Stephen Lovejoy

- **Professor Dept. of Ag Economics Purdue**
- **At Purdue since 1980**
- **Research-Extension-Teaching**
- **Courses – Env. Policy Analysis / Env. Decision Making**
- **Headed Purdue's Center for Alternative Agriculture**
- **Former Senior Policy Analyst US EPA**
- **Former editor JSWC**

St. Joseph Watershed Project

CEAP and ARS Funding Overview

Zach Cain

M.S. Student, Purdue University

Supervised by Dr. Stephen Lovejoy

Long Term Goals of Project

- **Objective 1: Determine the farm firm financial impacts of and the decision making values for utilizing alternative production practices and systems given the unique natural capital, environmental characteristics and cultural norms in the St. Joseph Watershed.**
- **Objective 2: Determine which acres, which production systems, which inducements and the level of costs involved to induce land management changes to meet alternative WQ standards (TSS, Do, fecal coliform, toxics, metals, etc.).**
- **Objective 3: Estimate and place a value on some of the benefits resulting from reductions in concentration of contaminants and the corresponding changes in ecological system health.**

Goal of Thesis Work

- The goal is to determine how changes in land use effect environmental and economic parameters for farmers in the St. Joe watershed
  - For example: If Farmer A puts in a buffer strip what is the impact to the environment? How does it change the bottom line?
  - The idea is to apply the same shock to an environmental and economic model to better understand the effects of land use changes

St. Joseph Watershed Area

- We will focus on a sub-watershed area to utilize an economic/ environmental model based on local conditions.

Sources of Information

- Representative farm firms will be established using Information about land use and farming practices obtained from a field study conducted by the Friends of St. Joe and the Allen Co. SWCD. This will be supplemented by interviewing farmers in the sub-watershed area
- For this assessment we will need detailed SWAT model data from the National Soil Erosion Lab that is accurately calibrated for sediment run off and nutrient loading for a sub-watershed area in the St. Joseph watershed

Field Record Information

- The Allen Co. SWCD/ Friends of St. Joe field record sheet will contain production information about the practices currently being utilized in the St. Joe watershed

  - Information on a per field basis:
    - Planting (timing, type of operation, rotations)
    - Seed (variety, rate, treatment)
    - Herbicide & Insecticide (application, rate, timing, price)
    - Fertilizer (application, rate, timing, price)
    - Field Operations (type, cost, number)

Field Record Sheet

Field Record Sheet

Farm		Year	
Field		Acres	1
Crop		Previous crop	
Planting date		Planter/drill	

Seed:

Brand	Seed Treatment	Hyrbrid/Variety	Rate/Ac - Unit	Total Qty - Unit	Unit Price	Total cost
				units		
Seed cost / ac.	(if any)	$ -		Seed cost total		$ -
					Not required	

Fertilizer:

Date applied	Application Method	Analysis	Rate/Ac - Unit	Total Qty - Unit	Unit Price	Total cost
			lbs.	ton	$ -	$ -
			lbs.	ton	-	-
			lbs.	lbs.	-	-
					-	-
Fert. cost / ac.		$ -		Fertilizer total		$ -
					Not required	

Herbicides:

Date applied	Application Method	Type	Rate/Ac - Unit	Total Qty - Unit	Unit Price	Total cost
					$ -	$ -
					-	-
					-	-
					-	-
					-	-
					-	-
					-	-
					-	-
Herb. cost / ac.		$ -		Herbicide total		$ -
					Not required	

From Fields to Farms

- Characteristics of the specific farms in the selected sub watershed
  - EXAMPLES in Allen County
    - Half of farms are 50 acres or less
    - Less than 5 % are 1000 acres +
    - Less than 1/3 have livestock
    - Nearly ½ work off farm 200+ days/yr
    - Average value of machinery is nearly $400/ac
- Prices – Actual Received vs Anticipated

Additional Information

- It will be necessary to gather some additional information from farmers in order to properly develop representative baseline farms, including:
  - Size and Enterprises of Farm Firms
  - Size/ productivity of machinery
  - Labor Resources
  - Drying/ Storing Capacity
  - Expected Commodity Prices
  - Expected Yield

Farm Survey

- This questionnaire will be submitted to Human Subject's Internal Review Board prior to interviewing farmers

