Western Economics Forum

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The Western Economics Forum

A peer-reviewed publication from the Western Agricultural Economics Association

Purpose

One of the consequences of regional associations nationalizing their journals is that professional agricultural economists in each region have lost one of their best forums for exchanging ideas unique to their area of the country. The purpose of this publication is to provide a forum for western issues.

Audience

The target audience is professional agricultural economists with a Masters degree, Ph.D. or equivalent understanding of the field that are working on agricultural and resource economic, business or policy issues in the West.

Subject

This publication is specifically targeted at informing professionals in the West about issues, methods, data, or other content addressing the following objectives:

- Summarize knowledge about issues of interest to Western professionals
- To convey ideas and analysis techniques to non-academic, professional economists working on agricultural or resource issues
- To demonstrate methods and applications that can be adapted across fields in economics (e.g. adapting conjoint analysis from marketing to environmental economics)
- To facilitate open debate on Western issues

Structure and Distribution

This will be a peer reviewed publication. It will contain approximately 3 or 4 articles per issue, with approximately 2,000 words each (maximum 2,500), and as much diversity as possible across the following areas:

- Farm/ranch management and production
- Marketing and agribusiness
- Natural resources and the environment
- Institutions and policy
- Regional and community development

There are two issues per year, which will be mailed out with the WAEA newsletter in the spring and fall.

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INVASIVE SPECIES IN AGRICULTURE: A RISING CONCERN

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"The Boll Weevil say to the Farmer,
You can ride in that Ford machine,
But when I get through with your cotton
you can't buy gasoline,
You won't have no home, won't have no home."

Boll Weevil Song (performed by Carl Sandberg in the 1920s)[1]

Invasive species are not new phenomena in U.S. agriculture, as illustrated by these 1920s lyrics from the Boll Weevil folksong. The boll weevil entered the United States via Mexico in the 1890s, and by the 1920s, this pest had spread to all cotton producing states, wiping out tens of thousands of acres of cotton, costing billions of dollars, and literally driving thousands of farmers off the land. There are similar examples in other parts of the world. In the 1860s, an agronomist transferred grape vines from the U.S. to France, to try to improve wine quality, and accidentally introduced phylloxera, a small louse that feeds on the roots of grape vines. As a result, France lost almost 75% of its vines at the time.[2] Despite this history of dealing with invasive species in the United States and elsewhere, many informational gaps remain with regard to optimal policies.

The purpose of this article is to provide the reader an introduction to issues concerning invasive species in U.S. agriculture. We explain why invasive species are viewed as a growing concern in the United States, and consider the role of economics. There are two aspects to that role. First, economic factors may influence the introduction, spread, response to, and control of invasive species, and ultimately determine whether an invasion is successful. We also argue that economists have a crucial role to play in terms of analyzing the problem and improving the understanding of the economic impacts of invasive species. Economists can evaluate alternative policy responses to deal with the uncertainty associated with any one of a vast number of potential invaders of specific ecosystems, and the resulting ecological and economic damage. While understanding interactions between species can be done in a purely biological model of an ecosystem, it is economic behavior—beginning with the mode by which the species was introduced, and certainly including patterns of production, marketing, and consumption—that determines how an invasive species affects agricultural industries and, ultimately, policy responses to invasions. We outline the various approaches that economists are taking in their research on invasive species, to incorporate these factors in modeling invasive species in U.S. agriculture.

In 2003, the USDA's Economic Research Service (ERS) instituted a three year competitive grants program aimed at improving the understanding of the economics of invasive species. The ERS program underscores the fact that policy makers realize there are important informational gaps when it comes to dealing with invasive species. Recently, there has been a flurry of legislative action directed at invasive species, at both the state and national level. For instance, in 2004 the California legislature passed a bill (AB2631) that establishes an Invasive Species Council to develop a statewide invasive

[1] http://www.simplelife.com/organiccotton/08WEEVLsng.html
[2] http://wine.about.com/library/weekly/aa052900.htm

species plan for the prevention, detection, and control of invasive species. Oregon and Idaho created similar councils in 2001 and 2003, respectively. A National Invasive Species Council was established by the President in 2003 (see www.invasivespecies.gov). It will be interesting, from a political economy perspective, to observe how these councils evolve—will they be relatively more focused on protecting agriculture or the environment, for instance, when conflicts arise? In addition, a number of Congressional acts have been recently passed, such as the "Brown Tree Snake Control and Eradication Act of 2003" (H.R.3479) to provide for the control of the brown tree snake on Guam and other areas such as Hawaii. Clearly, governments are prepared to develop new policies to respond to invasive species.

