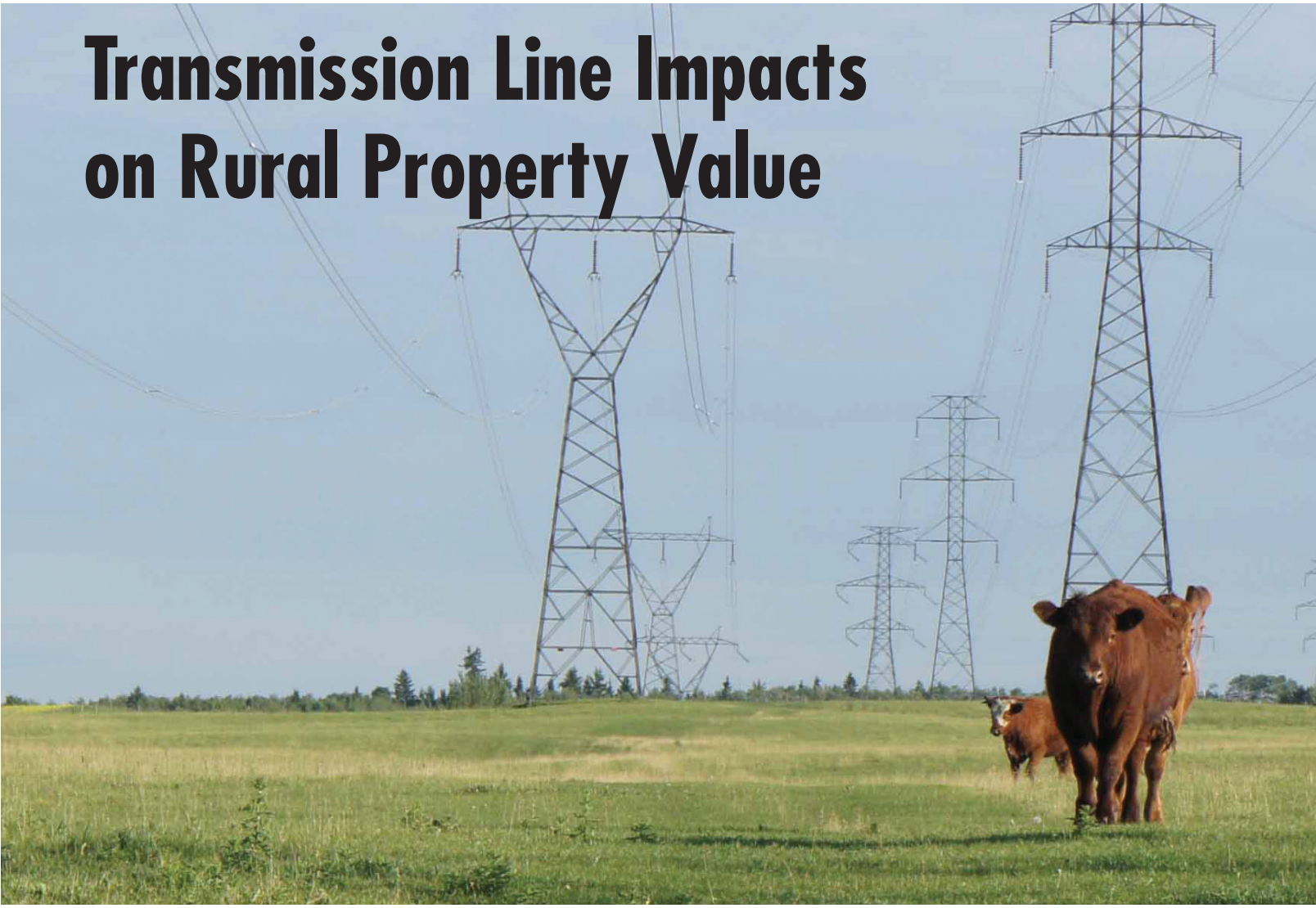
Transmission Line Impacts on Rural Property Value



