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Farmer perspectives on ecosystems service management, land use targeting and the future of Cornbelt agriculture

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Abstract
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$40,494 for year one
$40,275 for year two

Q What kind of perspectives do Iowa farmers have on targeted conservation?

ECOLOGY

A Most of the participating farmers recognized the importance of producing multiple benefits (or at least minimizing "bads" such as erosion) but lacked broad-scope information (e.g., nature of various problems and, in turn, what specifically to do about them in a low-cost way). There was a tacit acceptance of a targeted approach to conservation, yet considerable uncertainty exists regarding the cost, broad management consequences and the availability of incentives. Incentives that are independent of strict policy initiatives (e.g., driven by the NRCS) may be required to engender more autonomous application of enhanced, outcome-based conservation management that is aligned with targeted conservation; such incentives may well be in the realm of environmental markets and/or Payment for Ecosystem Service opportunities.

Background

This project explores farmer perspectives regarding targeted conservation and the deliberate management of ecosystem function at farm and landscape scales. In Iowa's Squaw Creek watershed located in Jasper County and the Headwaters of Big Creek watershed located in Boone and Polk Counties, the group analyzed the economic, agronomic, social and cultural aspects of farmer decision-making regarding ecosystem service management on their farms as well as for Iowa as a whole.

Increasing scientific understanding of the benefits of targeted conservation exists when applied to row-crop dominated landscapes like Iowa's. From an application standpoint, targeting can be as simple as broadly coupling standard Best Management Practices (BMP) with the strategic placement of perennial plant cover or other options in landscape positions that have particular characteristics or "vulnerabilities." It has been shown that these small and strategic changes in land management and land cover can lead to disproportionately large biophysical benefits relative to their spatial extent. Ultimately, it is believed that this approach can greatly improve ecosystem service delivery, minimize land-use trade-offs, and more efficiently use funds already allocated to conservation by various government programs.

Despite the biophysical promise of targeted conservation, application remains limited. There are many significant challenges to more widespread application of targeted conservation. Prior research identified perceptions that targeted conservation is variously unnecessary, too intrusive (on private property rights), and/or is too costly (particularly in the context of opportunity costs). There are limited policies and policy tools that directly or explicitly support targeted approaches to conservation.

These are curbs on the capacity to model or otherwise assess the field- and farm-level impacts of the targeted approach in a way that resonates with farmers and fosters a willingness to engage in a more targeted approach to environmental management.

Project objectives were:

1. **Farm-scale modeling:** Identify key sub-basin locations based on GIS assessment of Hydrologically Sensitive Areas and topographic variation. Guided by this information, selected farmers were contacted to gather site-specific farm management data to serve as input data for the development of farm-level conservation plans. Using initial information from farmer participants, site-specific alternative management scenarios were developed that incorporate (where appropriate) perennial Best Management Practices (BMPs) for the selected field sites designed to variously minimize erosion, overland flow, nutrient transport and or enhanced habitat.
2. **Farmer interviews:** Conduct semi-structured in-depth interviews with the targeted farmers regarding their baseline current farm operation in comparison to site-specific alternative management scenarios.
3. **Decision Support Tool analysis:** Conduct a parallel study to examine various "ecosystem-service" management tools that are available to aid farmers and technical service providers. Various PC-based decision support tools have been developed to aid in the field/farm level and (to some degree) landscape-level capacity to plan and design targeted conservation plans and analyze expected outcomes.
4. **Workshop with field agents and policy makers:** A centrally located "working meeting" was held for a select group of regional field agents and administrators in order to share findings from the Science-based Trials of Rowcrops Integrated with Prairie (STRIPS) project and farmer data from this project.

Approach and methods

The Squaw Creek and Big Creek watersheds were chosen for study in an effort to link with ongoing research, but also to capture some geographical variations in farmer data. The Squaw Creek watershed links directly with the ongoing STRIPS work at Neal Smith National Refuge; the Headwaters of Big Creek watershed was selected given its close proximity to Iowa State University, collaboration potential related to the recent creation of a local watershed management project, and research potential associated with recreation-related ecosystem services at Big Creek Lake.

Conclusions

This research provides a data-driven demonstration that targeted conservation is bio-physically possible at watershed scales using relatively low-cost methods and is generally supported by farmers (with caveats). It points to the need for new public/private institutions and social relationships (perhaps via new markets for environmental quality) in order to facilitate expanded application of targeted conservation. The investigators, with a focus on water quality developed a novel "targeting" methodology that utilizes publically available, Geographic Information System (GIS) compatible data. The targeting criteria are places on the land that are likely to deliver soil, phosphorous, or nitrates to surface waters.

In order to facilitate the targeting of farms/fields that featured Hydrologically Sensitive Areas (areas in a watershed especially prone to generating runoff and are therefore hydrologically sensitive with respect to their potential to transport contaminants to perennial surface water bodies), the team created three GIS-based models (using newly available Iowa-specific LiDAR data) that facilitate the classification of areas of natural resource concern.

1. To identify areas of concentrated surface flow, there is a stream power model able to recognize areas of potential ephemeral and classic gulley erosion.
2. To identify areas prone to rill and sheet erosion, there is an erosion potential model based on slope and slope-length characteristics.
3. To identify areas with a high nitrogen-leaching potential, there is a model that classifies areas with high probability of subsurface drainage and areas with restricted surface drainage (e.g., depressional wetlands).