In agriculture, *invasive species* is a very broad term that typically applies to any non-indigenous pests, weeds, plants, insects, fungi, bacteria, viruses, and other disease-causing agents that can interrupt the production of livestock, crops, ornamentals, and rangeland. The term applies to pests that have entered the U.S., have moved to new locations within the U.S., or have the potential to enter the U.S. Damaging invasive species are not just an agricultural problem–they also affect industry, human health, and ecosystems. But not all invasive species are harmful, and some have been deliberately introduced for economic gain. For instance, the vast majority of crops grown by U.S. farmers today (e.g., rice, corn, wheat, and soybeans) are not indigenous to the U.S., yet they define U.S. agriculture and they have had a large positive economic impact on the nation (U.S. Congress). In this article we focus on issues related to harmful invasive species, most of which have been accidentally introduced into the United States.

There is renewed interest in invasive species today for two key reasons. First, scientists believe that both the speed and the extent of dispersion of invasive species have increased in the last few decades because of population growth, alteration of the environment, and globalization (Pimentel et al.). Globalization has led to growing trade volume and international trade is a common pathway for invasive species. Second, in the post 9/11 world, political fears include the possibility of the deliberate introduction of pests by terrorists–a biosecurity risk.

Economic analysis has an important role to play in the study of invasive species because the spread of invasive species is partly determined by human behavior. Economic incentives may influence the extent to which a particular invader can establish itself in an ecosystem. Furthermore, economists can estimate the cost of an invasion and the costs of managing an invasion, or even eradicating the species. Finally, economists can evaluate the effects of various control measures, and identify the optimal policy response. At the present time, policy response to invasive species is often conducted in an emergency situation, and it may be based on limited scientific data. The British management of the mad cow disease is a classic example of how not to handle a situation requiring an immediate policy response and when there is limited scientific data available. The government first indicated that humans were not at risk. Since then at least 200 UK residents have died from eating from eating BSE infected beef. Almost inevitably, emergency responses will ignore adaptations by firms and consumers, and hence miss the role played by human behavior. Ongoing research by economists will hopefully fill that void and introduce the economic dimension into models of invasive species.

Some invasive species have been intentionally introduced to an ecosystem, with their potential negative effects misjudged or not even estimated. For example, deer were brought to New Zealand from England and Scotland for sport in the 19th century. But they have become a serious pest in New Zealand, negatively impacting native species (especially grasses) and thereby reducing biodiversity in that country.

The possibility of unintended harmful consequences of an introduced species has become a key issue with regard to genetically modified organisms (GMOs). For example, some environmental groups (such as Greenpeace) and others are concerned that genetically modified (GM) corn from the United States imported into Mexico for animal feed was then illegally planted by some Mexican farmers. The belief is

that the bT corn will pollinate with native wild corn varieties and, through uncontrolled gene transfer, will eliminate native varieties that do not grow anywhere else, reducing biodiversity.
In the United States, pest resistance to bT corn is an issue. Pests that are not killed by eating GM corn could multiply, leading to a resistant pest population. This is the reason the U.S. government requires refuge areas around fields of GM corn. About 40% of the U.S. corn acreage is now planted to GM corn, and environmental activists are concerned that this "invasive" species may not only lead to uncontrollable pests but the corn itself with competitively overrun existing species due to economics.

Alternatively, some scientists believe that the introduction of GMOs will increase biodiversity through gene transfer, and that this could be beneficial. At the same time, the introduction of GM corn has a positive impact on the environment through reduced pesticide usage. The introduction of GMOs is a question of uncertain benefits and costs, and this is becoming a significant issue for western U.S. agriculture. For example, California has a big stake in GM crops but environmental groups and organic farmers are actively campaigning against GMOs in California, by highlighting potential economic and ecological risks of GM crops. The state of California has passed legislation that discourages the introduction of GM rice and some counties in the state have banned GMOs outright. Policy concerning GMOs and policy concerning invasive species thus share many similarities, and the economic analyses required for both are very similar.

How are economists researching the issues

Economists are conducting research that addresses many of the above mentioned issues regarding invasive species. Broadly speaking, there are three categories of ongoing research regarding invasive species: research addressing immediate policy needs, research developing new decision tools for policymakers and private actors, and research regarding aspects of the invasive species problem intended to contribute to future policy design and implementation. Of course, many economists may undertake research that spans multiple areas. For example, a project may develop a new decision tool and, at the same time, apply it to a current policy problem.

