

# PURDUE AGRICULTURAL ECONOMICS REPORT

DECEMBER 1999

## Responding to Financial Stress What are the Options?

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and Alan Miller, Farm Business Management Specialist*

**F**armers are currently facing significant financial and economic stress. Many are calling the situation a crisis. Others cite relatively high net farm income for all the nation's farmers as evidence that the severity is being overstated. There is some truth in both.

National net farm income is expected to be in the high \$40 billion to lower \$50 billion range in 1999. The exact level will depend on the extent of emergency appropriations from the government. If all of the approximately \$8.7 billion approved is paid to farmers by the end of the year, farm income could exceed \$50 billion and be the second highest on record after the nearly \$55 billion of 1996. However, government payments could represent as much as 47% of the total income of farmers, indicating that farmers are nearly as dependent upon government as they are on the market.

Lower market prices for farm products and, thus, lower incomes are generally blamed on reduced farm exports because of the Asian crisis. U.S. exports have declined 17% since they peaked in 1996, but only part of that decline is due to the financial and economic problems in Asia. Other contributors to the

reduction in U.S. farm exports have been a strengthening value of the dollar and increased (in fact, record) world production of farm products. Looking to the future, Asian economies appear to be recovering, but future economic growth is likely to be much more modest than the approximate 10% annual growth in gross domestic product during the decade prior to 1996. The value of the dollar with respect to other currencies is not expected to strengthen during the next year or two, which is neutral or possibly even positive for future export growth. But world production of agricultural products continues to expand, indicating that U.S. producers will continue to face intense competition in export markets. So the recovery in prices and incomes may be slow in coming (without a drought or other weather event) and the financial problems of the industry are likely to continue for the next couple of years.

**Types of Managerial Responses**  
Farm business managers can employ a number of specific strategies if their business is under financial stress. The strategies can be categorized into one of the three following basic types of managerial responses: 1) managing cash flow, 2) managing liabilities, and 3) managing assets.

Farm business managers can use the following strategies to increase

net income and manage cash flow in financially stressful times.

1. **Control cost:** This is a time to be even more vigilant in determining which inputs produce sufficient revenue to cover their cost. Any strategy to reduce costs in plant and animal production should be considered again – and with a sharper pencil.
2. **Renegotiate cash rents:** Rents are one of the largest cost items in crop farming and have some flexibility because they are often negotiated on an annual basis.
3. **Reduce capital spending:** It makes sense to be much more cautious in machinery and equipment purchases during periods of financial stress. This may be the



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time to repair rather than replace, and even if you replace, it may not be the time to buy excess capacity or up-grade.

4. Reduce family withdrawals: Many family expenses are difficult to cut back. Maybe you will have to postpone spending for big ticket items such as family vacations and car purchases. But be careful – come families cut too deep, particularly in the areas of health and medical insurance.
5. Increase revenues/thruput: do you have some assets that are not generating as much revenue as they might? Can you rent out

your storage facilities or your hog buildings to generate revenue? Can you use underutilized machinery to do custom work? Underutilized assets are particularly costly in times of financial stress.

6. Increase non-farm income: One way to bridge the gap in financially stressful times is to obtain income from non-farm sources. An off-farm job may not be what you want, but you should certainly investigate the option to supplement farm income from off-farm employment.

Farm business managers can use the following strategies to manage debt during financially stressful times.

1. Extend loan terms: A typical adjustment to reduce cash flow pressures is to negotiate longer repayment terms. Longer terms to repay will often reduce cash flow pressures, but remember that the debt must still be serviced and that this strategy does nothing to reduce cost or increase income. Extending debt servicing terms in many cases is a mechanism for “buying time” to make more fundamental changes in the farm business.
2. Re-amortize carry-over: One way to manage this carryover is to covert it into a longer term loan – say five years – and set up a payment schedule to systematically reduce it over a period of time.
3. Interest-only payments: In situations where a loan is well secured and the cash flow shortage is assumed to be temporary, your lender may accept an interest-only payment as an alternative to the full principal and interest payment required by the amortization schedule.
4. Increase collateral: This strategy again does little to relieve the root causes of financial stress. It does give your lender a stronger

financial position and raises your lender’s comfort level in case of default down the road, so it may relieve current intense financial pressure. But be careful to avoid assigning any more collateral than is absolutely necessary.

5. Acquire guarantees or contracts: Like increasing collateral, this strategy in essence increases the comfort level of your lender and consequently should increase his or her willingness to extend repayment terms or re-amortize collateral.
6. Reduce debt: Certainly one way to reduce financial stress is to pay off some of the debt and reduce the debt servicing requirements. The funds might come from non-farm earnings, other family members in the form of a gift or personal loan with attractive terms, or the sale of farm business assets.
7. Refinance: Have interest rates declined? If so, it might be possible to refinance some loans and reduce interest expenses. You need to compare the cost of refinancing with the savings in interest. This might be a good time to move variable rate loans to fixed rate loans in order to reduce the risk of any future interest rate increase.

Farm business managers can use the following strategies to manage assets during financially stressful times.

1. Liquidate cash/investments, and reduce debt: In essence, this strategy involves the use of cash and financial reserves that have been maintained in the farm business to reduce the debt load. But most farm businesses do not maintain substantial cash or liquid asset positions, so this strategy is typically not a realistic option.
2. Sell inventories, and pay down debt: Some farms have

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accumulated substantial inventories. Although selling inventories at depressed prices may not seem to be an attractive alternative, it may be a reasonable option, particularly if the stress is severe and if there are substantial storage and other carrying costs associated with carrying inventories. However, the entire proceeds received from liquidating raised products will often be taxed at ordinary income tax rates unless expenses or deductions are available elsewhere to offset this taxable income.

