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Land use conflicts are as old as Oregon's history. Oregon has developed a number of laws governing the use of land designed to protect the state's land resources and minimize land use conflicts. In spite of these efforts, land use conflicts do occur. One type of conflict which is particularly difficult is choosing between two mutually exclusive uses of land on a given site. Local governments are often in the position of having to make land use decisions in which permitting one use of a resource forecloses the options of another use. An example is a decision to permit urban development on farm land which because of its location next to an urban area gives it a social advantage over other land equally suitable for farming.

Analysis of decisions such as this is always difficult. Individual values of land resources are the initial source of conflict, and so the private impacts of land use decisions are generally where most efforts are focused in evaluating the outcome of a land use decision. Using the urban/agriculture example cited earlier, urban developers place value on land because of its profit potential as a site for residences. Farmers value land for its ability to generate income through production of agricultural commodities. Estimates of these two different sets of values are established in the market for land, and are manifested in the bid prices that both parties offer in striving to acquire property. If no land use ordinances existed, land use would be determined by the highest bidder.

Society may impose restrictions on land use to improve social efficiency for three reasons. First, because the costs or benefits of private land use decisions often affect other properties, externalities exists. Generally, private markets will not take these externalities into account and the total value of land without restrictions may be smaller than with some restrictions. Forbidding the location of an all-night gas station in a quiet residential neighborhood is a good example. Second, society may see some land uses as providing goods and services to the broader public and therefore deserving public protection. For example, the public sector may preclude residential development in agricultural areas to protect agricultural landscape values.

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Finally, society may restrict the location of development to minimize the cost of public service provisions, e.g., sewer and water. Use of the urban growth boundary concept for permissible development falls in this third category. Public land use action to address either of three categories is intended to improve the overall social efficiency or value of land use. However, there is no guarantee the public action achieves its desired end. Some public land use controls may cause more cost than benefit because of the difficulty of obtaining good planning information and difficulties in implementation. In sum, the public sector imposes land use restrictions because private markets can not capture all values relevant to society.

Oregon's comprehensive land use plan is the embodiment of these different social values. Oregon has adopted nineteen statewide planning goals that address three major concerns. The first concern is the process itself, Goals One and Two are Citizen Involvement and Land Use Planning. The second concern is for conservation and includes such goals as Goal Three, Agricultural Lands and Goal Five, Open Spaces, Scenic and Historic Areas, and Natural Areas. The third concern is for development and includes such goals as Goal Nine, Economic Development, and Goal Twelve, Transportation.

The goals are not ranked in order of legal importance nor is there an unambiguous procedure for selecting which goal to pursue when they are in direct conflict with one another. The goals and statutes do reflect both conservation and development objectives and they detail implementation procedures that acknowledge the existence of conflicts and considerations that can lead to a planned solution.

Consider land use conflict between agriculture and aggregate mining which involves Planning Goals Three and Five. Goal Three is, "To preserve and maintain agricultural lands." Implementing this goal requires that the non-farm uses that are permitted be minimized to allow for maximum agricultural productivity but also that open space uses be permitted on agricultural land that is being preserved for future agricultural growth. Oregon Revised Statute 215.296 sets standards for allowing certain non-farm uses within exclusive farm use zones. It states that any use will not force a significant change in farming practices on surrounding land nor will it significantly increase the cost of farming on surrounding land. Further, an exception is not automatic even if it meets these conditions; the statute states only that the exception may be approved.

Goal Five is "To conserve open space and protect natural and scenic resources." It states that areas with aggregate resources should be inventoried and planned for interim, transitional and "second use" utilization as well as for the primary use. Goal Five also states that "where conflicting uses have been identified the

economic, social, environmental and energy consequences (ESEE) of the conflicting uses shall be determined and programs developed to achieve the goal."

Oregon Administrative Rules 660-16-010 states that based on the ESEE analysis a program to achieve Goal Five will adopt one of three methods to resolve the conflict. The first method is to protect the resource (aggregate) site when the site is of great importance relative to the conflicting use (farming). The second method is to allow the conflicting use fully when the conflicting use is of sufficient importance relative to the resource site. The third program is to allow but limit the conflicting use. This, of course, is not possible with aggregate mining and farming. Before any program can be selected, however, an economic analysis, as part of the ESEE, must be done.

Analyzing the economic impact of any land use decision is difficult for many reasons. Site specific data are not usually available, time horizons are long or infinite, and future costs and returns are not known with certainty. It is also difficult to predict future social or political changes which might affect a land use decision, such as changes in environmental policies or change in social attitudes. And, many of the social values in question about conflicting land uses are not expressed in private markets where prices and values can be observed. In spite of the difficulties in making projections, the projections need to be made as accurately as possible.