The first category of research focuses directly on providing input into the policymaking process using existing analytical approaches, or on improving the use of existing methods, such as Glauber and Narrod, who integrated the risk assessment and economic impact analyses used by the USDA to evaluate the impact of regulations intended to restrict the spread of karnal bunt, a wheat disease that originated in Southeast Asia. This type of research is valuable not only for its immediate contribution to policy, but also because it identifies the strengths and weaknesses of current approaches. Another research area in this category seeks to quantify the costs of specific eradication control procedures for specific invasive species problems. The book edited by Sumner includes a number of such case studies. While work in this area is almost by definition focused upon a specific problem, findings from specific cases can be used to aid in developing decision tools. For example, Knowler and Barbier model how to measure the costs of an invasion when it permanently changes growth rates for competing native species, and then apply this model to a comb jelly invasion of the Black Sea anchovy fishery.

The second category of research builds upon the first. Much of the work in this area focuses on bio-economic modeling and seeks to address the following research question: How can economists best use the often limited information available regarding the biological and economic parameters of an invasive species problem to provide input into the policymaking process? At least two levels of the policymaking process are included in this research question. First, policymakers must choose how to respond to a specific invasive species problem. Second, policymakers must choose how to allocate finite resources across invasive species problems. Recent work in this area includes a paper by Marsh, Huffaker and Long who develop a dynamic pest management model and use it to determine the optimal way to control a virus in the Northwest potato industry. The foundations for modern bioeconomic invasive-species models include work by Hueth and Regev, and Taylor and Headley.

Choosing the optimal response to a specific invasive species problem is generally modeled as an optimal control problem, due to the importance of population dynamics and how these dynamics interact with human decisions. Eiswerth and Johnson develop an optimal control model of a biological invasion, and solve for the optimal management decision. They emphasize the importance of the spatial dimension of invasive species control decisions, focusing on site characteristics, which affect the success of the invasion and control decisions. Among others, Brown, Lynch, and Zilberman address the importance of the spatial component of biological invasions and management decisions. The spatial aspect of biological invasions represents a new area where information is needed, and where economists must work with experts from other disciplines. For instance, our work on the greenhouse whitefly in California strawberries emphasizes the movement of the whitefly from crop to crop during the year, as its preferred host changes. Models of economic decisions made by producers concerning land use and crop selection thus interact with models from entomology concerning the growth and movement of the whitefly, to provide the framework for determining policy responses such as the registration of new chemicals to control the whitefly invasion.

This second research category addresses broader methodological questions of interest to economists. First, some work in this area integrates geographic information systems analysis with other economic considerations. Because there is an important spatial component to invasive species problems, this is a very promising research area. Second, risk and uncertainty are very important considerations when making decisions regarding invasive species. The potential economic and ecological effects of a given invasion could include a very large number of possibilities, and little or nothing may be known about the likelihood of each. Approaches to incorporating risk and uncertainty in invasive species decision models could be used for many other economic problems.

The third category of research examines different characteristics of the invasive species problem and policy choices. This research is primarily theoretical. Broadly speaking, the contribution of work in this area is to identify factors that may influence management and control decisions, but were not yet incorporated in current research in the two preceding research categories at that time. Hof developed a spatial-temporal model of managing an invasion that incorporates costly, location-time-specific management effort, and limited management resources. This model provides a template for developing decision tools for invasive species control. An early analysis of resident pest problem by Bhat, Huffaker, and Lenhart analyzed the value of a public agency as a means of implementing welfare-maximizing control measures. Their model of controlling the beaver population provides insights into the public role of invasive species control. The Boll Weevil Eradication Program in the American South, an area-wide program, provided an impetus for other early work addressing the value of collective action, although this work was primarily empirical, rather than theoretical. In order for the eradication program to be implemented in a given area, it had to be approved by a majority vote of cotton producers. Once approved, program participation was mandatory. This model may be of use when responding to other invasions, for instance, in helping to identify the workings of successful pest control districts.

Future Research

Policy makers have identified three key areas for invasive species research:

1. Comprehensive benefit/cost analysis of invasive species;
2. Evaluation of alternative control or management strategies; and
3. Combining biological and economic modeling.