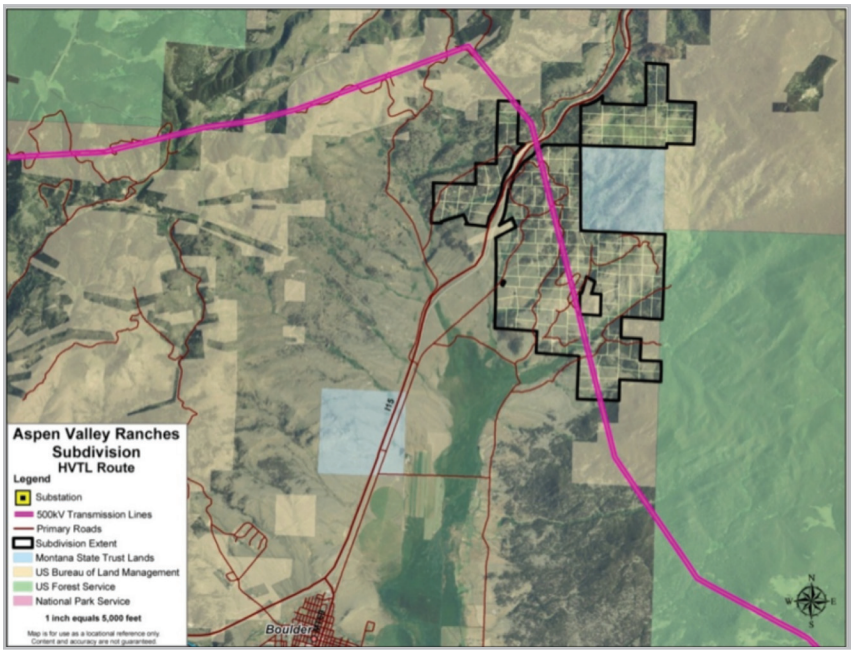
BY JAMES A. CHALMERS, PH.D.

Montana case study explores the variables

The impact of transmission lines on property value has long been the object of research and debate. The context of the historical discussion has generally been on developed residential properties in urban and suburban locations with the conclusion that the effects have been small or non-existent. The question remains whether this holds true in rural locations where land value is a much larger proportion of total property value and there is a combination of agricultural, residential and recreational uses.

The case study reported here investigates this question by analyzing sales in a rural subdivision in southwestern Montana that is crossed by 500kV transmission lines.

Figure 1: Aspen Valley Ranches Transmission Line Route



Aspen Valley Ranches Case Study

The Aspen Valley Ranches subdivision in Jefferson County, Montana, presented a unique opportunity to study the effects of high-voltage transmission lines on property values. The 156-lot rural subdivision lies on both sides of I-15 about 23 miles south of Helena and roughly four miles north of Boulder, Montana. Figure 1 shows a map of the subdivision and location of the transmission lines.

The lots are roughly 20 acres in size and are generally quite similar, although there is variability in terms of lot access, views, tree coverage, existence of riparian habitat and topography. The 500 kV lines bisect the development with 26 lots crossed by the easement. These attributes make the subdivision highly suitable for study using multiple regression analysis, a technique that has been widely recognized for its applicability to the investigation of whether high-voltage transmission lines systematically impact property values and if so, to what extent.

At the time lot sales began in 1986, the transmission lines were already in place. Although the lots were primarily promoted within the local market, some of the original marketing was also based out of Honolulu to buyers who had not seen the lots. Seller financing was the norm with 5% to 10% down and payments over 15 or 20 years at interest rates of approximately 10%.

Data Collection

There were two sets of conveyances of interest, the original sales by the developer and subsequent sales of unimproved lots between private parties. We were fortunate to get the cooperation of the developer, who provided information on their original sale of lots including contract date, contract price, down payment, monthly payment and number of payments.

