol (Appendix A) was designed by the ISU Center for Survey Statistics and Methodology (ISU CSSM) to provide a random sampling protocol for obtaining practice implementation information on randomly selected farm fields from ag retailer records. The sample population determined by ISU CSSM needed to provide a statewide representative sample was 500 samples, which were apportioned across each of the major land resource areas (MLRAs) in Iowa based on the percentage of row crops in each MLRA. A total of 1,500 samples were distributed statewide in order to provide a reasonable margin of oversampling to account for potential nonresponses.

From a total population of 590 ag retail locations across Iowa, 150 locations were randomly selected for sampling and each was assigned 10 samples to provide totaling up to the 1,500 potential samples to be collected. The number of randomly selected retailers in each MLRA was based on the number of responses apportioned to each MLRA based on the percentage of row crop acres present in each MLRA.

Randomization protocols provided by CSSM were provided for each ag retail location detailing protocols for random selection of 10 customers per location and one randomly selected farm field per customer to assure random selection for survey responses.

Sample Selection Procedure for INREC

Z. Zhu, 9/3/2017

In the attached file SampleSelection.csv, there are five columns. The first column is the id number from 1 to 600, corresponding to up to 600 locations in the sample. The second column is the first letter of the last name of the farmer for identifying the starting point. The third column gives the section number (high/low). The forth column is the direction in which the field is being sampled (N/E/S/W), and the fifth column is the second direction to break a tie.

If the total number of farms in a location is less than 50, sample every 5^{th} farm after the starting point.

If the total number of farms in a location is between 50-99, sample every 10^{th} farm after the starting point.

If the total number of farms in a location is between 100-199, sample every 20^{th} farm after the starting point.

If the total number of farms in a location is 200 or above, sample every 30^{th} farm after the starting point.

Example: suppose location 1 serves 150 farms.

1. The first row and the second column is M. So we find the first farm with the last name starting with M, which becomes the starting record. If there is no farm with last name starting with M, we find the next farm with the last name starting after M as the starting record.
2. 150 farms are between 100 and 199, so we count from the starting record to the 20^{th} record, which becomes the first sample. Count to the 40^{th} record for the second sample, and continue until enough sample is selected at this location. If there is a non-response, record the basic information for the non-response, and count from the last sample to the next 20^{th} record as a new sample.
3. The first row third column is High. For all the selected farms from the first location, select the section with the highest section number.
4. The first row forth column is West. We select the west most field in the section from (3) to survey.
5. The first row fifth column is South. If there are more than one fields which can be considered west most, select the most southern one to survey.

Appendix C - Survey Questions Short Form

1	Token						
2	Retailer Company						
3	Retailer City						
4	County where field is located						
5	Field size		acres				
6	Field owned or rented?	Owned	Rented				
7	Total acres farmed		acres				
8	2017 crop year land use	Corn	Soybean	CRP/Land Retirement	Hay/Grazed Pasture	Energy Crop	Other
9	Crop Rotation	Corn/Soy	Continuous Corn	Extended Rotation	Permanent Pasture/Hay/CRP		
10	Were cover crops used?	Yes	No	Don't Know			
11	What type of cover crop if so?	Rye	Oats	Other			
12	Tillage type prior to corn planting	No-Till	Conservation Tillage	Don't Know	Other		
13	Tillage type prior to soy planting	No-Till	Conservation Tillage	Don't Know	Other		
14	Was anyhdrous applied in the fall before corn?	Yes	No				
15	If so, was a nitrapyrin based nitrifiction inhibitor used?	Yes	No				
16	If not, what N application method was used?	Spring pre-plant	Spring pre-plant & in-season sidedress	In-season sidedress only	Other		
17	What was combined N rate of all commercial sources?		pounds/acre				
18	What manure fertilizer sources were used?	Liquid swine	Beef	Poultry	Dairy	Manure not used	Don't know
19	If swine manure was used, when was it applied?	Fall before corn	Spring before corn	Both fall and spring before corn	Don't know		
20	Does retailer know what N rate of manure application was?	Yes	No				
21	If so, what was the N rate of manure application?		pounds/acre				
22	What P application practices were used?	Commercial P incorporated with planter	Liquid P injected	Commercial P in knifed bands	Commercial P surface applied and incorporated w/n 1 week	Other	Don't know
23	Is soil sampling for P levels done for the field?	Yes	No	Don't know			
24	Does P application only occur when P levels are at are below optimum?	Yes	No				

Appendix D - Farmer Consent Card