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Protecting Farmland From Development – How To Determine Which Lands Are Under The Most Pressure.

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Introduction

There is much interest in protecting existing agricultural economic bases in areas of rapid suburban sprawl by protecting farmland from non-agricultural development. Policy makers addressing such concerns need information about which lands are under the most pressure. This issue is receiving considerable attention from policy makers in Idaho.

Historically Idaho's economy has been driven by the utilization of land for agricultural (or other natural resource) driven industries. Consequently the value of land was dependent on its usefulness in the production of a commodity. As population increases, the demand for land-based amenities grows. This results in a substantial conversion of land from agricultural uses to non-agricultural uses.

In a paper presented at the Western Regional Science Association Meetings in February 2002, Vasquez, et al. made a case for utilizing income multipliers (IM's), defined as the ratio of market value of farmland to gross land rent from agriculture, to quantify the effects of development pressure on farmland values. Farmland values have two components: 1) agricultural value—value due to income producing potential as a result of direct agricultural production, and 2) a development value increment which is the difference in actual value of a parcel and its agricultural value. Because agricultural and development uses of land are mutually exclusive, the total value of the land must be equal to the total market value (agricultural value + development increment) of the land. Therefore, as development pressure increases, the IM increases, other factors remaining constant.

Vasquez, et al. determined that, for their study area in South-central Idaho, parcels of irrigated land sold from 1993 through 1998 with IM's greater than 20 (80 parcels) were from a different population than parcels with IM's less than 20. The variables that they found to be significantly related to values of parcels with high IM's were all nonagricultural variables such as population, proximity to roads and distance to towns; and the overall F test for their "best" model was quite significant (0.01). However, the goodness of fit for their best model was marginal (R^2 of only 0.43).

The objective of this paper is to follow-up on the research done by Vasquez, et al. by quantifying the development value increments implied by the IM's greater than 20 that they calculated, and determining whether these development value increments can be explained by development related independent variables. Good measures of development pressures on farmland (both relative measures such as IM's and absolute measures such as development increment values of specific parcels) should be quite useful to local government officials and decision makers with nonprofit entities who are working to preserve farmland and agricultural areas by use of such mechanisms as purchasable development rights, transferable development rights and farmland trusts. Also, such information should be of interest to land owners, appraisers, assessors, real estate brokers and developers.

Data

The basic data for this study were information on the 80 South-central Idaho irrigated parcels identified by Vasquez, et al. as selling from 1993 through 1998 with IM's greater than 20. These parcels were all located in a 75 mile (east to west) by 40-mile (north to south) area in South-central Idaho; commonly know as the Magic Valley (Figure 1). Data on these parcels were obtained from Farm Credit Services (FCS), from geographic information system sources at the University of Idaho and from the *2000 U.S. Census.*

