Economic Analysis and Policy Development To Support Multiple Benefits

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Project: Policy Research and Development to Support Multiple Benefits from Agriculture: Phase II. LNC 02-204 Research/Ed

Special thanks to Patrick Welle (Bemidji State University), Hiroki Uematsu (grad student), Prasanna Gowda (Consultant), Paul Brietzke (Agronomist), Kevin Olson (Consultant), Tex Hawkins (US Fish and Wildlife Service), Frank Casey (Defenders of Wildlife), Linda Dahl (White Water Watershed Project), Larry Gates (Watershed coordinator), Dennis Keeney (Institute for Agriculture and Trade Policy), Bill Thompson (Minnesota Pollution Control Agency), and Farmers, Agency Staff, and Non Profit Leaders on the Project Team and Community Committee.

Background and Context

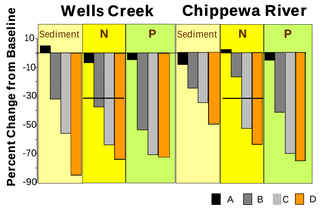
Agriculture during recent decades has focused on maximum production of a relatively few commodities, despite serious impacts on natural, social and community capitals in rural areas, or the quality of food produced. Farmers growing for differentiated markets, consumers, conservationists and policy makers increasingly want incentives for public benefits not adequately compensated through markets.

The Multiple Benefits of Agriculture Initiative (MBA) was led by Land Stewardship Project (LSP). Overarching goals were to:
-Quantify benefits from landscape-level diversification, not just from individual farms scattered across watersheds.
-Estimate the value of non-market public benefits, such as water quality not paid for by current markets, and incentives needed to encourage farmer adoption of diverse crops and livestock on the land.
- Describe necessary policy changes to more effectively support multiple benefits from agricultural landscapes.

Two Watersheds Study Completed Previously

In two Minnesota watershed study areas, agricultural land-use scenarios were developed by watershed citizens and modeled using the Agricultural Drainage and Pesticide Transfer Model. In the Wells Creek study area, fertilizer rates were higher than necessary so best management practices (BMPs) were adequate to achieve nutrient reduction goals. The biggest bang for the buck was estimated to come from scenarios B and C, especially for N and P. In the Chippewa study area, crop diversification in targeted areas away from row crops was required to achieve a 30% in-stream reduction of nitrogen. Additional multiple benefits in both area were analyzed and found to show similar trends with increasing diversification. These included fish health, bird habitat, avoided sedimentation costs, greenhouse gas production and carbon sequestration (Boody el al, 2005). A similar water quality modeling study has also been completed for Rock Creek watershed in the Sandusky River Basin of Ohio.

Predicted MN Watershed-Level Changes (Aggregated In-Stream)



Change in Environmental Benefits Compared to Baseline Data in a Minnesota study

	Wells Creek Study Area				Chippewa Study Area			
Scenario	A	B	C	D	A	B	C	D
Water runoff	1%	-3%	-24%	-35%	0%	-1%	-21%	-61%
Greenhouse gases	-2%	-12%	-18%	57%	0%	-6%	-37%	-34%
Carbon sequestration	-3%	31%	41%	86%	17%	37%	59%	112%
Lethal fish effects	10%	-57%	-72%	-98%	2%	0%	0%	10%

Scenarios

A. Extension of current trends
Increased field size, focus on annual crop production
B. Adoption of BMPs
Shift to conservation tillage, use Univ. of MN recommended nutrient application rates, 100 ft riparian buffers
C. Expanded diversity
Five year crop rotation (5% organic), more grazing and wetland restoration
D. Managed year-round vegetative cover
Cover crops, 300 ft buffers, and grass on higher slopes for energy, seed, increased managed grazing --cattle numbers :

Chippewa	Wells Creek
Dairy	
+640(252%)	+6785(125%)
Beef	
+515 (90%)	+1710 (125%)