Uncertainty in predicting the risks from invasive species and their economic impacts is a pervasive issue underlying all three areas. This is particularly true as it applies to biosecurity risks, but also for accidental introductions of new species or for pests that simply moved from one crop to another, as in the case of the greenhouse whitefly invasion of strawberry fields in California. In all three areas, the stochastic elements of the problem involve both biological and economic components. For instance, the movement of the greenhouse whitefly from crop to crop or field to field is not yet fully understood by

entomologists, but they have identified the recent phenomenon of the summertime planting of a growing share of California strawberries as a contribution from producers to the whitefly's success. Newly planted strawberries provide a desirable host for the whitefly at a time of year when there previously had been less ideal hosts. The greenhouse whitefly problem in the California strawberry industry illustrates that there may be unintended, unpredictable consequences from invasions that occur when changes in human behavior interact with pest behavior that had not previously been observed. Among the most interesting features of invasive species modeling, therefore, is that neither economic models alone nor biological ones would capture these surprise outcomes.

The spatial and temporal nature of biological invasions, and uncertainty regarding effective control measures and the value of damages resulting from the invasion all suggest that collective action, whether publicly or privately coordinated, is an important consideration when making management decisions regarding invasive species, and one deserving of future analysis. Collective action may involve government policies alone, or involve pest control districts (either voluntary or mandatory). Industry groups may also take the lead. In any case, it seems likely that invasive species responses will not be limited to individual producers pursuing their own pest control strategy. Economists therefore can play a fundamental role in shaping the nature and extent of invasive species control policies. The PREISM program undertaken by the USDA's Economic Research Service, in collaboration with other researchers, includes research projects to make progress in all three categories. One theme of this research is the role of property rights, and differences in private and social benefits of invasive species management decisions. Another theme of this research regards the role of trade, and international aspects of invasive species control. (For more detail on specific projects, please consult the ERS website:
http://www.ers.usda.gov/Briefing/InvasiveSpecies/preism.htm).

Adapting previous information concerning the control of established pests is likely to fall short of capturing the population dynamics of new species, so interactions by economists in this effort with experts from the biological sciences are essential. The data requirements for both spatial and temporal aspects of invasive species behavior will be great, and will ultimately push modeling efforts in both sciences in exciting new directions.

References

Bhat, M.G., R.G. Huffaker, and S.M. Lenhart. "Controlling Forest Damages by Dispersive Beaver Populations: Centralized Optimal Management Strategy." Ecological Applications 3(August 1993):518-530.

Brown, C., L. Lynch, and D. Zilberman. "The Economics of Controlling Insect-Transmitted Plant Disease." American Journal of Agricultural Economics 84(May, 2002):279-291.

Eiswerth, M.E. and W.S. Johnson. "Managing Nonindigenous Invasive Species: Insights from Dynamic Analysis." Environmental and Resource Economics. 23(November 2002):319-342.

Glauber, J.W. and C. Narrod. "A Rational Regulatory Policy: The Case of Karnal Bunt." Chapter 11 in Sumner, D. A., editor. Exotic Pests and Diseases: Biology and Economics for Biosecurity. Iowa State University Press (Ames, 2003).

Hueth, D. and U. Regev. "Optimal Agricultural Pest Management with Increasing Pest Resistance." American Journal of Agricultural Economics 56 (1974):543-52.

Hof, J. "Optimizing Spatial and Dynamic Population-Based Control Strategies for Invading Forest Pests." Natural Resource Modeling 11(Fall 1998):197-216.

Knowler, D. and E. Barbier. “The Economics of an Invading Species: A Theoretical Model and Case Study Application.” In The Economics of Biological Invasions, eds. C. Perrings, S. Dalmazzzone, and M. Williamson. p. 70-93. Edward Elgar Publishing (Cheltham, UK, 2002).

Marsh, T., R. Huffaker, and G. Long. “Optimal Control of Vector-Virus-Plant Interactions: The Case of Potato Leafroll Virus Net Necrosis.” American Journal of Agricultural Economics 83(August 2000):556-569.

Pimentel, D., L. Lack, R. Zuniga, and D. Morrison “Environmental and Economic Costs Associated with Non-Indigenous Species in the US.” BioScience, Vol. 50, No.1, (2000): 53-65.

Sumner, D. A., editor. Exotic Pests and Diseases: Biology and Economics for Biosecurity. Iowa State University Press (Ames, 2003).

Taylor, C. and J. Headley “Insecticide Resistance and the Evaluation of Control Strategies for an Insect Population.” Canadian Entomologist, 107 (1975):237-242.