Methodology

- Income Multipliers

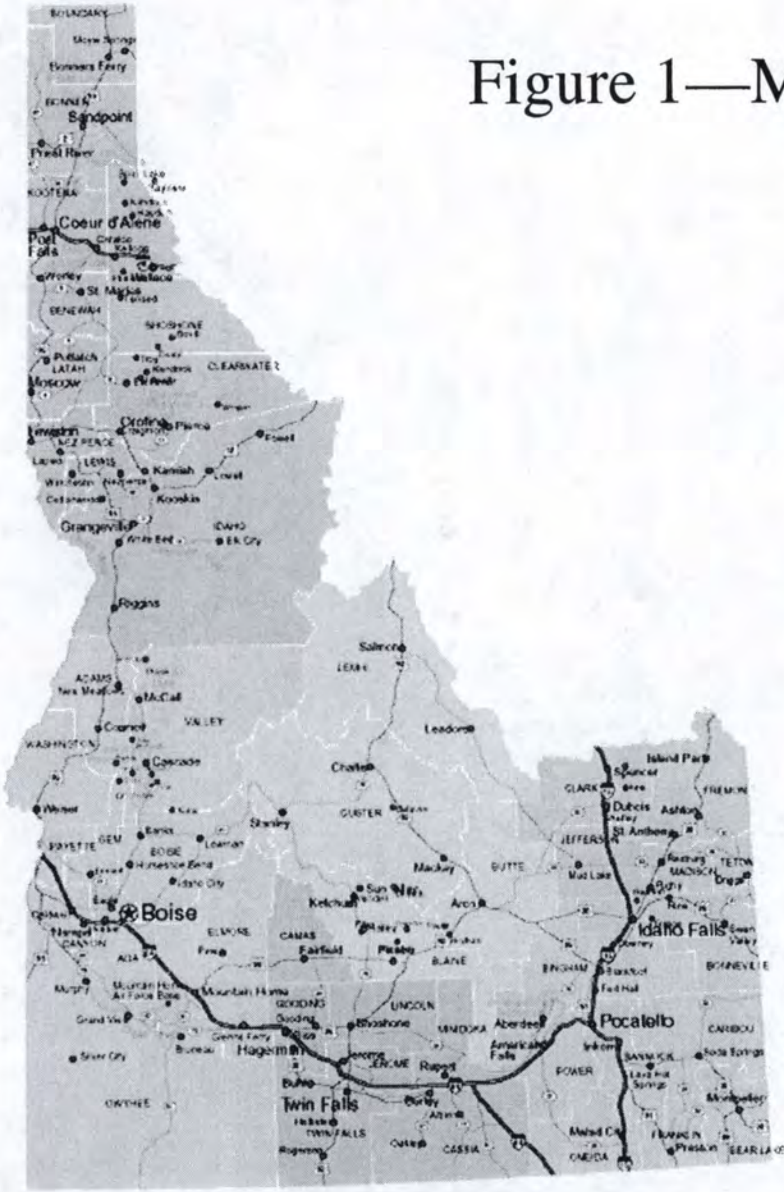
$$IM = \frac{P}{GI} \qquad \textit{(Eq 1)}$$

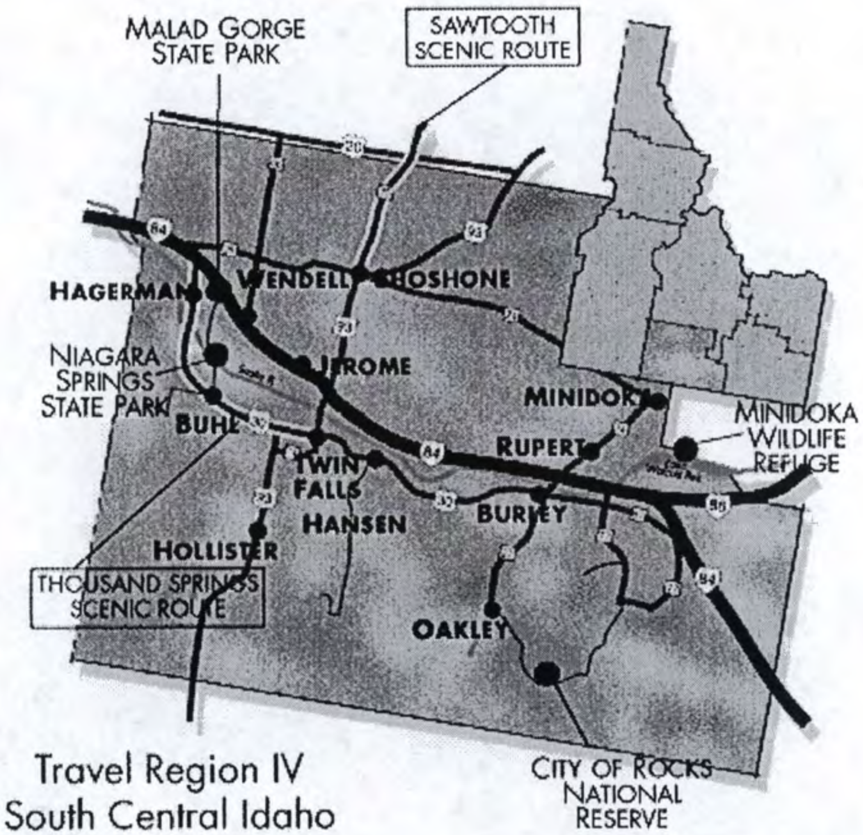
Where: IM-Income Multiplier, P-Sale Price, GI-Gross Income