SARE Proposal Objectives

- Thoroughly develop policy concepts intended to reward farmers for utilizing integrated farming systems that result in significant environmental and social public benefits
- Create feasible and effective methods for measuring the environmental and social results of farm management
- Educate and involve stakeholders and
- Recruit a planning committee for a demonstration project

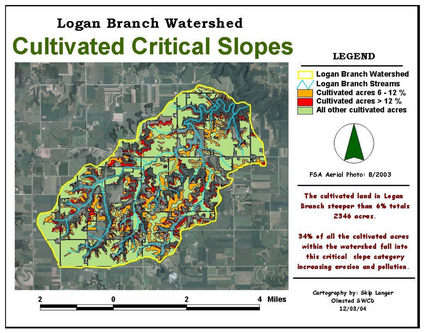
What Did the Project Do?

1. Developed a watershed-based effort in the Logan Creek subwatershed in Minnesota (see methods/results)
   a. LSP convened farmers, researchers and agency staff
   b. Gowda used the Soil and Water Assessment Tool (SWAT) to model water quality, Brietzke interviewed 13 local farmers
   c. Murphy and Hawkins used the Coordinated Conservation Planning Tool (CCP) at a watershed level to predict bird occurrence
2. Welle and Uematsu conducted two economic analyses of public and private policies (see methods/results)
   a. Possible program costs were compared to the Willingness to Pay (WTP) for a hypothetical Conservation Security-like program
   b. Financial risk as might be estimated by Lenders for adopting no-till and rotational grazing was evaluated
3. Evaluated policy options and tools for performance based policies for agricultural conservation (see outcomes)
4. Provided extensive education through presentations, papers, round tables and policy briefings (see outcomes)

Education/Demonstration Methods and Results

Logan Creek Water Quality Modeling

The 11,000 ac Logan Creek sub-watershed is in the Whitewater Watershed in SE MN. It overlies karst bedrock and is dominated by row crop agriculture (64%). It was monitored for flow, sediment and N since 2000.



Methods

1.B: The Soil and Water Assessment Tool (SWAT) was calibrated and 10 years of simulations were run for 5 N rates and 20% of row crops converted to pasture. Insufficient data existed for base flows and spring locations, and changes to perennials were not localized to vulnerable slopes.

1.A&B: Virtual Farms created for "average" Dairy, Cash Grain and Beef farms based on current land use decisions from the National Ag Statistics Service and practices qualifying for Conservation Security Program. "What if" scenarios were modeled with SWAT based on 10 conservation practices, changes in N rates, and crop rotations. Practices were individually modeled, whereas farms combine practices. Results were incomplete, but trends were clear.

Results

- Reductions in N losses of 11.18% resulted from reductions of application rates of 43%.
- Conversion of 20% of row crop land to pasture resulted in a 6% reduction in sediment losses.
- 52% of variability of sediment losses, averaging .81t/ac in-stream, was predicted.
- N dropped 75-80% and sediment dropped 88-95% on fields changed to grass.
- In fields with row crops changed to 30% residue cover and grass waterway, sediment dropped 6-18% and N usually increased (0.3-6%).
- 100 or 300 foot buffers along the creek reduced sediment by 5% or 15%, respectively.
- An EPA watershed 3-state implementation proposal through Green Lands Blue Waters was not funded.

2. Economic Analyses

Welle and Uematsu conducted two economic analyses to predict the level of incentives need by farmers to adopt farming systems that would qualify for a Conservation Security Program (CSP). They compared those to the public's willingness to pay (WTP) from Boody et al., 2005.

Methods

2. A: State CSP-like Adoption Costs The economic model used a "choice variable" called a CSP unit that was based on management practices that address quality criteria for resources of concern set by the Natural Resources Conservation Service. A complex set of equations were aggregated into the following:

The Public's Marginal WTP for CSP = Marginal CSP Payment + Marginal Administrative Costs.

As a proxy for CSP adoption costs in 2005, costs estimated by the USDA for 21 EQIP practices related to resources of concern were used.