Although a numerical economic analysis is important in making land-use decisions, equally important are the broader questions society must address in resolving land use conflicts. In this paper, we present a list of questions to be considered with regard to the economics of a land use decisions. Reasons for asking each questions are discussed, and these concepts are then illustrated with an example of a land use conflict involving agriculture and aggregate mining.

How "unique" are the resources? What is the availability of substitutes?

The reason for asking this question is obvious. If other land is available that is equally well suited for both of two alternative uses, then a decision can be made as to which use is permitted on which sites. If no suitable substitute land is available for one of the two uses, then that use likely receives preference in land use designation. A problem arises when no good land is available for either land use. This case might be described in economic terms as a market where supply is fixed (perfectly inelastic) and demand is also perfectly inelastic. No equilibrium market price is achieved, and a non-market mechanism must be used to resolve the conflict.

Determining the demand for land is difficult, especially if the market is narrowly defined to be a small geographic area. Costs and returns for alternative land uses must be estimated. Because land is an input in the production process, the future demand for products produced on it must also be considered. Estimates of the number of potential buyers must be made.

In the case of a land use conflict involving agricultural production versus aggregate mining, the following questions must be answered. What alternative agricultural land of comparable quality is available? What alternative sources of comparable quality gravel are available? How good are the agricultural and mining resources in terms of quality and accessibility? If agricultural land is converted to aggregate mining, is valuable land being given up to get gravel that could be mined equally profitably on another site which has lower or no agricultural value? By restricting mining on agricultural land, are we protecting a land resource at the expense of a highly valuable mineral? Are there significant start-up or business establishment costs associated with farming or mining alternative sites? Are there significant non-market values to keep agricultural land in productions? Are farming operations more or less efficient when they are concentrated compared to being interspersed with surface mines?

What economic activity would occur "with" and "without" a decision to change land use?

In analyzing a land use change, economic activity and output must be projected under both the current and the alternative land use. The purpose in asking this question is to discern potential changes in demand for the land in the future. How do these changes relate to, or perhaps conflict with, the alternatives being considered?

In the example of agriculture versus mining, the current use of farming should not necessarily be assumed to remain constant. If agricultural markets are changing in a way that would suggest that in the future land use would change. even without a change in land use designation today, then this should be accounted for in the economic analysis. Similarly, if land use is changed to mining and the aggregate market is perceived to be changing such that land use in the area would be pressured to increase the intensity of agricultural production, then this should be included in the economic analysis as well.

The relevant alternatives are not "before" and "after" the land use change, but rather "with" and "without". The reason for the importance of this distinction is that the before/after analysis compares past economic output of current land use to future economic output of the alternative use. The correct evaluation is to compare future

economic output of the two alternatives. Thus, estimated future economic activity from agricultural production should be compared to estimated future economic activity from mining, in our example.

How much weight should be given to future income relative to current income? What discount rate is appropriate for making streams of income over time comparable?

The value of production from land to an individual or to society depends upon when that value is received. One dollar received a year from now is not worth one dollar today because of risk, inflation, and opportunity cost. Comparing economic activity for two land uses in which income streams occur over a period of time requires that discounting be used to put all future values into today's dollar values.

The first step in addressing this question is to estimate income streams over time. Another critical step in the discounting process is selection of a discount rate. High discount rates result in low weights on future income. Because risk is included as a component of the discount rate, it is conceivable that two different discount rates should be used, each reflecting the relative risk to society of the proposed land use.

Finally, the discounting process must specify a time frame that is the same for both alternatives. Is income going to be generated for a finite number of years with one alternative, and an infinite number of years with an alternative land use? This equal life is necessary to insure that a high income, short duration land use is compared fairly to a lower income, long term alterative. Equivalent annual annuities can be used to evaluate alternatives with different lives fairly.

Questions to ask for our agriculture/mining conflict include the following. What is the expected social income expected from agriculture and from mining, and for how many years each? How does society value the food products given up to obtain aggregate, or the aggregate given up to produce food? Will population growth or other future trends effect these values? Are current agricultural management practices sustainable? At what rates will aggregate be mined? What will social income streams be after the mining operations are complete? How does the risk to society of agricultural production compare to the risk to society of aggregate mining? These questions focus on events which may not take place until many years in the future, making them difficult to answer with confidence.

How much weight should be given in a county land use decision to the interests of non-county residents? How much weight should be given to current land owners requesting a change?

Decisions need to be made in the analysis concerning the geographic scope of the analysis. A decision to change land use designation potentially affects the designated property, neighbors to the designated property, the county, and perhaps a larger region such as the state. A county considering a land use change should consider the impact on the county's economy, but also on the statewide economy, since some economic activities are likely to take place outside the county.

Evaluating these questions involves an examination of raw product sales, value added activities, and final consumption location. The distribution of sales within the county, within the state, and outside the state is necessary to evaluate impacts geographically. The extent to which the product receives additional value through processing must also be estimated.