Appraisers commonly use income multipliers to compare properties with regular and constant returns (especially rental housing and commercial buildings). They generally define income multiplier as the ratio between the sale price of a property and its effective gross income (Appraisal Institute, 1996).

Income multipliers are useful predictors because they are market derived and do not rely on personal judgment. If decisions of market participants are based on the same variables, then income multipliers of similar properties will have the same ratios. Also, future sales reflect past market activity, and income multipliers modify themselves

Figure 1—Magic Valley Area, Idaho.





over time. Nelson an Schumaker did a study of income multipliers for farmland in Canyon County, Idaho. They found consistency between high-income multipliers and areas with high development pressures and low-income multipliers and areas with low development pressures.

Parcels that had income multipliers (IM's) greater than 20 (indicating development pressure) were selected from the data set obtained from FCS for analysis in the study reported herein.

- Development Value Increments

$$DevInc = P - \left[\frac{P}{IM} * 20 \right] \qquad \textit{(Eq 2)}$$

This assumes that income multipliers of 20 or less are indicative of parcels that have only agricultural value. So, for parcels with income multipliers greater than 20, agricultural value can be calculated as gross income multiplied by 20. Then, since total price of a parcel is equal to agricultural value plus development increment, development increment equals parcel price less the gross income times 20, and development increment can be calculated as indicated in equation 2 (above).

- The Regression Model

Ordinary least squares regression techniques were used in this study to estimate a model with development increment as the dependent variable. This model can be specified as follows:

$$Dev\ (z) = IM\ (z1,\ z2, \ldots .\ zn) \qquad \textit{(Eq. 3)}$$

Development Increment (z) is a function of z characteristics determined by the interaction of agricultural and non-agricultural attributes of parcels. This model was used to estimate the impact on development increments of each of the parcel characteristics, *ceteris paribus*. A list of independent variables that were used in estimating the model and their expected signs is shown in tables1 and 2.

Table1. Regression Model Variables—Continuous

Symbol	Variable	Expected sign
Continuous Variables		
DevIncr	Parcel Development Incremental (dependant)	
SALEPR	Sale Price	(+)
DA41A43-RD	Distance to local/neighborhood road*	(-)
DISTA31-RD	Distance to Secondary Road/State Highway*	(-)
DA21A25-RD	Distance to Primary Road/ US Highway*	(-)
CLOSERD	Distance to closest road*	(-)
DISINTST	Distance to Interstate*	(+)
DIS>5000	Distance to town—population over 5000*	(-)
DIS2500-5000	Distance to town—population between 2500-5000*	(-)
DIS1000-2500	Distance to town—population between 1000-2500*	(-)
DIS500-1000	Distance to town—population between 500-1000*	(-)
DISTOAny	Distance to closest town (population - 500 or greater)*	(-)
ELEV	Elevation*	(-)
SLOPE	Slope of parcel	(?)
SOIL	Average land capability class**	(+)
POPU	County Population	(+)
POPDENS	Population Density	(+)
NIFARM	Net farm income by County	(+)

*Distances are measured in meters.