3. Sell capital assets, and reduce debt: As with selling inventories, the liquidation losses that might be incurred if capital assets such as land, machinery, and equipment are sold may be high, and this strategy also will likely reduce the long-term income-generating capacity of your farm business. Again, you must consider the tax consequences of such a sale.

### Selecting a Strategy

How do you choose among various strategies? Two possible scenarios are critical in choosing a strategy. The first is whether the source of the financial stress is external and of short-run duration. An example of this type of financial stress would be the unexpected reduction in income brought on by a decline in grain prices, because favorable growing conditions resulted in above average yields. While this change can have important implications for the cash flow of the farm business, continued strong demand, increased usage of commodities because of lower prices, and normal production levels the following year may allow grain prices to quickly recover.

This type of stress could also be brought on by a localized drought in which yields for the farm are depressed because of bad growing conditions for this year, but recover under normal weather the following year. In both cases, cutting the quantity of fertilizer applied, postponing capital purchases, or lengthening

repayment periods will help the farm business through these short-run events. These techniques buy time until prices improve or the economic environment recovers.

The second scenario is when the problem is of longer duration or is caused by problems internal to the farm business. In this case, strategies to buy time will likely not be effective. While the actions used to buy time will appear to work initially, financial problems will reappear later, requiring additional changes. In many cases, the adjustments that the farm manager will need to make when the problem reappears will be much more difficult.

While the problem in this second scenario might be caused by an external event, it can create problems internal to the farm business. In a new lower price environment, the farm business may no longer be generating a sufficient amount of revenue from its fixed assets. While cost cutting or debt restructuring can buy time, financial stress will likely reappear. A better solution to this problem would be finding ways for enhancing the thruput of the farm business. Increased thruput will increase the efficiency of the fixed resources and lower per unit fixed cost.

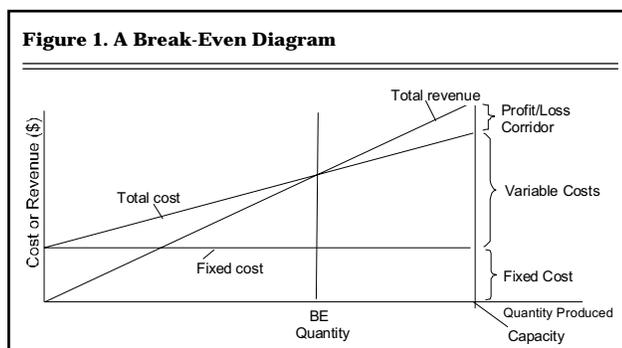
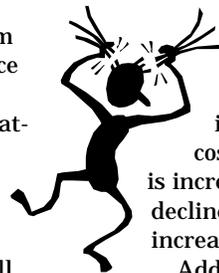
Strategies to manage income or cash flow through increasing revenue, reducing cost, or increasing thruput will not only reduce current financial stress, but will have long run benefits in terms of increasing

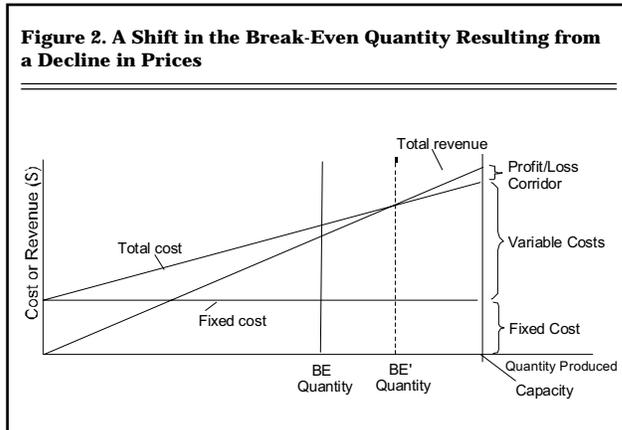
profitability or net margins in the farm business. But in many cases, these strategies are either not available or do not provide sufficient benefits to relieve financial stress. This leaves a strategy of selling assets. Selling assets may be very painful, but at the same time may be necessary to solve a serious financial stress problem.

A break-even diagram may be helpful in choosing among various long-term strategies (Figure 1). The horizontal axis in Figure 1 represents the quantity of production or the size of the farm business. The vertical axis represents the cost of production and the revenue from sales of production. There are two types of costs represented in Figure 1 – fixed costs and variable costs. Total fixed costs are the same regardless of the quantity produced. This is represented by the horizontal line in Figure 1. While total fixed costs stay the same as quantity is increased, fixed costs per unit will decline as the quantity produced is increased.

Adding variable cost to fixed cost provides total cost. Because total variable cost increases as the quantity of production increases, more production results in more cost. This causes total costs to increase in response to increases in the quantity produced.

As volume increases, total revenue will increase. Because per unit revenue must be more than per unit variable cost for the farm business to undertake production, total revenue will rise faster than total expenses.



