Rangeland Economics, Ecology, and Sustainability: Implications for Policy and Economic Research

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Introduction

> "Economic research in range management is concerned with management decisions by people in relation to the goals they desire. … Questions and decision making are conditioned by the economic and social environment of our society." (Cook and Stubbendieck 1986, p. 183)

This observation of the role and context of economic research on rangelands has not changed over the years. Yet, rangeland economic research and policy needs have not been systematically examined since Cook and Stubbendieck (1986). Our purpose is to consider what the future rangeland research needs are for economic and policy analysis. In this examination, the scale of analysis is extremely important. Often the policy questions affect firms, communities, regions, or the nation as a whole and change over time.

Basic Rangeland Economic Models

A central premise of traditional rangeland economic studies is that private ranchers will choose to apply an improvement practice out of enlightened self interest (Sayre 2004). Similarly, for policy analysis, the profit motive is assumed to determine the adjustments that will be made as policies change. The quantitative analysis starts with the individual firm as the basic unit of analysis. A typical ranch is defined for a particular area and is developed through either expert panels or surveys of livestock producers. Impacts are imposed upon this model ranch to determine how it would react if it behaved as a profit-maximizing operation. With this approach, we find the profit-maximizing mix and quantity of products that should be produced, the best way to produce those products, and the effect on profits. As land use policies and prices change, ranchers are assumed to adjust their production strategies and resource use so as to maximize profit.

With that in mind, many of the same research needs identified in Cook and Stubbendieck (1986) remain today. While progress has been made in many areas, in order to answer policy and economic questions there are both theoretical and data issues to resolve. For a profit maximizing or cost minimizing firm, economics can provide some insights into the decisions to be made. While we know that most ranchers are not profit maximizers in the economic sense (profit is not the most important decision criterion), they can generally be assumed to prefer more income to less, holding everything else constant (Gentner and Tanaka 2002, Torell et al. 2001). In order to determine what ranchers should do as policies and conditions change, or perhaps more important "what they will do," there are three basic sets of data that are required: (1) input prices, (2) output prices, and (3) basic ecological, biological, and physical data along with knowledge and assumptions about the motivations of land users.

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Input Prices

Input prices are generally the most straight-forward data to obtain. As long as we can identify what inputs are required to produce an output, finding a market price equivalent is generally not difficult. Further, because much of the input for rangeland improvements and management strategies are incurred early in the planning process, prices of these inputs are usually known with more certainty than output prices.

Output Prices

Market and non-market output prices are what economists are most concerned about. Determining market prices is normally a matter of determining the location and time of the market for which you are seeking prices for a given product or service and finding the appropriate reporting service.

Non-market goods and services provided from rangelands are generally much more difficult to value. Techniques have been developed over the years to estimate these non-market values with two common approaches being the travel cost and contingent valuation methods. Each has its own set of assumptions, constraints, and limitations. Some question whether these non-market resource values are both comparable to market prices and applicable to broader areas than where they were estimated. The debate centers on whether survey respondents provide reliable estimates of the value of non-market goods and services, given that the public has little or no experience with purchasing such goods. Critics note that for a variety of reasons, respondents' stated intentions may not equal true willingness to pay. Observers have noted that respondents may not carefully consider personal budget constraints when stating willingness to pay bids. Bids may reflect individuals' interest in contributing to a worthy cause rather than their true value for the resource in question (Carson 2000).

Basic Ecological, Biological, and Physical Data

There exists a large body of research regarding the implications of different management practices on the ecology, biology, and physical environment of rangelands. While each study provides more information, from an economic modeling and policy perspective, they are not always helpful. The information most useful for economic analyses is in the form of a functional relationship rather than replicated studies of a control and a treatment. Development of these functional relationships requires many treatment levels over time to quantify the desired relationships. There are some basic issues in that trade-off. The most important trade-off is related to the statistical validity and accuracy of an experiment. Normally time and money are limited for any given study so the trade-off is more treatments versus more replications. Economists generally prefer more treatments while ecologists usually prefer more replications. From a policy and management perspective, the question is not always whether to do something or not (the all-or-nothing dilemma), but rather at what intensity should it be implemented.