**Highest capability class for agricultural land is 1, and the lowest class is 7.

Table 2. Regression Model Variables—Discrete

Symbol	Variable	Expected sign
Discrete Variables (0, 1)		
IRRTYPE	Type of Irrigation (furrow or sprinkler)	(?)
Water	Presence of Water bodies	(+)
County	Located in—Cassia, Gooding, Jerome, Minidoka, or Twin falls County	(?)
YRSALE	Year of sale (1993, 1994, 1995, 1996, 1997 Or 1998)	(+)

Results

After each regression run, variables were checked for significance and correlation. As the model was run iteratively, variables not significant were eliminated, as were those that were highly correlated with more significant variables. This resulted in a simple but meaningful model final model (table 3).

Table 3. Summary Output

Regression Statistics				
Multiple R		.88174		
R Square		.777465		
Adjusted R Square		.768681		
Observations		80		
	Coefficients	Standard Error	T stat	P - value
Intercept	6569.641	7313.433	.0898298	.371864
SalePR	.172866	.01086	15.91798	6.51 E –26
CloseRD	5.005201	1.673654	2.990584	.003751
DISTOAny	- 1.50277	.734724	- 2.04536	.044281

The model yielded a highly significant F-test, implying an important interaction of the variables in the model. Not all of the signs of the coefficients were consistent with expectations. Proximity to roads had a positive coefficient. This indicates that development pressure is greater for parcels farther from roads than for those closer to roads, which was not consistent with expectations. However, the study area has many good rural roads (around almost every section). Also, the roads considered in the model are all paved, and most unpaved rural roads in the area are of very high quality, well maintained, and travelable in all seasons. Possibly being away from roads (by necessarily short distances) gives desirability to a parcel.

Anecdotal evidence (discussions with rural residents) indicated that such residents often prefer to live on a high quality, low traffic dirt road rather than near a paved road where there is more traffic moving at higher speeds. Given this information, it is possible that the appropriate sign for close to roads is positive.

A correlation matrix for the variables in the final model is presented in Table 4. In the model, distance to any road is highly correlated with distance to any town. This can be explained by the fact that, since roads lead to towns, and many people desire to live in or near a town, there is a higher occurrence of roads near towns. Because both variables were judged to be likely factors affecting development, they were left in the model to avoid possible biased estimators if eliminated.

Table 4. Correlation matrix of variables.

	SALEPR	CLOSERD	DISTOAny
SALEPR	1		
CLOSERD	-.0399	1	
DISTOAny	-.0696	.815188	1

This model states that, for an average study area parcel with an IM greater than 20, approximately 17.3% of its value is derived from non-agricultural factors. An increase in the distance of one meter from the nearest road will increase the parcel price by $5.00 or for every kilometer farther away from a road the parcel price will increase by $5,000.00. On the other hand, an increase of one meter from a population center of 500 persons or more will decrease the parcel price by $1.50 or for every kilometer farther away from town, parcel price decreases $1,500.00.

<u>Conclusions and Implications</u>

An econometric model was used in this study to determine the effects of development characteristics on values of agricultural lands that were thought to have development potential. Since agricultural use of a parcel and development of a parcel are mutually exclusive, the development value of a parcel that is valued at a level greater than its agricultural value is the market value of the parcel. The difference in the market value of a parcel and the agricultural value of a parcel is the development increment related to the development potential of the parcel. Of course, each of these values is, conceptually, a measure of present value of anticipated net returns (adjusted for risk).

In this study, values were estimated for development increments of irrigated agricultural parcels in a South-central Idaho study area. Results indicated that the value of development increments for agricultural parcels could be explained with development related variables such as distance to roads and distance to towns. The implications of such measures of development pressure on farmland should be quite useful to local government officials and decision makers with nonprofit entities who are working to preserve farmland and agricultural areas by use of such mechanisms as purchasable development rights, transferable development rights and farmland trusts. Also, such information should be of interest to land owners, appraisers, assessors, real estate brokers and developers.

Other analytical tools that should be useful to policy makers and others concerned with development of agricultural lands are income multipliers and other coefficients that measure development pressure (possibly ratio's of total parcel value to development increment value). The results of this study suggest that such coefficients can be used to effectively evaluate development pressure on farmland.

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