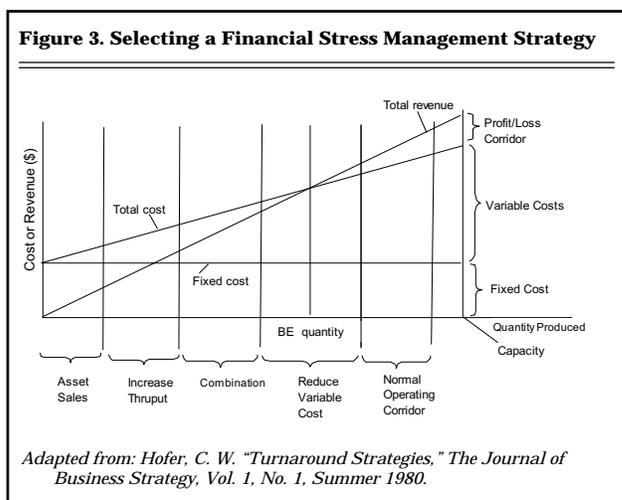


At some point, total cost will intersect total revenue. This is the break-even point (BE) for the farm business. At quantities of production to the left of the break-even point, the farm business is losing money. However, even below this break-even level, if per unit variable cost is less than per unit revenue, production helps to reduce the losses, so it makes economic sense to continue to produce. All quantities of production to the right of the break-even point (BE in Figure 1) provide a profit.

Figure 2 illustrates what happens to the break-even point in Figure 1 if there is a general decline in per unit sales prices. The total revenue curve tilts down, and the break-even point shifts to the right (from BE to BE'). Farms that were just breaking even before the price decline no longer break even and will feel pressure to

adjust. One possible adjustment would be to increase the quantity produced. For example, we might expect increased competition to rent ground as farmers' profits are squeezed by the increase in the required break-even volume. But is this the best alternative? What about making adjustments that will reduce variable costs and shift the break-even back to the left? Or what about selling off unproductive assets in order to shift the break-even point back to the left by reducing fixed costs and shifting the total cost line downward? Any or all of these alternatives may be preferable to bidding up rents for cropland.

Now let's use a break-even diagram to choose a strategy to manage financial stress (Figure 3). Near the break-even point, strategies for cutting variable cost to reduce financial



stress are preferred. Relatively small changes in variable costs may allow the firm to return to the break-even point or better. But further to the left in Figure 3, fixed costs (depreciation, interest, taxes, insurance, and family living) are an increasingly important part of total cost, so cost-reducing strategies become relatively less effective, and revenue-enhancing strategies – including increasing thruput – become increasingly more important. At some point (moving even further to the left in Figure 3), fixed costs, which cannot be reduced in the short term, become so dominant in the farm business that cost reduction and revenue enhancement are no longer effective and asset reduction or liquidation strategies are necessary. This appears to be when fixed costs are 40 percent or more of total cost. Clearly, resolving the problem before it becomes this severe is highly desirable. But if the fundamental financial stress is resulting from excessive depreciation, interest, and labor costs (i.e., fixed costs), there are only two ways to solve the problem: 1) spread those fixed costs over more revenue by increasing thruput, or 2) get rid of the fixed resources that are creating the high fixed costs.

It is possible to operate at less than break-even for some period of time. But in the long run, failure to achieve a cost-volume-profit relationship that allows the farm to break even on average catches up with the farm business. Then, the resources those farms controlled move into the hands of more profitable farms.

In many cases the root causes of financial stress are internal and have been long in the making before the symptoms become critical. The persistent inefficiency associated with too little volume or costs that are too high often goes unrecognized until it is too late. One of the most important rules of financial stress management can be summed up in the simple but powerful equation: early recognition = early resolution. Certainly the resolution is generally much easier and less painful when financial problems of this type can be nipped in the bud.

# Recreation Demand at Indiana State Parks

Jeremy Emmert, Undergraduate Student and Gerald Shively,\* Assistant Professor

## Introduction

**T**he use of public resources to expand state park systems is an important economic policy issue. Many U.S. states have extensive park systems designed to serve outdoor recreation needs. In recent years, however, public officials have begun to express concerns regarding growing populations of outdoor enthusiasts, high rates of visitation, and perceived crowding during peak periods of park use. This has led many states to consider adding new parks or expanding existing parks. Indiana is currently in the process of establishing a new 3,000-acre state park that will be located near Lafayette, in the north central part of the state. The Prophetstown state park will encompass approximately 2,770 acres of an early Native American Settlement and is designed to preserve the cultural and historic heritage of the area, as well as provide a site for recreation. The park will include a "Living History" farm, patterned on a typical Indiana farm from the 1920s.

In the early 1990s the Indiana Department of Commerce completed a fiscal impact study for Prophetstown. The study specifically examined impacts of park establishment on the state budget and projected a

net gain in income for the state budget following park construction. However, the study examined neither the likely profile of visitors to the new park nor the potential impact of the new park on rates of use at existing parks. In response, we set out to measure patterns of demand at three popular state parks, and to provide analysis of the possible impacts of a new park on visitation rates at those parks.



We first constructed a demand curve for park visits using standard statistical techniques.\*\* we then measured the relative importance of various factors on rates of park visitation, and investigated three specific questions. One, do parks serve primarily local needs? Two, are parks used equally among state residents, regardless of income level? And three, to what extent do visitors substitute among parks? This final question aimed to clarify whether visitors might reduce rates of visitation at existing parks in order to visit Prophetstown upon its completion.

## Park Survey

Data used for our study came from surveys that we conducted in

October 1998 and April 1999 at three state parks: Shades, Turkey Run, and McCormick's Creek. All of these parks are popular destinations, and experience some degree of crowding during peak periods of use. Brief written surveys were completed by a random sample of adult park visitors. Information collected included town or city of origin, size of group, household income, reason for visiting the park, and frequency of visits to a list of Indiana state parks.