Supplemental Information for PC-LP Model

Time and Labor Resources:

How many permanent employees do you have? _____

How many hours per day can they work? _____

How many part-time employees do you have? _____

How many hours per day can they work? _____

What is the part-time hourly wage? _____

Drying and Storage Resources:

How many hours per day does the dryer run? _____

What is the dryer capacity in points of moisture removed per hour? (10 points per hour from 250 bu. = 2500) _____

What is the bushel capacity of your storage? _____

Expected Commodity Prices:

What prices do you expect for :

	Farm Dried	Off Farm Dried	Farm Stored	Expected Yield
Corn	_____	_____	_____	_____
Soybeans	_____	_____	_____	_____
Wheat	_____	_____	_____	_____
Hay	_____			_____

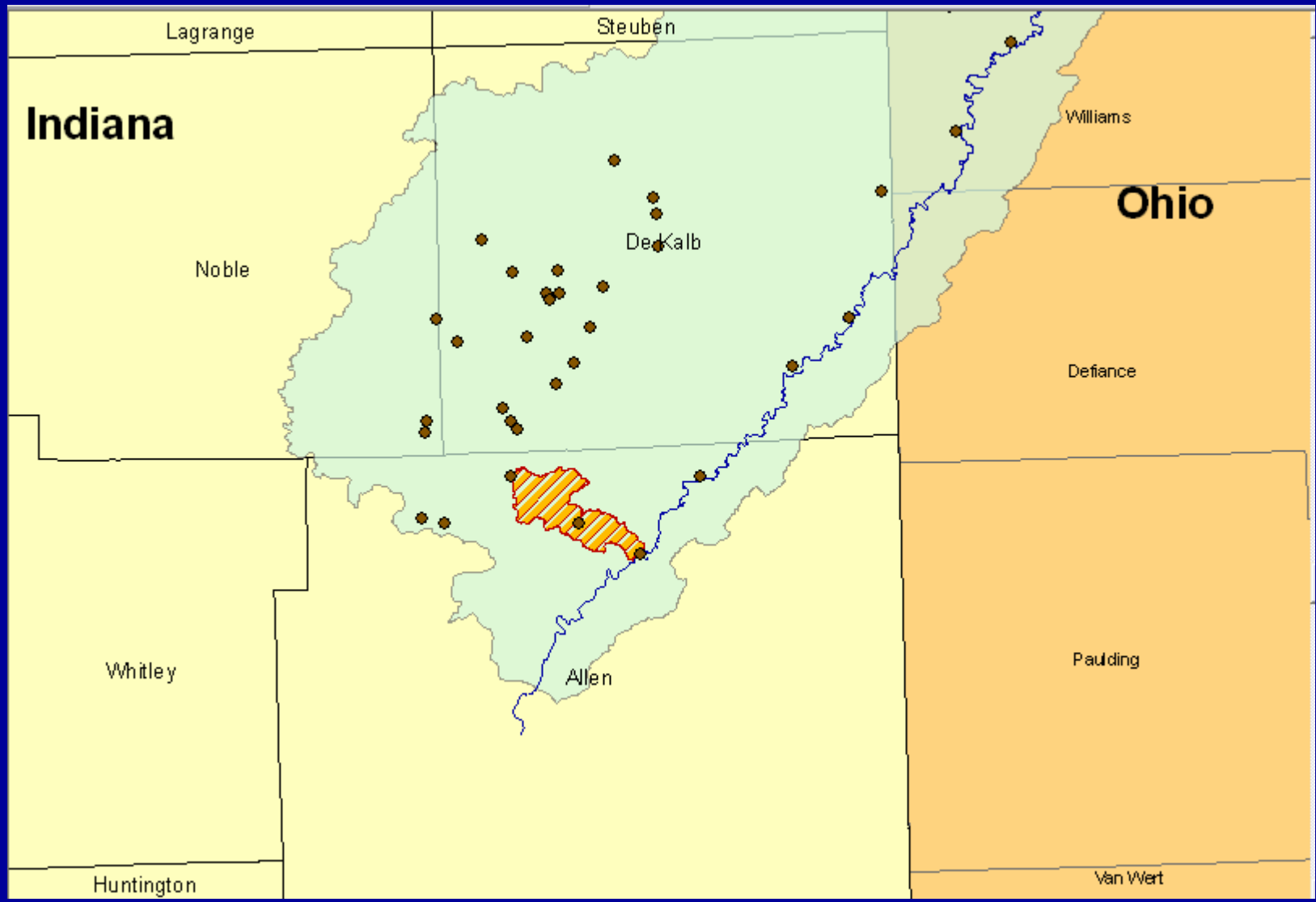
Machinery Resources:

For each field operation listed on the Field Record Sheet please indicate the following-

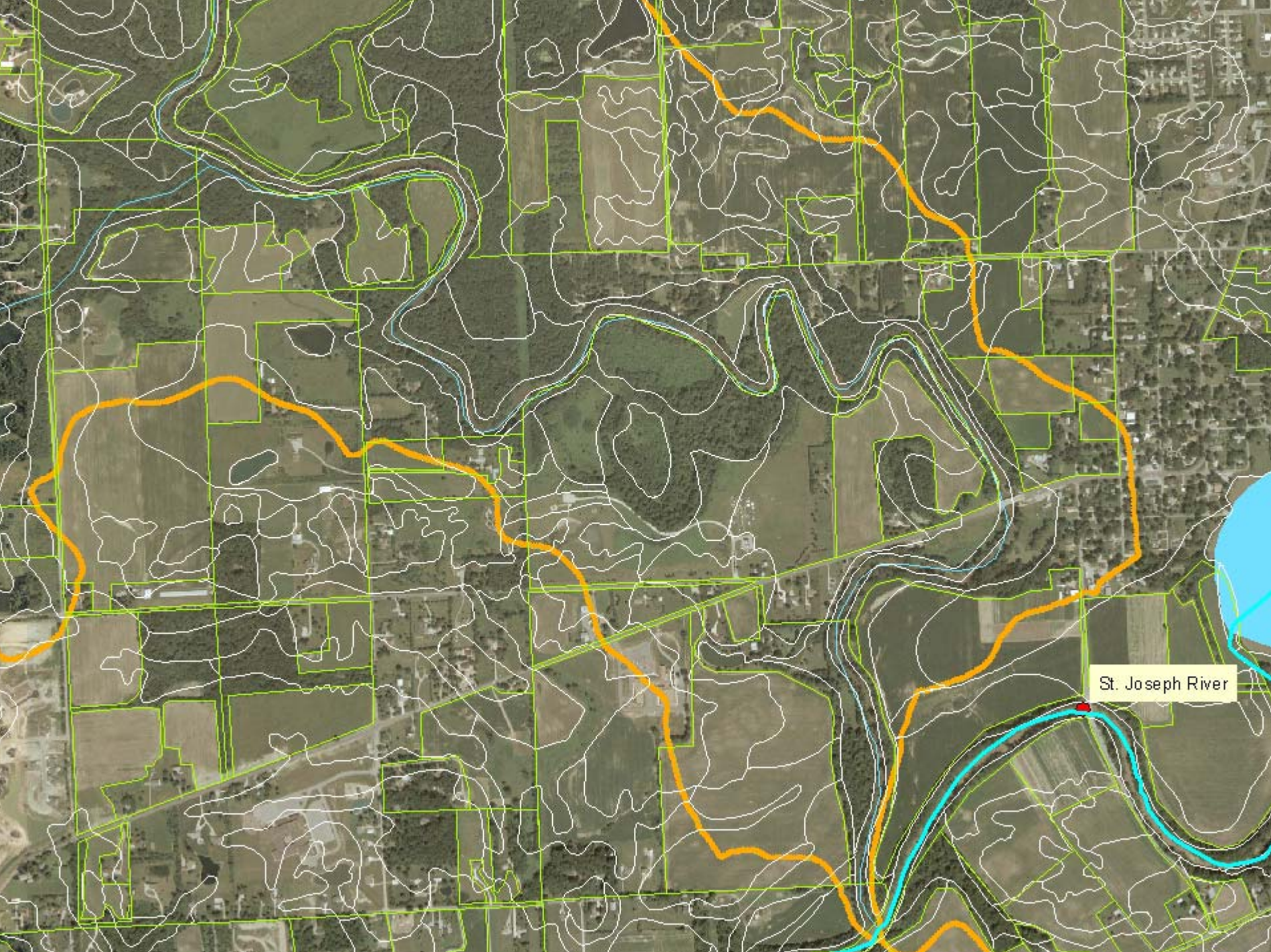
Operation	Size of Tractor	Labor Hr./ Machine Hr.	Hours Operation/ Day	Number
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