The second set of transactions involved the resale of lots by private parties. For these transactions, since Montana is a state in which real estate sale prices are not a matter of public record, we worked from the buyer's address on the deed, or if the buyer in question was the current owner, the address from current tax records. An attempt was made to get a phone number for each of these individuals from published directories and, if successful, they were called and asked to provide information on sale price and terms. If we were unsuccessful in making phone contact, a letter soliciting their cooperation was sent to the address on the deed. These efforts resulted in a total of 183 sales of unimproved lots of which 136 were sales by the developer and 47 were sales between private parties.

The next step was to measure the distance from the center of each lot to the nearest point on the transmission lines. If a lot was encumbered by the easement, the area encumbered was also calculated from recorded plats and aerial imagery. In addition, two days were spent in the field evaluating each lot on the following four criteria:

1. **Riparian Habitat:** The lot was assigned a 1 if riparian habitat was present, 0 otherwise.

2. **Lot Access:** Lots that were difficult to access and/or would be limited to seasonal access were coded 1. Lots that were along the primary roads and generally at lower elevation with good all season access were coded 3. Lots that fell in between were coded 2 and generally represented those that would require owner plowing to assure all-season access.

3. **Lot Quality:** The main variables considered were the availability of building sites, view from those sites, vegetative cover and general topography and privacy of the lot. We used an eight point scale with 8 being highest quality and 1 being lowest quality.

4. **Transmission Line Visual Intrusion:** The last variable identified in the field research was a subjective measure of the visual intrusion of the 500kV lines on the lot. For many lots, the likely building site was easy to identify. Given topography and vegetation, the line at a given distance was rated as highly intrusive (3), somewhat intrusive (2 or 1) or not intrusive at all (0).

The eight variables associated with each sale transaction include:

1) Purchase price
2) Year of sale
3) Visual intrusion (scale of 0-3)
4) Riparian habitat (1 if present)
5) Lot quality (scale of 1-8)
6) Encumbered area (in acres)
7) Distance from center of lot to line (in feet)
8) Access quality (scale 1-3)

The data collection process provided sales information on 183 transactions. Of those, 51 were sold in the 1980's, 81 in the 1990's and 51 in the year 2000 or later. The average sale price trended upward over this period, starting around $13,000 and ending close to $90,000.

In the sections that follow, the effect of the 500kV lines are examined as they affect both the price at which the lots sold and the rate at which they sold, i.e. other things equal, did the relatively unaffected lots sell sooner than the affected lots. We refer to these two analyses as the sale price analysis and the absorption analysis.

Sale Price Analysis

A large number of models were estimated using sale price as the dependent variable. Distance and visual intrusion were good substitutes for one another and therefore did not work well together. In terms of the transmission line variables, the best results were obtained with visual intrusion either measured as four separate categorical (0 or 1) variables (highly visible, visible, barely visible, not visible), or as distance in feet measured in six zones (0 to 500; 501 to 1000; 1001 to 1500; 1501 to 2000; 2001 to 4000 and 4001 or more).

Surprisingly, in both the distance and the visual intrusion models, the encumbrance variable appeared to have no effect on sale price and was therefore left out of the final regression equations. There are a few possible explanations. First, once proximity is accounted for, the area of the easement itself often appears no different than the rest of the lot, and therefore, requires no discount. Second, on many of the encumbered lots, the likely building site is well determined by the location of the access road and the topography of the lot and the easement may not impact the utility of the lot.

With respect to the lot characteristics variables, lot quality and riparian character added good explanatory power, however access quality did not. It may be that we failed to capture the true access differences among the lots, or perhaps poor access to some is perceived as enhanced privacy to others, resulting in no net effect on value. In any event, the access quality variable was left out of the final models. In general, since distance is an objective measure that is easily interpreted, the distance specification was favored relative to the visual intrusion specification.

The Distance Model

Distance was entered into the model in 500 foot zones out to a distance of 2,000 feet, 2,000 to 4,000 feet, and over 4,000 feet.

At the time lot sales began in 1986, the transmission lines were already in place.

Table 2: Sale price analysis with high-voltage transmission lines impact measured by distance zones.