## Findings

Table 1 summarizes some of the main data collected in the survey. A total of 168 individuals responded to the survey. Respondents reported an average of 5.5 annual visits to Indiana state parks, and an average of 1.7 annual visits to the park at which the survey was completed. In other words, repeat visits within the park system appear to be very common. Although most park visitors were Indiana residents, the average distance traveled to reach the park was high. On average, visitors traveled 86 miles to visit a park. Approximately 30% of visitors came from within a 50-mile radius of the park at which a survey was completed. People who lived near a park had higher rates of park visitation than those who lived farther away. Median household income among respondents was \$46,417.

\* This article summarizes research from Jeremy Emmert's undergraduate honors thesis in the Department of Agricultural Economics. The thesis, entitled "Income and Substitution Effects in the Travel Cost Model: An Application to Indiana State Parks" was selected as the best undergraduate paper in the country at the annual meetings of the American Agricultural Economics Association, which were held in Nashville, TN, August 9-11, 1999. Dr. Gerald Shively, an assistant professor in the department of agricultural economics, was his thesis advisor.

\*\* To conduct our analysis we developed a "travel cost model" of park demand. Travel cost models are widely used in recreation studies to relate visitation rates at existing parks to travel distance, household income, and park characteristics. The idea behind the travel cost model is that the distance a person travels to a recreation site is an indirect indicator of the value the visitor places on the recreation site. In the travel cost model, park visits are interpreted as commodities that a person "purchases" with his or her time. One advantage of using this method to measure economic benefits is that it is based on economic data derived from observed behavior rather than from responses to hypothetical questions, as are sometimes used.

**Table 1. Summary of survey data from park visitors**

Number of visitors surveyed	168
Average annual number of state park visits reported by respondent	5.5
Average annual number of visits to park where surveyed	1.7
Average distance traveled to the park (one way, miles)	86
Median household income of visitor (\$1998)	\$46,417

**Figure 1. Relationship between travel distance and park visitation**

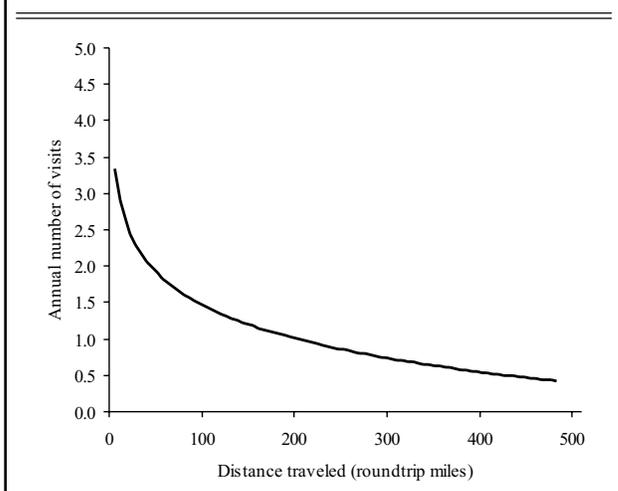
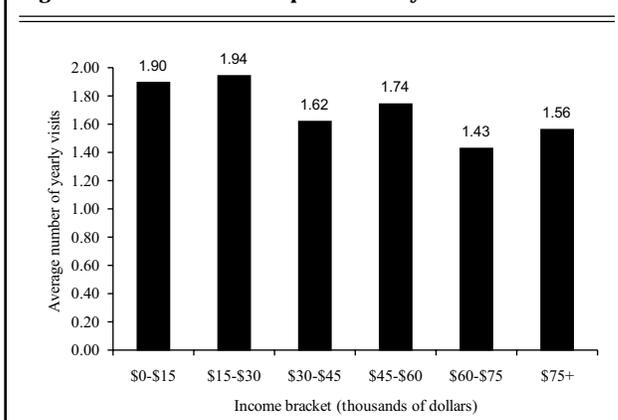


Figure 1 shows the relationship between distance traveled and reported rates of visitation. The graph indicates that visitation rates fall off sharply as distance to the park increases. We found that this negative correlation between travel distance and number of park visits was both statistically significant and robust to inclusion of other variables in the analysis. The importance of distance was further confirmed by data showing that visits to parks tended to cluster in proximity to origin. This general pattern was represented at all sites studied and confirms that while it is by no means exclusively true, parks do tend to serve local recreation needs. Hiking,

which was the most common reason noted for a park visit, was reported by 69% of respondents. Wildlife observation, the second most frequently cited activity, was reported by 27% of respondents. One-third of respondents reported overnight visits.

Our data show that the median household income in the sample (\$ 46,417) exceeded median household income in Indiana as a whole (\$ 35,147 in 1996). While on the surface this suggests that parks may serve upper income groups more than lower income groups, we also discovered that overall *rates* of park use were higher in lower-income groups. For example, Figure 2

**Figure 2. Annual number of park visits by income**



illustrates the relationship between annual household income in the survey and the reported number of park visits. As the chart indicates, there was a tendency in the data for average visitation to decline as incomes rose. In short, we found that while individuals and families from upper-income groups are more likely to visit parks, those from lower-income groups tend to visit more often. Although a visitor in our survey was about twice as likely to be from the top income bracket as from the bottom income bracket, controlling for distance traveled and number of annual visits, high- and low-income residents were roughly equally likely to make a park visit. Our conclusion is that the benefits of state parks appear to be distributed equitably among state residents.