2.B: Credit Risk Simulation The financial risk of converting to no tillage (NT) and management intensive rotational grazing (RG) was calculated as a lender might estimate. A model was based on "FINPACK for Lenders", Data were collected from the FINBIN database. The unit cost of NT and RG were from EQIP costs. Rotational grazing costs were a combination of prescribed grazing and fencing practices and production costs/cow on Minnesota dairy farms from the USDA Agricultural Resource Management Survey (ARMS) data. Credit risk rating scores were calculated and statistical significance of changes analyzed.

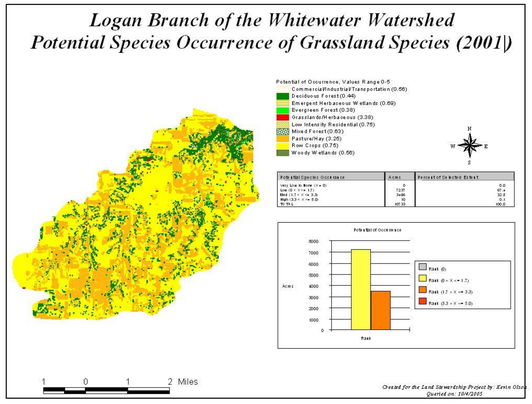
Results

- The WTP for agricultural practices that improve environmental quality was found to be $201 per MN household or $400 million (Boody et al., 2005).
- Average annual EQIP payments of $2,221,086 for 21 practices were 0.6% of the WTP. Payments of $6,048,823 for all 71 practices used in MN were about 2% of WTP.
- A ten-fold expansion was assumed to be needed to address TMDLs related to ag in MN = $60 million. Start-up, producer transaction and admin costs were estimated by a state agency to be 55% of farmer cost-share, totaling $93 million. *The benefit/cost ratio was $400m/$93m or > 4 to 1 for a program paying for multiple benefits.*

- The adoption of NT did not change credit risk ratings, estimated as minimal risk, with or without EQIP.
- The adoption of RG worsened credit risk scores from minimal to average risk, with or without EQIP. Usually, FINPACK predicted that total cost of production increased for RG because *ARMS data reported a 20% increase in total direct and overhead expenses, while sales/cow declined by 10%.* The literature and farmer experience have generally reported the same or higher net profits because of significant cost savings that outweighed gross income loss. **The accuracy of the sampling and data set for ARMS for RG should be reevaluated.**

1.C &3. Coordinated Conservation Planning Tool (CCP)

This was developed by the US Geological Survey to predict bird success in refuges. It incorporates land cover spatial database and 280-bird matrix for the Upper Mississippi and Great Lakes. The model calculates potential species occurrence, species richness, and habitat area for a landscape.



Methods: The CCP was applied to "what-if" scenarios designed with significant input from watershed residents and local agents who work and live locally. Scenarios included a conversion of the entire watershed's cropped land to pasture/hay and moderate conversion of just the cropped land with greater than a 6-degree slope to pasture/hay.

Results: Conversion of 20% row crop land to grass produced a 90% improvement in predicted grassland bird species occurrence. By grouping species on a watershed basis, the model can provide an estimate of the cumulative effect of farmer decisions. A single-farm analysis is too costly. The results parallel the SWAT analysis for sediment and nitrates. Practices of an individual farmer could be credited based on predicted outcomes at the watershed level, which raises many issues outlined in Keeney and Boody, 2005.

Major Findings

- As shown in previous Multiple Benefits of Agriculture Initiative modeling studies, water quality in Logan Creek was predicted to improve by adding perennial cover.
- The SWAT model proved difficult to use in the driftless area due to insufficient data about the location of springs and estimates of base flow for streams.
- The public benefit/cost ratio of spending to provide incentives for high levels of stewardship on farms is > 4 to 1.
- Lenders may estimate increased risks for adopting RG based on USDA survey data that may over-estimate the cost of transition and not accurately reflect stable or improved net profit potential. Lender education and improved national data sets are needed.
- Understanding is growing and practical policies are being developed in MN and nationally based on obtaining multiple environmental benefits from diversified farming practices, including prairies for biofuels.
- Education and research on Performance-Based Agricultural Conservation policies, measurement systems and indicators is growing among the farm, environmental, conservation, ecolabel and research communities, as well as policy makers.