Dependent Variable: Ln (Sale Price)

	B	Std. Error	T	Sig
(Constant)	9.645	.072	134.300	.000
Zone 0 to 500	-.163	.065	-2.491	.014
Zone 501 to 1000	-.139	.074	-1.882	.062
Zone 1001 to 1500	.011	.067	.165	.869
Zone 1501 to 2000	-.017	.074	-.234	.816
Zone 2001 to 4000	-.063	.052	-1.204	.230
Riparian	.157	.044	3.592	.000
Lot_Quality	.024	.009	2.549	.012
Yr88	-.022	.093	-.236	.814
Yr89	.039	.081	.487	.627
Yr90	.059	.096	.615	.540
Yr91/93	.083	.097	.859	.392
Yr94	.402	.082	4.927	.000
Yr95	.582	.093	6.246	.000
Yr96/98	.692	.105	6.603	.000
Yr99	.307	.083	3.722	.000
Yr00/02	.624	.094	6.657	.000
Yr03	.716	.093	7.730	.000
Yr04/05	.830	.108	7.691	.000
Yr06/07	1.503	.099	15.131	.000
Yr08/09	1.491	.126	11.801	.000
Yr10/11	1.617	.137	11.827	.000

N	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
183	.797	.771	.24683	1.724

To account for general market appreciation or depreciation, variables were included for the year of sale. If insufficient sales occurred within a given year, the year was grouped with other years. Table 2 shows the regression output for the model where the lot's distance from the transmission line is used to summarize the proximity and visibility effects of the transmission lines.

The R-square value indicates that almost 80% of the overall variation in lot prices is accounted for by the independent variables. Further, most of the time trend variables, the riparian variable, lot quality and the two closest distance variables enter with the expected sign and at a high level of statistical significance.

When the dependent variable (sale price) is expressed in natural logs, the interpretation of the coefficients on the explanatory variables is that they show the relative change in the dependent variable. In particular, the coefficient multiplied by 100 gives the percentage change in the dependent variable in response to a unit change in the independent variable. The coefficient on the riparian variable, for example, indicates that if a lot is coded 1 for riparian, it has enjoyed a 15.7% sale price premium, other things equal, to a lot coded 0 on that criterion. Similarly, for each of the unit changes in lot quality coded from 1 to 8, the coefficient indicates a 2.4% increase in sale price, i.e. the highest quality lot (Coded 8) would have a 7 unit increase over the lowest quality lot (coded 1) indicating a 16.8% value premium.

Of particular interest, the estimated coefficients for the 0 to 500 foot and 501 to 1000 foot zones imply statistically significant discounts of 16.3% and 13.9%, respectively, compared to a lot more than 4,000 feet from the line. Beyond 1000 feet, however, there is no statistically significant effect of proximity to the line.

The Visual Intrusion Model

In a second formulation, the same basic regression model was used except that the visual intrusion variable was used instead of distance as the proxy for the high-voltage transmission line effects. The overall explanatory power of the model was almost identical to the distance model and the pattern and significance of the independent variables was also very similar. The coefficients on the first two visual intrusion levels (barely visible and visible) have no statistical significance, but a lot coded 3 (highly visible) suffers an estimated 9.7% discount relative to a lot where the line is not visible.