Our final investigation focused on the likely use of Prophetstown, and the potential impacts of Prophetstown on rates of use at existing parks. Unlike the results reported above, which are based on observed rates of visitation, our investigation at this stage relies on responses to hypothetical questions. Our survey gave a brief synopsis of Prophetstown park, and asked respondents whether they would be likely to visit the new park. Table 2 summarizes our findings. Although a relatively small proportion of visitors (25%) had heard of the planned park before taking the survey, 90% of respondents reported that they would be likely to visit it. Moreover, of those who said they would visit Prophetstown, 95% said they would visit the park in addition to the park where they were filling out their survey. Only 5% said they would use

**Table 2. Knowledge and likely use of Prophetstown state park**

Percentage of respondents that had heard about Prophetstown park	25%
Percentage that reported they were likely to visit Prophetstown park	90%
Percentage that would visit Prophetstown park instead of park at which survey was conducted	5%

Prophetstown as a substitute for the park they were visiting. Based on the reported data, we found that if the 5% of respondents who said they would substitute Prophetstown for the park they were attending had actually made the substitution, their average travel distance to the park would have decreased by 43%. This supports the idea that a major factor conditioning park visitation is travel distance. In fact, we found that in terms of overall statistical and economic importance, distance was far more useful in explaining rates of park visitation than was income. These results suggest policy makers should always consider the

importance of population centers and highway access when siting new parks, since lower distances and lower travel costs are correlated with higher rates of visitation.

Based on the results of our survey, it seems likely that Prophets-town could become a frequently visited park upon its completion. Furthermore, based on our findings from the survey, we believe the new park may help to reduce congestion at nearby state parks, albeit by a small amount. Finally, given current patterns of use, the establishment of Prophetstown state park is unlikely to reduce the overall importance of

existing parks for residents of the state.

**Further reading**

Emmert, Jeremy. 1999. "Income and Substitution Effects in the Travel Cost Model: An Application to Indiana State Parks." Undergraduate Honors Thesis. Department of Agricultural Economics, Purdue University.

Indiana Department of Commerce (IN DOC). 1992. "An Assessment of the Potential Impacts from the Establishment of the Proposed Prophetstown State Park." Research Office, Indiana Department of Commerce.

**Estate & Business Transfer Planning: Individuals, Spouses, and Family Businesses**



**Part I: March 15, 2000; 7:00 p.m.- 9:30 p.m. Part II: March 22, 2000; 7:00 p.m.- 9:30 p.m.**  
**Bartholomew County-Purdue Cooperative Extension Office Meeting Room**  
**1971 State Street, Columbus, IN**



**T**his two-part series is sponsored by the Bartholomew County Cooperative Extension Service and the Department of Agricultural Economics at Purdue University. Topics for this program are intended for individuals, their spouses, adult children especially owners of interests in closely-held businesses. Professionals who assist others with their estate and financial planning needs are encouraged to participate. The instructor has applied for CE credit for insurance agents, and CLE credit for lawyers. Indiana accountants may obtain five hours of CPE credit.

The lecturer is Gerald A. Harrison, an Extension specialist and member of the Indiana Bar. Dr. Harrison has studied and lectured on estate planning in Indiana since 1972. Besides research, teaching and writing for the Extension Service, he has taught three courses at Purdue: Estate and Financial Planning,

Federal Income Tax and Agricultural Law. You may contact him at 765-494-4216 or by E-mail: <harrison@agecon.purdue.edu>.

**Part #1 March 15, 7:00 - 9:30 p.m. Topics: Planning Goals and Objectives, Property Ownership Law and Implications for Estate Planning; With and Without a Will, Avoiding Probate, Probate, Introduction to Federal Estate and Gift Taxes and Indiana Inheritance Taxes with Recent Changes.**

**Part #2 March 22, 7:00 - 9:30 p.m. Topics: More on Federal Gift and Estate Taxes Including Special Valuation of Farmland and the new Family-Owned Business Interest Deduction, Estate Planning with Living Trusts; Choices for Closely-Held Businesses, Buy-Sell Agreements; and Charitable Planning Income and Gift and Estate Tax Planning. An Introduction to Conservation Easements.**

Course materials will be provided. **Pre-registration is required.**

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**Registration Form**

**Must be received by March 12, 2000**

The fee is \$20 per individual (\$30 if for professional continuing education (CE) credit—there is a \$10 additional fee for each CE certificate, beyond the first) and \$5 for a registered individual's spouse. Please make a check payable to: Bartholomew  
*Please register me (us) for the March 15 & 22, 2000*

*County Extension Education Fund.* You may register by mail or at the Bartholomew County-Cooperative Extension Service Office, Monday-Friday, 8:00 a.m.- 4:00 p.m. Phone: 812-379-1665. E-mail: <jon.cain@ces.purdue.edu>.  
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 \* \_\_\_ I require auxiliary aids or services because of a disability. Contact program host, Jon Cain, Phone: 812-379-1665.

# GPS Based Guidance Systems for Farmers

*Jess Lowenberg-DeBoer, Professor*

## Introduction

**G**lobal Positioning System (GPS) guidance for ground based application equipment in agriculture is being adopted rapidly. Among other benefits, these systems help operators reduce skips and overlaps in applying fertilizer, pesticides and other inputs. In the last two years, use of the GPS guidance for ground equipment has gone from almost nothing to about 5% of all custom fertilizer and pesticide application equipment in the U.S. Crop producers are also starting to use the systems.

"It is our hottest item right now," said Curtis Schaben, Ag Leader, Ames, Iowa. "Especially for larger operators, with large areas of drilled soybeans. Many already have GPS to use with yield monitors. They are looking for other GPS uses."