What Were The Outcomes?

Intended	Achieved Or In Progress
A southeast MN demonstration project planned	Logan Creek community committee convened, modeling done and EPA Watershed project proposed through Green Lands Blue Waters, but not funded. Two other projects in progress (see below)
100 people engaged	IA Roundtable (40), Ohio Roundtable (40) 3 Briefings in Washington (40), + Many other individuals engaged in performance-based farm policy discussions
Expanded interest in non-market benefits of agriculture	- 21 Presentations during grant period and continuing -~150 copies of published papers distributed + web distribution + publication in BioScience 2005 and Science 2007 - 4 Fact Sheets, 5 Briefing Papers, 2 White Papers -Use of a multiple benefits framework is apparent in the following examples: Lake Pepin TMDL stakeholder process and Carbon Sequestration Prediction projects in MN; Cooperative State Research and Extension Programs in the Agricultural Systems area; Agricultural Research Service Agricultural Systems Program; the CSP and the Conservation Effects Assessment Program in NRCS
Up to three measuring mechanisms/ payment plans ready to be demonstrated	-Pastured cropland payment was accepted by NRCS for Conservation Security Program (2005) - Reinvest in Minnesota Clean - Energy program designed for multiple benefits in 2007 by MN gov't and stakeholders who agreed to seek multiple benefits from planting perennial biofuel crops on sensitive lands--LSP assisting - Community-Based Food Value-Chains for increased institutional purchasing from livestock farms on marginal lands –community incentives to be developed (current) - Eagle Bluff Environmental Learning Center in SE MN may buy biomass from farmers who change row crops on steeply sloped lands to prairie (current) -Green Lands Blue Waters demo project proposed in Science and several being pursued (current) - Coordinated Conservation Plan +RUSLE2- GIS Based Tool under development to help communities value incentives (current)

Publications and Acknowledgements

Papers (Available from www.landstewardshipproject.org/programs_mba.html)
Boody, G, B. Vondracek D. Andow, M. Krinke, J. Westra, J. Zimmerman, and P. Welle. 2005. Multifunctional Agriculture in the United States BioScience, 55 (1):27-38.
Casey, F.,G. Boody. 2007. An Assessment of Performance-Based Indicators and Payments for Resource Conservation on Agricultural Lands. Defenders of Wildlife/LSP 27 pp.
Keeney, D.,G. Boody. 2005. Performance Based Approaches to Agricultural Conservation Programs dealing with Non-Point Source Pollution, Including Utilization of the Provisions of the Conservation Security Program. A Concept Paper Prepared For The Workshop On Performance-Based Farm Policies held in Ames, IA in December 2005. Institute for Agriculture and Trade Policy/ LSP. 19 pp.
Uematsu. H. 2006. Financial Risk Of The Working Land Conservation Programs Minnesota As A Case Study. Bemidji State University MS Thesis
Welle, P., H. Uematsu. 2005. Farm Profitability and Economic Efficiency Under Working Land Conservation Programs: Minnesota as a Case Study.

Fact Sheets (Available from www.landstewardshipproject.org)
- How Farms can Improve Water Quality (2005)
- Biofuels: Sustainable Energy from the Land (2007)
- Growing Green Fuel: RIM-Clean Energy (2008)
- Several fact sheets on CSP.

Briefing Papers (Available from www.landstewardshipproject.org)
- Geographic Information System Tool for Conservation Planning (2005)
- Executive Summary of Performance Based Policy Paper by Keeney and Boody (2005)
- Briefing Proposal on Performance-Based Policy for Agricultural Conservation to be held in WA DC (2006)
- Real Outcomes from Stewardship Farming: An Evaluation of Three Tools to Get Us There (2006)
- Results and Policy Implications of Modeling Diversified Farming Systems in Watersheds in OH and MN (2007)

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