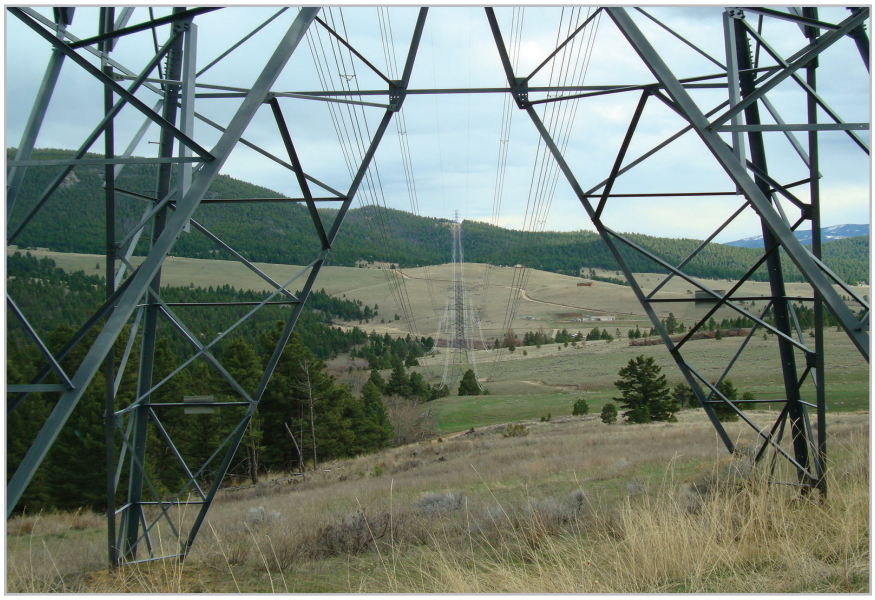
These results were generally consistent with the implications of the distance model, but suffer from the fact that they reflect a subjective evaluation. To apply them would require generalized definitions of the visual intrusion variable, which would be difficult to develop given the influence of site specific factors. The basic question was whether a subjective visual intrusion variable would outperform a more perfunctory distance variable. Although considerations of the location of the line relative to vegetation, viewshed, likely building site and other factors were incorporated into the visual intrusion variable, the distance model performed equally well, and the economic interpretation was easier and more readily applied.

Absorption Analysis

The second question to which the Aspen Valley Ranches data can be applied is whether the absorption (i.e. rate of sale) of lots was affected by their proximity to, visibility of, or encumbrance by, the 500kV lines. In this analysis, the year of sale is the dependent variable and it is regressed on lot quality, riparian and the transmission line variables. Other things equal, the more desirable the lot, the sooner it should sell. Conversely, the greater the effect of the transmission line variables, the longer it should take to sell.

The most striking implication is that only between 2% and 3% of the variation in the sale year was accounted for by these variables. This implies either that the lots were priced so that there was a predominant randomness in the timing of the sales of individual lots or there were some causal factors (independent

The Bonneville Power Administration has 500 kV lines that bisect the development with 26 lots crossed by the easement.



variables) playing a significant role in the timing of lot sales that we failed to identify. The former is the more likely explanation. If the lot prices had premiums or discounts that were a generally accurate reflection of the market's valuation criteria, then absorption of relatively desirable lots shouldn't be any different than absorption of those that were considered less desirable lots. It is only if lot pricing does not appropriately incorporate the positive and/or negative attributes of individual lots that an absorption effect would manifest itself.

General Conclusions

The Aspen Valley Ranches subdivision is one of 57 case studies carried out to investigate the effect of the 500kV transmission lines that cross the state of Montana on the value of the various agricultural, residential and recreational land uses affected by the lines.

The findings of the larger study titled, "Final Report: High Voltage Transmission Lines and Montana Real Estate Values," were published by NorthWestern Energy in January 2012. To view the report, visit www.northwesternenergy.com.

At the most general level, those findings suggest that vulnerability to transmission line impact on value is a function of three variables: use, size and availability of substitutes. Properties whose sole use is residential are more vulnerable to value impact than agricultural or recreational uses, where a broader set of property attributes become relevant for the purchaser. Second, as properties get smaller, they become more vulnerable due to decreased flexibility in the siting of improvements. Finally, the existence of close substitutes unaffected by transmission lines increases the likelihood of value impact.

The Aspen Valley Ranches case study reported here reinforces these general conclusions:

- While there is some variety in use, the terrain and location are such that residential is still the predominant, and in most cases, the exclusive use of the lots.
- Although the lots are 20 acres, there is frequently little flexibility in building site location due to access related issues and topographic constraints.
- The lots are relatively homogeneous and with 156 lots, there are plenty of substitutes.

The statistical analysis shows a discount of about 15% in the sale price of the lots within 1,000 feet of the center line of the 500kV line, but none beyond that. The analysis shows no absorption effect implying that the pricing of the lots must have been a fair reflection of the market's evaluation of the relative strengths and weaknesses of the individual lots.

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