"We also sell a lot in Western Canada where fields are large and air seeders are popular. It can be very dusty there at seeding time and the GPS keeps them on track in the dust."

GPS guidance systems can be used for all types of agricultural operations: planting, spraying, fertilizer spreading, tillage. Potentially, they replace the foam and disk marker systems now used to guide operations.

In its most basic form GPS guidance is a horizontal "lightbar" in a plastic case 12 to 18 inches long linked to a GPS receiver. The operator watches a bar of light. If the light is on the center line the machine is on target. If a bar of light extends to the left, the machine is off the swath to the left and needs to be corrected. If a bar of light extends to the right, the machine is off to the right. The lightbar can be mounted inside or outside of the cab. Similar GPS guidance systems have been used for aerial application since the early



1990s. While innovators in the use of GPS guidance for agriculture often have experience in using GPS for variable rate application and yield monitoring, GPS guidance is often used just to improve accuracy and speed of uniform application.

More advanced systems have a screen showing the swath of the machine as it moves through the field. Early models only allowed straight line parallel swaths, but now software is available for any contour. Areas covered with previous swaths are marked on the screen. These systems have the capacity to generate "as-applied" maps showing what part of the field was covered and the application pattern.

## GPS vs. Foam Markers

GPS guidance potential advantages include:

- Accuracy at higher speeds.
- Works with spinner spreaders.
- Provides effective guidance over growing crops where foam falls between plants.
- Allows operation when visibility is poor.
- Less affected by weather.
- Has lower recurring costs.
- Reduces operator fatigue and eye strain.
- Has lower set up time.
- Is not affected by wind or boom bounce.
- Reduces chemical use, by reducing overlaps.
- As-applied maps can be generated.
- Reduces need to enter already sprayed areas.

## GPS Guidance Cost

The most frequently mentioned disadvantage of GPS guidance is the up-front cost which ranges from about \$3000 for a farmer who already has a GPS to over \$14,500 for a custom applicator. A basic system with GPS and lightbar can be purchased for about \$7000. According to Azbell the biggest differences between the farmer and custom systems are speed, screen display and the ability to provide as-applied maps.

"Some of the cheaper GPS guidance units that you see advertised are slow. It is like using a computer with 286 chips," Azbell said. "They are also strictly lightbar units, with no screen display or map making ability."

Foam marker systems purchase prices range from \$900 to \$2,800. According to Azbell speed is also an issue in foam systems. The lower cost foam systems are slower and work ok when application is done with a tractor. Commercial applicators operating at 20 mph need more foam output than the lower cost systems can provide.

The useful life of the GPS units is hard to estimate because of the short period that they have been on the market, but Azbell said that he recommends that users try to recover costs in 3 years. Foam marker systems often last about 5 years or more, Azbell said.

"The GPS guidance system will work longer than three years, but by that time it will probably be obsolete," Azbell said. "It will still do everything you originally wanted it to do, but something much better will be on the market."

## Cost/Benefit Examples

Cost and benefits vary widely depending on the crop, acreage covered, swathing accuracy achieved and other factors. Table 1 provides examples of GPS guidance costs and benefits for two scenarios: a producer buys a whole system including GPS

and lightbar, and a producer who already has a GPS.

The examples show GPS guidance as increasing per acre costs. The per acre costs almost double for the producer who already has a GPS and for the producer starting from scratch guidance costs increase by a factor of six. This means that for many potential users the key to determining the profitability of GPS guidance is on the benefit side.

The benefits estimated in Table 1 focus on only the opportunity cost of sprayer operation and the cost of extra chemical and fertilizer. Azbell's estimate of the percentage overlap is used, 10% with foam markers and 5% with GPS guidance. For simplicity the example assumes that the operators are very cautious and make only overlaps, no skips. The machine cost of overlaps is estimated at the custom rate, \$4.40/a.

The estimation of the economic impact of skips is complicated because the effect of crop yield varies by crop, the weed population and how long term weed seed bank effects are valued. A skip is much more costly in a higher value crop, such as sugar beet, potatoes, or seed crop, than it would be in bulk commodity corn, soybeans and wheat. If the skip occurs in a very clean field, the yield effect may be minimal, but in a heavily infested field the yield may drop to almost zero. Weed scientists suggest that the greatest economic effect of skips may be on

creating a seed bank that will lead to management problems in future years.

This is a conservative estimate of GPS guidance benefits, which does not include many of the advantages outlined above, shows that for the producer who already owns a GPS, use of GPS guidance is profitable. In this example, the producer who does not own a GPS would need about 2000 acres to breakeven. Sensitivity

testing shows that for the producer with a GPS, the breakeven acreage for the lightbar is only 600 a. Of course, relatively few 600 acre farmers already have GPS.