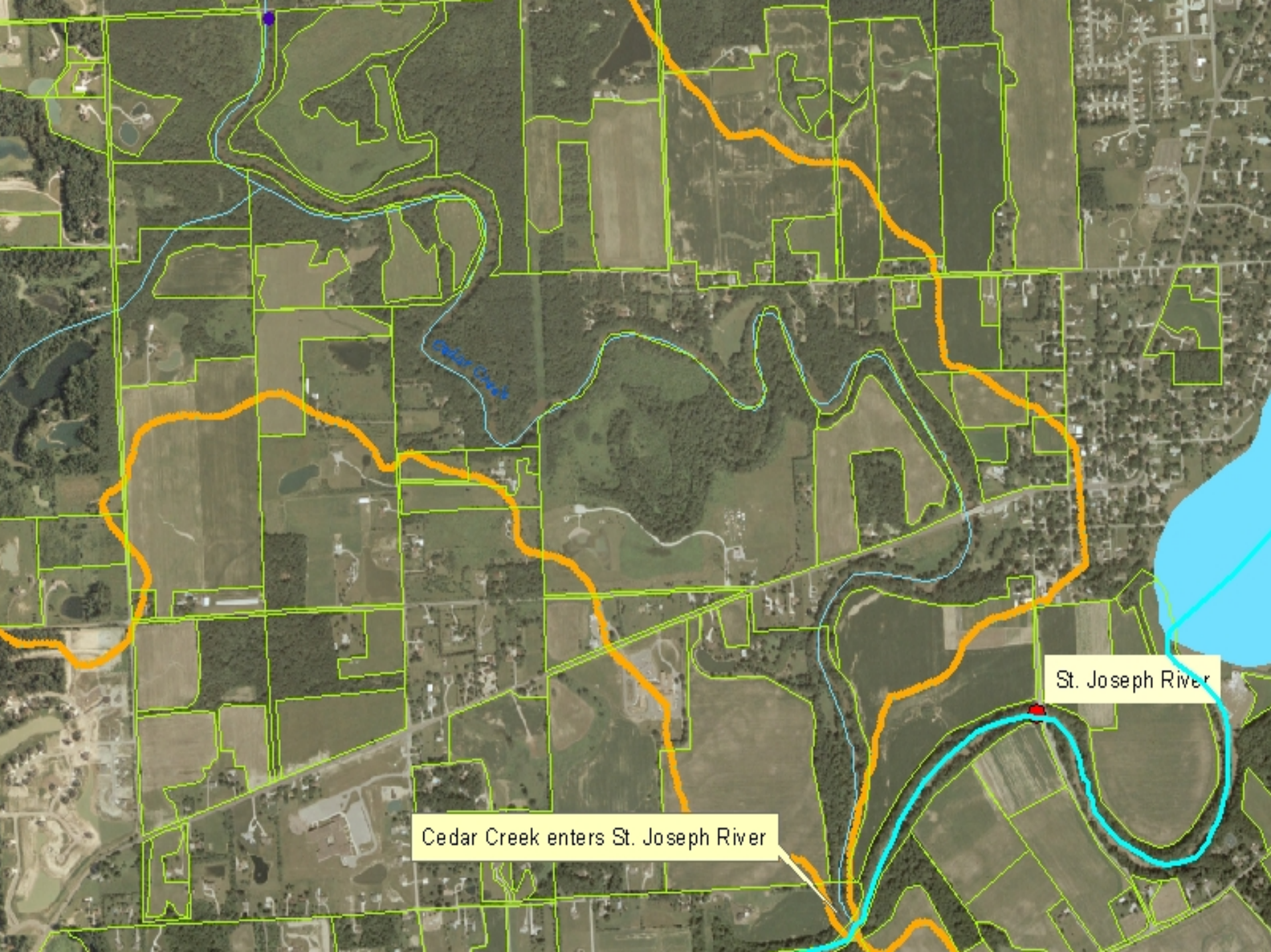
Large Tractors _____ # Small Tractors _____