Looking to the Future

As we examine future research needs of rangeland economic and policy analyses, there are several core areas where our understanding must improve. Economists have historically used profit maximization as the explicit goal of decision-makers in economic models. There has been work done in many areas that indicate profit is not the primary or even secondary motive of ranch ownership. Instead, lifestyle and the way-of-life are the top motivating factors (Gentner and Tanaka 2002; Torell et al. 2001; Sengupta and Osgood 2003; Torell et al. 2004). This is especially true in ranching where average rates of return on investment have historically been low compared to other investment alternatives. Because we know that people do invest in ranching and choose to accept these lower returns, there have to be other criteria that are valued. We assume that ranchers prefer more money to less, but with other more important objectives they will not always choose the alternative that gives

them the most money. This does not mean that economic models are not useful in the decision-making process. It does mean that the results must be interpreted carefully.

Public land managers may not even consider profit as a decision criterion when they are making allocation choices. Economics can still play a role in defining the relevant costs and benefits from each alternative that the decision-maker can weigh. The problem for nonmarket goods and services is when subjectivity can enter into the decision process. Nevertheless, economics can provide useful information to these decision-makers, but it has to be interpreted in context with other priorities.

As an alternative to traditional quantitative methods for range economics research, Sayre (2004) highlights that in some cases qualitative research tools may be most appropriate. Qualitative research is much more subjective than quantitative research and mainly uses individual, in-depth interviews and focus groups to collect data. Through interviews of land users, we might identify the range of adoption rates for new technologies, why rangeland conditions are in their current state, thresholds where significant change in rangeland uses would be expected, and how alternative rangeland users are likely to adjust to a particular policy change. The qualitative research could also be used to assess the goals and objectives of land users and how those users indicate they would respond to altered land use policy.

With that as background, the areas we see as needing further research include: (1) decision-maker motives and how they relate to actual management decisions and actions, (2) ecological, biological, social, political, and economic relationships, and (3) how different human and geographic scales affect the results. Each of these areas will have different levels of importance depending upon the policy question being asked.

Decision-maker Motives

Research in this area needs to focus on both the private and public decision-maker. In both cases, we need a better understanding of the objectives each one is striving to attain. Once we know those objectives, we must understand how decisions are made and actions are implemented as land users and managers try to achieve their individual goals. It is only then that we can begin to incorporate that decision process into our economic and policy analysis models.

If ranchers list “lifestyle” as the most important reason for buying a ranch, does that impact the management decisions of the ranch? For example, riparian area management has been an issue for several years and is likely to continue into the future. One alternative may be to herd cattle away from streams or to fence them off. From a purely profit maximizing position, we can determine which choice should be made. The rancher may be asked or expected to incur the herding costs but the resulting benefits of improved riparian habitat accrue to the public and recreational public land user. The rancher may opt not to herd animals because of the lack of personal benefits, because of time constraints or because it does not fit the lifestyle being sought. Or, they may choose to herd the animals because the idea of being out on horseback all day is appealing, regardless the profit consequences. In either case, the profit-maximizing choice is altered by these noneconomic motives.

Similarly, the private and especially the public land manager may have other criteria that need to be considered when making allocation decisions. Even if all the relative values for inputs and goods and services were known, different decisions may be made based on alternative management objectives. As an example that highlights the growing importance of other management objectives, and also the deteriorating evolution of the economics of many traditional range improvement practices, net present value analysis for many rangeland improvements indicates they are not economically justified based on the traditional comparison of added costs versus added livestock returns. This situation has existed for many years (Smith and Martin 1972). Yet, private individuals and land agencies have spent millions of dollars implementing these apparent “uneconomical range improvement practices.” In some cases the expectation is that other non-quantified resource values that are desired by society, such as enhanced

watersheds, water flows, improved wildlife habitat, and rangeland health, justify the private expense and the additional expenditure of cost share dollars (Lee et al. 2001). In other cases the improvement is implemented knowing the economics of the improvement is dismal but a brush and tree infested landscape is not desired by the resource manager. This recognition of "other resource values" was made by Hyder and Sneva in 1956 (p. 34) with the statement: "The economics (sic) of brush control must be determined by the amount of forage and meat products gained; however, the principal objective in brush control should be an upgrade in range condition."