Thirty-three of the targeted farms/farmers agreed to participate and were interviewed for the project. Among the key findings:

- The majority of interviewees initially responded with neutral or negative feedback to suggested conservation practices. Primary concerns included finances, management, the creation of additional problems, coordination with available government programs, and loss of tradition.
- Ultimately, many interviewees recognized the importance of producing multiple benefits, but variably perceived they lacked technical information, certainty regarding outcomes, management capacity (e.g., knowledge, time, skills) and financial incentives to manage for multiple benefits and production.
- Regulations were unpopular among interviewees, largely due to perceptions of a loss of independence; nonetheless, many interviewees perceive regulations as inevitable. Interviewees believed that the effectiveness of regulations depends on the ability of the measures to be adapted to their landscapes and management regimes.
- Interviewees often spoke about farmers working together to meet production goals, but it did not appear likely that this trend would translate to cooperating for conservation, which currently lacks the monetary incentives associated with production.
- Although a number of suggestions were made to encourage multiple benefits, it remains clear that monetary incentives matter; interviewees were motivated by dollars.
- Ultimately, although the NRCS was perceived as the technical expert, interviewees were hesitant to work with the NRCS in a coordinated program for several reasons. As a result, it may be important to consider alternative agencies, non-governmental organizations, or institutions that may be more appropriate for coordinating a targeted conservation program.
- With respect to remotely accessing on-farm information for use in targeted conservation, what matters is how the information is used. If the information is used to prescribe regulatory practices, interviewees were overwhelmingly opposed to its use, but if it was used to start a conversation with the farmer and a point of suggestion, farmers were much more receptive.

Impact of results

The targeting methodology developed by this project will be promoted as a relatively low-cost method for conservation agencies (e.g., NRCS) to target water quality priority areas. Beyond the targeting tool, the farmer interview information will be integral to what will be called a "Unified Argument for Target Conservation" in Iowa.

This argument centers on a comprehensive, data-driven demonstration that targeted conservation is biophysically possible at watershed scales using relatively low-cost methods, is socially demanded (supported by social and economic data), broadly supported by an array of key stakeholders, generally supported by farmers (with caveats), and has the strong potential to foster new public/private institutions and social relationships via new markets for environmental quality.

The interrelated projects and data sets to be used in qualifying our "Unified Argument for Target Conservation" are:

1. To demonstrate that low-cost methods of conservation targeting exist, researchers present the GIS model-based targeting methodology as described in the final report.
2. To demonstrate that targeted conservation approaches are broadly supported (or demanded) by key stakeholders, researchers present various STRIPs and other related work including:
    a. 2012 citizen survey data showing a strong willingness to support and help pay for a policy shift towards targeted conservation management;
    b. Drake Larsen's master's degree research which discovered that "ecosystem service management" may provide a conceptual platform for building consensus regarding a broadly desired multifunctional agricul ture, yet cautioned that a major roadblock to practical application of ecosys tem service management is a lack of support for landscape-level planning and coordination of management.
3. J. Arbuckle's 2012 Iowa Farm and Rural Life Poll data regarding farmer opinions of targeted conservation. The Arbuckle data will be coupled with the farmer interview data described in this project report.
4. The lessons learned from the modeling exercise and related examinations in another Leopold Center project (E2013-08, Integrating project knowledge and models: the next step in developing a Payment for Ecosystem Services scheme for the Big Creek watershed) will inform understanding of the potential to foster new public/private institutions and social relationships via new markets for environmental quality.

Education and outreach

Three manuscripts are being prepared for submission to scholarly publications. A chapter in a Ph.D. dissertation is being prepared for Spring 2015 submission.

Two associated publications have been produced:

Christianson, Tyndall, and Helmers. 2013. Financial Comparison of Seven Nitrate Reduction Strategies for Midwestern Agricultural Drainage. *Water Resources and Economics* 2, 30-56.

Tyndall JC, Schulte L, Liebman M, Helmers M. (2013) Field-Level Financial Assessment of Contour Prairie Strips for Environmental Quality Enhancement. *Environmental Management*. 52(3): 736-747.

Presentations made on the project include:

Zimmerman, E. Schulte LA, Tyndall, J. 2014. Payment for Ecosystem Services (PES): Early lessons from Big Creek Watershed. 2014 Graduate Program in Sustainable Agriculture Spring Symposium. 2014. Iowa State University, Ames. Manatt, R., J. Tyndall, and T. Knoot. 2012. Analysis of on-farm decision support tools (DSTs) for ecosystem service management. Research in the Capitol. Des Moines, Iowa. April.

Manatt, R., J. Tyndall, and T. Knoot. 2012. Analysis of on-farm decision support tools (DSTs) for ecosystem service management. Iowa State University Symposium on Undergraduate Research and Creative Expression. Iowa State University, Ames, Iowa. April.

Manatt, R., J. Tyndall, and T. Knoot. 2011. Analysis of on-farm decision support tools (DSTs) for ecosystem service management. Science with Practice (SWP) Poster Presentation. Iowa State University, Ames. December.

Larsen, D. 2011. Overview of the project. Presentation to the Big Creek Lake Watershed Project Technical Advisory Committee. December.

Leveraged funds

To date, no additional funds have been leveraged by this project.

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