Farm Level Model

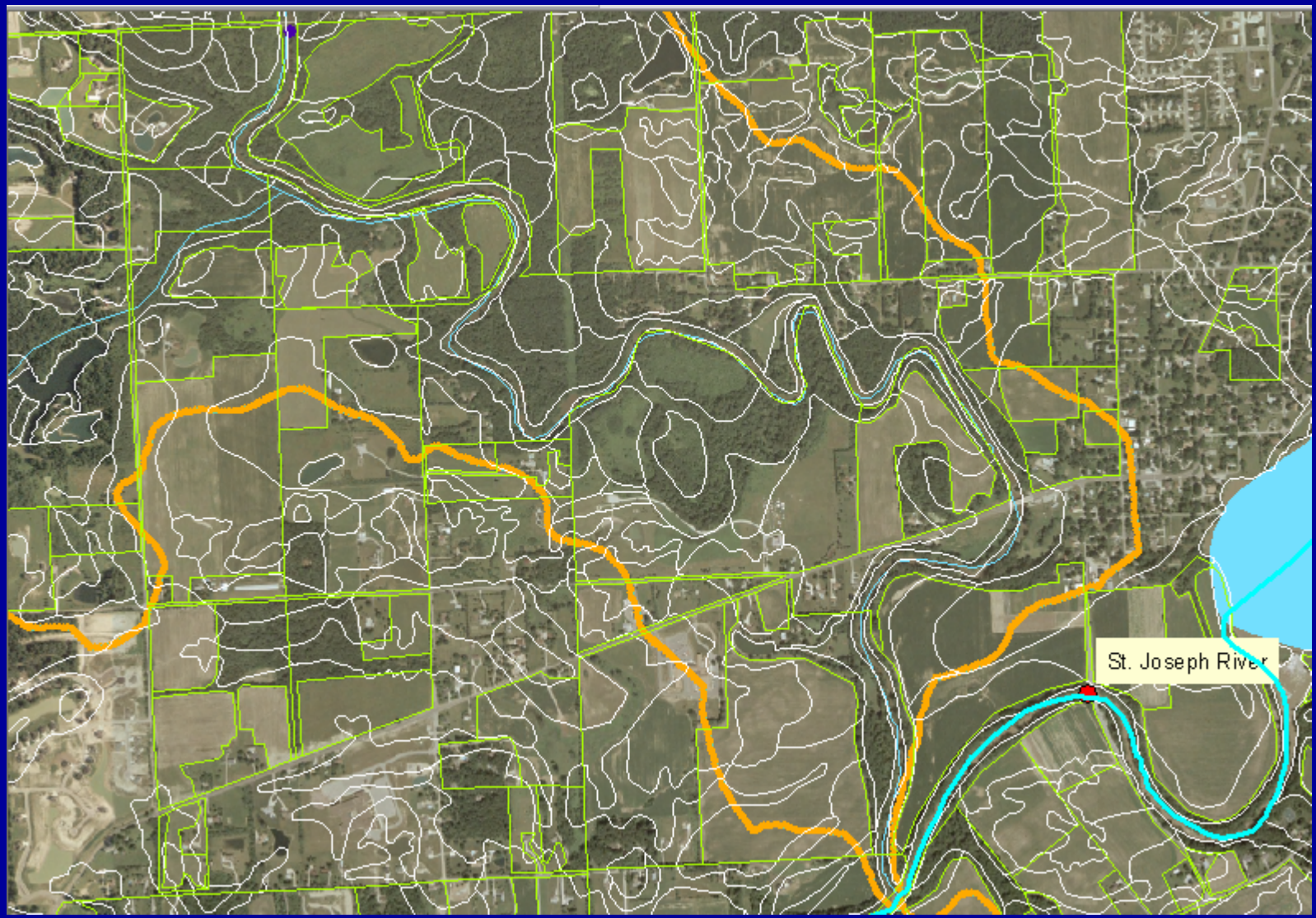


Farm Level Model


St. Joseph River


Cedar Creek
St. Joseph River
Cedar Creek enters St. Joseph River

Farm Level Model



Farm Level Model

- Once a sub watershed is selected, farm level models can be composed using data sets from various parties (primary data, NRCS, Allen Co. SWCD, USGS, etc.)
- We can use these models to capture farm level data from the Field Survey Sheet to better understand the land use practices in place on a per field basis

Government Payments

- It will be necessary to work with the NRCS/FSA to determine the best way to model commodity/ conservation subsidies on the farm level. We know who is getting subsidies and how much they are receiving but we do not know the scope of people who are not participating in government programs.