(The full report on the economics and adoption of GPS guidance is available on the Purdue precision farming web site at: <http://dynamo.ecn.purdue.edu/~biel/sitefarming/references.html>)

**Table 1. Cost and Benefit Examples for GPS Guidance and Foam Markers for Use by Producers.**

Item	Foam Marker	GPS Guidance	Lightbar Only
<b>Costs:</b>			
Purchase Price, \$	\$1000	\$7000	\$3000
Useful Life, years	5	3	3
Annualized Cost, \$/yr	\$264	\$2815	\$1206
Recurring Cost:			
Foam, \$/yr	\$336	0	0
Differential			
Correction, \$/yr	0	\$800	0
Annual Cost, \$/yr	\$600	\$3615	\$1206
Annual Cost, \$/a/yr	\$0.20	\$1.20	\$0.40
<b>Benefits in Reducing Overlap:</b>			
Percent of Area Overlapped	10%	5%	5%
Overlap Acres	300	150	150
Opportunity Cost Sprayer Operation			
\$/a	\$4.40	\$4.40	\$4.40
\$/yr	\$1320	\$660	\$660
Extra Chemical and Fertilizer, \$/yr	\$3000	\$1500	\$1500
Overlap Cost, \$/yr	\$4320	\$2160	\$2160
Overlap Cost, \$/a/yr	\$1.44	\$0.72	\$0.72
GPS Net Benefit		-\$0.29	\$0.52

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# Private Property: Rights, Responsibilities, & Limitations

*Jesse J. Richardson Jr.,\* Assistant Professor in the Department of Urban Affairs and Planning at Virginia Tech and Gerald A. Harrison,\*\* Extension Economist*

**P**roperty rights are a concern for many landowners and are on legislators' agendas even more now than in the past. In particular, property rights in land prompt much thought and debate in today's political climate. Many property rights issues arise in the context of agriculture. This publication addresses frequently asked questions about property rights in land in order to dispel myths and misunderstandings and generate thoughtful discussion.

## **I can do whatever I choose with my land, right?**

Yes, but within limits. Ownership of land extends from the sky to the lowest depths of the earth. The law holds property ownership in very high regard. Although landowners generally may do what they please with their land, there are limits on absolute ownership. Landowners are prohibited from using their property in a fashion that may injure their neighbors.

Property rights in land are often described by being compared to a bundle of sticks. Each stick represents a right. Each stick may be separated from the rest of the bundle. For instance, a landowner may rent his land to one person to farm and transfer the underground mineral rights to another entity. The landowner in this situation still holds other sticks in the bundle (like the right to sell the land), though a sale may be subject to rights extended to others.

In all circumstances, government agencies at the local, state and federal level hold other rights such as the right to tax. Some sticks in your



neighbor's bundle, like the right to use her property in a beneficial fashion, may also affect your property.

## **How do you determine which land uses "injure" the neighbors?**

Just as a property owner possesses rights to use his property, he also holds rights to prevent others from using their land in a manner that harms him or his property. "Nuisance" describes a situation in which one landowner is using his property in a way that unreasonably limits the use of his neighbor's land.

A "private nuisance" interferes with a relatively small number of people in their use of land. For example, if one neighbor plays her radio very loudly, especially during times that others sleep, that may constitute a private nuisance.

A "public nuisance" causes distress to a large number of persons (an entire neighborhood or community) in the use of their land. For example, a cement factory, which discharges large amounts of smoke and dust, may amount to a public nuisance.

## **Who decides whether a particular activity is a nuisance?**

The first step in deciding whether a landowner is injuring his neighbor is a complaint by the neighbor. Property rights depend in large part on whether persons are being good neighbors. The preferred way to resolve property rights disputes is to talk to your neighbor *before* you engage in an activity that may be offensive. If neighbors cannot agree, the offended neighbor may file a nuisance lawsuit. Then, a court will decide the issue.

## **How does a court decide whether an activity is a nuisance or not?**

In determining whether one landowner's use of land is an "unreasonable" interference of another property owner's use of land, the court must weigh many factors. On

the one hand, the court must consider the extent of the harm, the character of the harm, the type of use being interfered with, and whether the use interfered with is appropriate to the area. On the other hand, the court must consider the benefits (income to the landowner, jobs, and tax revenue) provided by the offending use, whether the harm can be avoided with the continuation of the activity, and whether the offending use is suitable in that area. Courts balance these factors and consider other factors to resolve an issue.

## **What can courts do if they find a nuisance?**

If a nuisance exists, the court has options in deciding what to do. The remedies may include money damages and/or an injunction. Money damages compensate the landowner for the interference with the use of his property. If the court orders the offending activity stopped, then the damages may be only for past injury. If the court allows the activity to continue, the damages may cover past and/or future injury.

An injunction is an order from a judge to stop an activity or a command that a certain action may begin or continue. In the nuisance context, the judge most often orders the landowner to cease the nuisance activity. However, courts may combine damages and a partial injunction. A partial injunction would order the landowner to cut back the offending activity to a certain level. For example, if a judge found that a large hog operation was a nuisance, the judge may limit the farmer to a smaller number of hogs.

The law allows judges great flexibility in fashioning creative remedies. In an Arizona case, the judge ordered a large cattle feedlot to move, but made the developer of the adjoining residential subdivision pay for the move because the feedlot was there first. The solution to a

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nuisance case may involve a balancing process to be fair, similar to the balancing used to determine whether a nuisance exists.

### **Do zoning regulations affect property rights?**

Yes. The United States Constitution and court cases give government entities the power to pass laws to protect the health, safety, welfare, and morals of their citizens. This power is called the “police power.” Indiana and other states delegate this power, as it relates to land use, to local government units like cities and counties. With respect to land use, most local governments exercise their police powers through zoning ordinances. Zoning restrictions are intended to protect the health, safety, welfare, and morals of citizens.

Typical zoning ordinances divide the locality into districts. Within each district certain land uses are allowed, and certain other land uses are prohibited. The aim of typical zoning ordinances is to separate land uses. For example, all single family houses would be together and not beside a cement factory. Zoning laws are intended to avoid nuisances by prohibiting land activities that are potentially offensive to others. The United States Supreme Court has ruled that zoning ordinances may be valid exercises of the police power of state and local governments.