Ecological, Biological, Social, Political, and Economic Relationships

The Sustainable Rangelands Roundtable (SRR 2003) has been identifying criteria and indicators to help determine if rangelands are being managed sustainably. The indicators are the basis for data sets and the suite of indicators should tell us something about the criterion. One of the issues that the economists involved with the project have had with identifying the indicators and their associated data sets is that we do not know the relationships between economic indicators and other ecological and biological relationships and indicators. There are some economic indicators that are fairly straight-forward such as the value of the livestock products coming from rangeland, while there are a whole suite of indicators where the linkage to sustainability is not so clear. In this last suite of indicators, we believe that they might be related to rangeland sustainability, but we are not sure of the relationship. For example, employment is one measure of economic and social health of a community, but does it relate to what people are doing to or on the land and how does that relate to the environment?

The basic research needs for evaluating sustainability fall into two general categories. First are the basic relationships between inputs and outputs. Generally, economists need outputs that are relevant to what society wants or needs. These can be traditional commodity-type outputs or environmental variables. For meaningful economic and policy analysis, the data need to come from a variety of treatment levels. Stocking rate studies are a prime example. If a study has a control and one or two stocking rates to examine either the response of the vegetation or the cattle, that gives us some information within the bounds of no grazing to whatever the highest stocking rate was. If we can define the functional relationship between stocking rate and outputs and environmental variables of concern, we can develop economic and policy models to help the manager determine optimal stocking rates for their objectives.

Second, the relationships between economic and environmental variables need to be identified and studied. We need to know how economic variables affect the environment and how environmental variables affect the economy. On one hand, we get environmental goods and services from the land that benefit people. On the other hand, how well the economy is doing affects what happens to the land. If a business is going bankrupt because they cannot sell enough products or obtain inputs at a reasonable cost, then they are not likely to invest in improving the landscape. If, as an example, a public land rancher has to continually reduce herd size because of allotment reductions, their ability to make management changes or invest in range improvements is significantly diminished.

Understanding key economic and ecological relationships across the West will be difficult. Each community is different in terms of its economic, social, and political make-up and each exists in a different environment. Research should seek to identify the key variables to measure and how those measurements can be combined to provide decision-makers with relevant information.

Spatial and Temporal Scales

We need to account for measures of scale in time and across space, and determine how these scales affect important variables. On the human side, we go from individual to communities to regions to the nation. We also go from an individual business to the industry as a whole. On the geographic scale, we are concerned about differences between local areas, regions, and nations. In each case, we need to know how the different economic variables can be measured, how each can be interpreted, and how

important each variable is to the decision-maker. Time has always been important in economic analyses, but when changes to rangeland ecosystems take decades, how time fits into decisions becomes even more important.

From a policy perspective, ideally we would desire to start at the smallest unit of analysis and aggregate to higher levels. What we do not know at this point is whether this is possible using various sampling schemes or whether the results truly mean anything. The question is if a measurement at one scale is related to the measurement taken at another scale and how that relationship can be modeled and used.

Conclusion

We have briefly examined some of the pressing needs for future rangeland economics and policy research. While the needs expressed in Cook and Stubbendieck (1986) are still important, the issues facing rangeland economists today are not the same as they were in the 1980s. The relative values of rangeland outputs have changed. Today's questions focus on whether rangelands are being managed for economic, social, and ecological sustainability. The current paradigm is that if any one of these systems is not being managed sustainably, then the system as a whole will tend to break down over time.

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