Top programs in Allen County, Indiana, 1995-2003:

(click to search by zip code or recipient name)

Rank	Program (click for top recipients, payment concentration and regional rankings)	Number of Recipients 1995-2003	Subsidy Total 1995-2003
1	Corn Subsidies	2,682	$31,842,757
2	Soybean Subsidies	2,402	$18,620,456
3	Wheat Subsidies	2,323	$12,477,856
4	Conservation Reserve Program	745	$6,332,334
5	Dairy Program Subsidies	91	$1,236,268

Top programs in De Kalb County, Indiana, 1995-2003:

(click to search by zip code or recipient name)

Rank	Program (click for top recipients, payment concentration and regional rankings)	Number of Recipients 1995-2003	Subsidy Total 1995-2003
1	Conservation Reserve Program	1,132	$23,510,861
2	Corn Subsidies	1,395	$18,224,808
3	Soybean Subsidies	1,100	$10,418,008
4	Wheat Subsidies	1,216	$5,245,584
5	Dairy Program Subsidies	50	$813,252

Costs of Conservation Initiatives

- We can determine the cost of conservation practices, such as buffers and waterways from the NRCS EQIP cost list in order to accurately portray them in the PCLP program

410	All Programs	Structure Grade Stabilization	Aluminum	NO	7500.00	AM	60
410	All Programs	Structure	Reinforced Concrete	NO	8000.00	AM	60
412	All Programs	Grassed Waterway	Grassed Waterway	AC	2500.00	AM	60
412	All Programs	Grassed Waterway	30ft. Wide	FT	2.05	AM	60
412	All Programs	Grassed Waterway	40ft. Wide	FT	2.24	AM	60
412	All Programs	Grassed Waterway	50ft. Wide	FT	2.73	AM	60
412	All Programs	Grassed Waterway	60ft. Wide	FT	3.10	AM	60
412	All Programs	Grassed Waterway	Erosion Control Blanket	Sq.Yd.	2.50	AM	60
561	All Programs	Heavy Use Area Protection	Gravel	AC	25000.00	AM	60
561	All Programs	Heavy Use Area Protection	Concrete	AC	60000.00	AM	60

PCLP Model

- PCLP is Purdue University's Crop and Livestock Linear Programming optimization model.
- PCLP was developed between 1992-94 by Dobbins, Preckel, Doster, and Han from the Agricultural Economics department at Purdue.
- This model will be used as the base for economic analysis when looking at the St. Joe watershed

- The model uses a whole farm perspective to account for important interactions among enterprises, identifying the combination of enterprises providing the greatest return to the available land, labor, machinery, and building resources.
- So basically we are looking at a mathematical model that optimizes return for the farm above everything else, using equipment, labor, timeliness, land usage, acreage size, livestock facilities, etc. as constraints to develop the optimal function.

PCLP Form

CROP OPERATIONS[1]

CCorn -- Corn following corn. (Crop #3)

Machinery Operations

	Machine Type ID No.	Use Page 7 Period Number: Beginning Period	Use Page 7 Period Number: Ending Period	Working Rate Acres Per Hour	Labor Hours Per Machine Hour
Land Preparation					
Planting	Yield adjustment set? 1 [1,2]				
	1 [1,2]			[1]	

	Machine Type ID No.	Job can begin weeks after plant	Weeks to complete	Labor Hours Per Machine Hour
Post-Plant				

- Generally this model has been used for:

-Alternatives for reducing labor bottlenecks that exist in the spring and the fall