For our example, we must ask what types of agricultural commodities are produced? Where are they sold? Are they processed, and if so where? Where are the final products sold and consumed? How much gravel is mined for use within the county, and how much is shipped outside the county? Some of the gravel and most agricultural products will likely be shipped outside the county. Will the money from these sales flow back to the property or county, or will they be drawn elsewhere? The value of the land resource in the two uses depends on whether the decision is viewed from a landowner, county, state, or even national perspective.

Will this decision set a precedent?

Some land use decisions are site-specific, while other are viewed as setting a precedent for any future requests. Any decision which is perceived to set a precedent should receive more robust analysis, to make sure all potential impacts have been considered. A precedent setting decision may result in secondary impacts which invalidate preliminary findings.

Consider a request to allow mining on agricultural land. The initial economic analysis would compare future farming costs and returns to future mining costs and returns. Now suppose a decision is made to allow this change. An example of a land use change illustrates to other land owners that land uses can change, and the decision may be viewed as a precedent. This could increase what is believed to be the supply of gravel, decreasing the value of gravel assumed in the initial economic analysis, and perhaps suggest that the value of economic output is actually greater in farming than

in mining under the new market price for gravel. Using the same reasoning, it is also possible that a decision to forego mining in favor of agricultural production (particularly of high-valued specialty crops) would also result in long run lower prices for agricultural output than originally analyzed.

Estimating secondary or long run price impacts requires careful construction of supply and demand functions for each alternative product considered. Supply functions are generally estimated based on production costs, number of producers, imports, and technology, and demand functions are estimated based on number of consumers, income, consumer tastes and preferences, and prices of substitute goods.

What effect will the decision have on the larger economy?

Another difficult aspect of some analyses is the different roles that commodities produced on different land uses play in the county economy. Agricultural products, for example, tend to be mostly exported from the county economy and therefore have a ripple effect on the economy through increased demand for other products and goods in the local economy. Other uses of land (for example, for residential purposes or for gravel that is used to support a local infrastructure) play different roles. Both are inputs into production processes. Having land available for residential development allows expansion of the population and the economy. It allows for an investment to be made in the local economy which has a one-time ripple effect through the economy as well as providing infrastructure for further development possibilities. Some of the gravel which would come from a mining operation maybe used as an input for local construction which may or may not stimulate additional economy activity in the future. Gravel used in road construction, for example, which is obtained locally might allow a contractor to build the road at a slightly lower cost. The lower taxes that might result from this could perhaps make the county a more attractive place to do business. This particular example seems somewhat tortuous, but is an example of the thought process that one would go through in analyzing this choice.

Quantifying these impacts is usually accomplished using input-output (IO) models of affected regions. These models account for the ripple effects that occur within a region due to changes in an industry. IO models are very data dependent. Some of the data required to implement an IO model include the level of inputs used in each industry, the source of those inputs, and the output from each industry. Extensive surveying of all affected industries is necessary to insure accurate IO models.

How reversible is the decision?

Finally, there is the question of irreversibility. Conservative decision makers tend to favor decision which can be reversed at low cost if circumstances change, or if the original decision turns out to be incorrect. In some time scale perhaps most decisions are reversible, but the cost of reversing can be prohibitive.

A decision to change land use from agriculture to mining is one which may be costly to reverse. Soil may have to be moved considerable distances, drain fields may need to be reestablished, and water sources may need to be redeveloped. Conversely, a decision to retain land in agricultural production is quite easily and inexpensively reversed to allow mining.

Summary Framework

The questions highlighted above can be integrated into an economic evaluation process to provide information to decision makers about the nature of tradeoffs. The process is illustrated below step by step. For ease of exposition the evaluation is set in a comparison of two sites, but more sites could be added.

1. Estimate the benefits to aggregate buyers (quantity and quality) from sites A and B over the life of mining.

2. Estimate the costs of production and marketing (transportation) for aggregate mining sites A and B.

3. Compare the aggregate benefits and costs overt the mining life and compute the estimated private net economic benefits to consumers and producers of aggregate production at sites A and B.

4. Estimate the benefits from foregone agricultural production at each site and the relative production costs for the life of agricultural production.

5. Compute the foregone agricultural net benefits (benefits minus costs) at each site.

6. Estimate the value of positive environmental effects of converting agricultural land to mining at each site, e.g., surface water recreation, wildlife.

7. Estimate the value of negative environmental effects due to mining production and transportation, e.g., loss of agricultural landscape values and noise and dust effects on neighboring properties.

8. Compute the discounted net benefits of mining production (including environmental effects) and of agricultural production or following land uses (including environmental effects).

9. Estimate the impacts of the change in production from agriculture to mining on the surrounding economy, noting sectors with particularly negative and positive impacts.

10. Consider the uniqueness and irreversibility of the decision to shift land from agricultural production to aggregate mining.