### **Can zoning prohibit me from putting a trailer on my property in which my elderly parents will live?**

Yes. Zoning may prohibit using property in the way in which you want or in the way that may be most profitable to you. The standard a court usually applies to determine whether zoning prohibitions are appropriate is the “arbitrary and capricious” standard. In other words, when local governments are acting to protect the health, safety, welfare, and morals of their citizens, the courts allow them broad discretion.

A court will usually overturn the local government’s zoning decision (for example, the denial of a request for a variance) if the decision is

unreasonable and not supported by any facts. A court will not interfere with a land-use plan simply because a landowner has identified a more profitable use than is permitted by the plan.

Courts will also determine whether a zoning ordinance is for the public good, rather than for private gain. If the ordinance is for private gain, it is not valid. Again, one must look not only at a landowner’s property rights, but how the exercise of those property rights will affect neighbors and the community at large. Property ownership entails not only private rights, but also obligations to the public.

### **What if the government takes some of my land to build a road or other government facility?**

Federal, state and local government agencies possess the power of eminent domain. An Indiana statute says private utilities may also possess the power of eminent domain for projects that benefit the public. Eminent domain pertains to the power of empowered agencies to acquire rights in private property to use for public purposes, even if the owner does not wish to sell. The Fifth Amendment of the United States Constitution provides that “. . . private property [shall not] be taken for public use without just compensation.”

Indiana’s as well as other states’ constitutions contain similar provisions. Any agency seeking to acquire private property rights for public use must follow steps in the law. Property owners may take action to insure fair compensation, or perhaps avoid the taking of their property in selected cases. Contact your lawyer or Purdue Extension for more information on eminent domain, condemnation and property rights.

The property owner must be paid a fair price. If the owner and the agency cannot agree on a price, then

a procedure exists for the court to set the price usually after testimony from professional appraisers and due consideration to both sides. Therefore, the government and other entities serving the public good may infringe on private property rights under legal procedures. The agency must pay an acceptable or objectively determined price.

### **Does the government have to pay when a regulation or law reduces the value of my property?**

Local, state, and federal governments may regulate land and land uses. Most members of society recognize this legal fact. However, just as the law places limits on the ability of landowners to use their land as they please, legal constraints exist on a government’s ability to regulate land. The question may well be framed as “How far is too far?” In other words, how much may a government regulation reduce the value of a particular piece of private property before a “taking” occurs? When a government goes “too far” in regulating private property, it must pay just compensation.

The courts have struggled to define the point where governments have gone “too far” in regulating property. If the regulation is not for a “public purpose,” the government must pay compensation. A regulation may not exist only to further private interest. Further, the requirements imposed by the regulation must be directly connected to the public purpose. Only on rare occasions does a taking result from lack of public purpose.

Two other situations automatically merit compensation for the landowner. First, when the regulation acts to physically invade private property, such as requiring a landowner to allow cable television wires on the landowner’s property, compensation must be paid. Any type of physical invasion is regarded, regardless of how small, warrants compensation.



Second, when the regulation makes a piece of property "worthless," compensation must be paid. "Worthless" in this context means no profitable uses exist after the regulation. A significant reduction in value may not entitle the landowner to automatic compensation.

If the regulatory taking does not fall into one of the categories mentioned above, a court considers the following factors to determine whether an unlawful taking has occurred:

- the economic impact of the regulation on the landowner;
- the landowner's investment backed expectations; and,
- the character of the government activity.

No hard-and-fast rules exist to guide either the court or landowners in applying these factors. However, two examples may help illustrate the concepts involved.

First, suppose that the state government passes a law to protect wetlands. The law prohibits anyone from building, farming, or conducting any other activity on a wetland or within 1,000 feet of a wetland. Suppose you own a piece of land that is primarily wetlands. After this law is passed, you cannot put a building anywhere on your land, farm the

land, or do anything with your land. In this case, the law has made your land worthless and an unconstitutional taking has occurred. The government must pay you for your land.

Now consider a situation in which you own farmland in Indiana. First it is zoned to allow you to use the property for offices or commercial purposes. Then it is rezoned so that now you may only build single-family dwellings. The land still retains value, so you may not assume that a total taking has occurred. The value of the land is much less than prior to the rezoning, however. In a suit for compensation, the court would have to balance the three factors listed above. A court would likely determine that no taking has occurred in this situation.

#### Conclusion

The law regards property rights very highly and jealously guards their sanctity. However, each landowner possesses the right to use his or her land in a reasonable manner. This right may be affected by a neighbor's use of his or her property. In these cases, where valid property rights of two or more persons exist, the respective property rights must be balanced to determine which right will prevail. A good neighbor policy of consulting with and giving advance notice to adjoining landowners can prevent many property rights disputes.

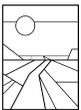
Similarly, the federal, local, and state governments may regulate land use. When there is a total or near total taking of one's property, the law provides for compensation at fair market value. A drastic reduction in the value of your land due to a new regulation does not automatically entitle a landowner to compensation. Property rights must be balanced against the needs, rights, and concerns of all parties involved.

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This information is available as ID-229. Additional references for this paper are available from Gerald A. Harrison. More land use resources are available at your Purdue Cooperative Extension Service Office.

You may obtain a reader entitled "Takings Law in Plain English," 47 pages, by sending \$4.00 (payable to Purdue University) to Gerald Harrison. Gerry Harrison's Ag Law Course Internet site includes several references for ag law topics such as "conservation easements," "lease law," "fence law" which may be accessed at: <<http://www.agecon.purdue.edu/academic/agec455/>>.

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