-Best combination of enterprises relating to changes in commodity price

-Effect on profit related to changes in machinery

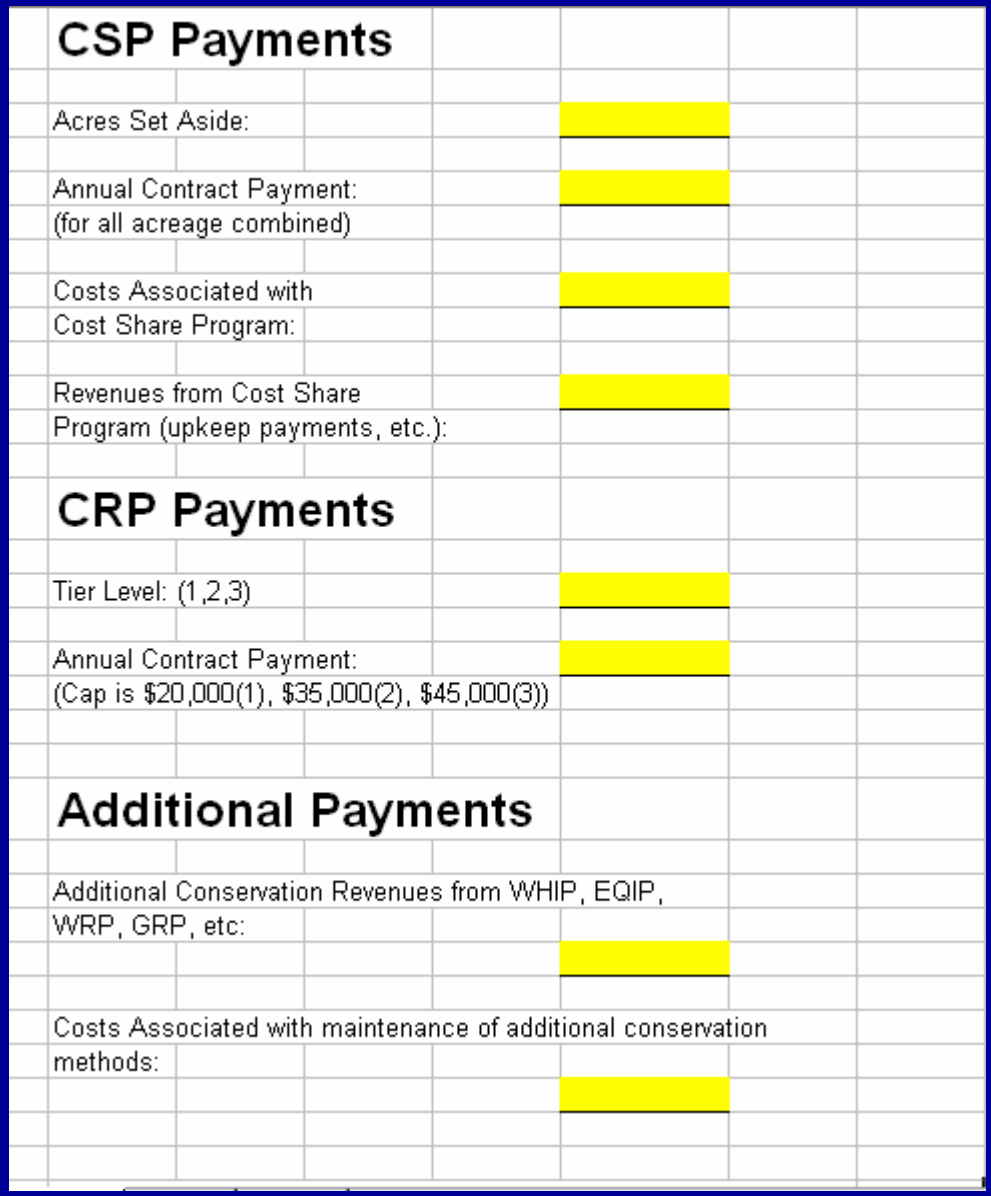
-Effect on enterprise mix of changing labor

-Effect of adding/reducing farm acreage

-Effect on profits of changing storage and livestock facilities

- Once representative farms are established this model will be used to predict how changes in farm inputs will effect the farmer’s profitability
- Currently I am working towards implementing a process to account for conservation payments and how those effect the optimization structure within PCLP

Payment Calculation Tools



CSP Payments

Acres Set Aside:

Annual Contract Payment:
(for all acreage combined)

Costs Associated with
Cost Share Program:

Revenues from Cost Share
Program (upkeep payments, etc.):

CRP Payments

Tier Level: (1,2,3)

Annual Contract Payment:
(Cap is $20,000(1), $35,000(2), $45,000(3))

Additional Payments

Additional Conservation Revenues from WHIP, EQIP,
WRP, GRP, etc:

Costs Associated with maintenance of additional conservation
methods:

Calculations

	Here are the payment calculations.	Corn	Soybeans	Wheat	Total
	Direct Payment Calculations				
1	Payment Rate	**0.28**	**0.44**	**0.52**	
2	Base Acres	**1**	**1**	**1**	
3	Direct Payment Yield	**115**	**39**	**54**	
4	Adjustment Factor	0.85	0.85	0.85	
	Total Direct Payments (1) X (2) X (3) X (4)	27.37	14.59	23.87	65.82
	Direct Payments per Base Acre	27.37	14.59	23.87	
	CCP Payment Calculations				
5	Target Price	**2.63**	**5.80**	**3.92**	
6	Direct Payment Rate	**0.28**	**0.44**	**0.52**	
7	Effective Target Price (5) - (6)	2.35	5.36	3.40	
8	*12-Month Marketing Year Price	**2.25**	**5.90**	**3.25**	
9	National Loan Rate	**1.95**	**5.00**	**2.75**	
10	Higher of (8) or (9)	2.25	5.90	3.25	
11	CCP Payment Rate (7) - (10)	0.10	0.00	0.15	
12	Base Acres (Same as (2) above)	1	1	1	
13	CCP Payment Yield	127	47	70	
14	Adjustment Factor	0.85	0.85	0.85	
	Total CCP Payments (11) X (12) X (13) X (14)	10.80	0.00	8.93	19.72
	CCP Payments per Base Acre	10.80	0.00	8.93	
	LDP Calculations				
15	Planted Acres	**1**	**1**	**1**	3
16	Actual Yield	**150**	**40**	**70**	
17	County Loan Rate	**1.98**	**5.10**	**2.50**	
18	Posted County Price on Exercise Date	**2.03**	**6.06**	**2.84**	
19	LDP Rate (17) - (18), if less than 0 then put 0 here	0.00	0.00	0.00	
	Total LDP Payment (15) X (16) X (19)	0.00	0.00	0.00	0.00
	LDP Payments Per Planted Acre	0.00	0.00	0.00	
	Total Payments	38.17	14.59	32.79	85.54
	Total Payments per Planted Acre	38.17	14.59	32.79	28.51

- I plan on incorporating these payment calculators into the PCLP model to show the effect of conservation payments on farm asset use, such as machinery, land, and labor.
- This information will be based on county averages taking into consideration that some farms will not be privy to government payments, developed in conjunction with NRCS/FSA

SWAT Modeling and GIS Applications

- Several researchers here at Purdue are using the SWAT model to examine the St. Joe area
  - It is imperative that we receive SWAT data on sedimentation and nutrient loads to be able to determine the environmental effects of our shocks
  - Additional GIS data has been obtained for the purpose of looking at land use in the watershed and mapping farm specific data from Field Record Sheet

Possible Shocks

- Our shocks will include:
  - Changes in Cropping Systems
    - No-Till, Conventional Tillage, Ridge Till
    - Row Crop Land Converted to Pasture
  - Changes in Input Levels
    - Adding/ Reducing Fertilizer application
  - Changes in Conservation Practices
    - Buffer Strips and Waterways
    - Tile Drainage
    - Irrigation

Incorporating Thesis Work into Long Term Goals

- This thesis project will tie into all three objectives, primarily the first one, by providing a base model for understanding the economic and environmental effects of changes in land use
- The economic model should give us a better idea of the optimum mixture of conservation benefit and economic gain

Additional Projects

- Undergraduate Honors Project on CSP
- www.choicesmagazine.org article highlights conservation gains and setbacks produced through Farm Legislation since the 1930's.

CHOICES

The magazine of food, farm, and resource issues

4th Quarter 2004

A publication of the American Agricultural Economics Association

History and Outlook for Farm Bill Conservation Programs

Zachary Cain and Stephen Lovejoy

Over the last 70 years, the United States Congress has taken on the task of determining how federal dollars will be invested in agriculture through farm bills.[1] The focus of

The Agricultural Adjustment Act began a time-honored tradition in American agriculture: the notion that it is necessary to control supply in order for farmers to receive a