U.S. Congress, Office of Technology Assessment, “Harmful Non-Indigenous Species in the United States.” OTA-F-565 (Washington, DC: U.S. Government Printing Office, September 1993).

www.ers.usda.gov/briefing/invasivespecies/

www.invasivespecies.gov

THE UNCERTAIN FUTURE OF THE MEXICAN MARKET FOR U.S. COTTON: IMPACT OF THE ELIMINATION OF TEXTILE AND CLOTHING QUOTAS

By
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Abstract

Accounting for about 20% of U.S. total cotton exports in recent years, the Mexican market has become a key destination for U.S. cotton production. Simultaneously, the U.S. market is critical for the Mexican textile/clothing sector absorbing almost 50% of its total output. This strong North American integration process, in part a result of NAFTA, might be jeopardized by the approaching implementation of the Agreement on Textiles and Clothing (ATC) in 2005. This paper presents the results of an econometric and simulation model that allows for the assessment of potential implications of the ATC's quota elimination on Mexico's cotton consumption and U.S. cotton exports to Mexico. It incorporates the growing interdependence between the U.S. and Mexico's cotton and textile industries and summarizes some plausible scenarios for the impact of the 2005 textile and clothing final quota elimination on U.S. markets.

Introduction

During the past 40 years, world textile trade has been in large part governed by the Multi Fiber Agreement (MFA) and its predecessor agreements. However, starting in 2005, in accordance with World Trade Organization (WTO) obligations and the Agreement on Textile and Clothing (ATC), the restrictions imposed by these previous agreements must finally end. The new global trade rules that WTO members agreed to follow, specifically the elimination of quotas in the textile and clothing (T&C) industry, are certainly going to have important implications for world textile and cotton trade.

In order to have a comprehensive understanding of the far-reaching consequences and policy implications of this change in the T&C industry (i.e. at the aggregate level), individual structural relationships for the main market participants need to be examined and updated. In the late nineties Mexico became the number one supplier of T&C to the U.S. market. In fact, Mexico currently exports between 44% and 50% of its textile and apparel products, and about 95% of them are exported to the United States (INEGI). Furthermore, in recent years, Mexico ranked as the world's 4th largest exporter of clothing (Mexican Ministry of Economy).

As a member of NAFTA, Mexico is now a privileged supplier of clothing to the United States and Canada where most of Mexican shipments are already duty-free. However, with the forthcoming final elimination of the T&C quotas, other big exporters currently bounded by those quotas, such as China or Pakistan, could easily challenge Mexico's privileged position due to the NAFTA agreement. Accordingly, Mexico's competitiveness in the cotton T&C industry could be jeopardized by the lower costs of many Asian countries. For example, Chinese textile wage rates are reported to be one tenth of their Mexican counterparts.

Imposing quotas to textile imports creates price gaps between importing and exporting prices constraining the free market level of trade. Therefore, trade theory implies that if quotas were the only binding constraint, liberalization of trade, (i.e., elimination of quotas) would cause the importing country (e.g., the United States) to increase its imports of textiles while exporting countries, formerly limited by

quotas, would increase their exports. Another implication of the textile quota elimination would be that the import price of textile products will certainly decline. In fact, empirical evidence suggests that the average "tariff equivalent" (i.e., import-export price gap) of the U.S. quotas for Chinese T&C imports could be as high as 40%. Since the average U.S. tariff for T&C items is between 12% and 15% (and will remain in place after the quota elimination), it is likely that U.S. average prices for T&C imports from China will decline a 20% or 25% as consequence of the 2005 final ATC quota elimination (Malaga and Mohanty, 2003).

Conversely, Mexico, which currently has a free trade agreement with the United States, is taking advantage of not being subject to quotas or U.S. tariffs. However, as suggested above, the 2005 ATC final elimination of quotas will likely cause U.S. imports of textiles from China and other Asian countries to increase while imports from Mexico will likely decline. Therefore, this reorganization is expected to reduce not only Mexico's exports of textiles and clothing but also the export-import price of textiles between Mexico and the United States.

Similarly, and mainly because of NAFTA, Mexico has recently become the largest market for U.S. cotton exports. For instance, during, 2000, 25.3% of U.S. total cotton exports went to Mexico (FATUS). Moreover, around 94% to 97% of cotton imports demanded by the Mexican textile industry come from the United States (INEGI). Consequently, it should not be difficult to argue that Mexico's demand for U.S. cotton is highly dependent upon Mexico's ability to export textiles and clothing. Understanding the impact of the ATC quota elimination on Mexico's competitive position in the U.S. market becomes a critical component to forecast future U.S. cotton exports to that key cotton market.

Methods

The Mexican model equations were estimated using time series data and Ordinary Least Squares. The regression period was 1964-2001 (Lopez, 2003). On the supply side, cotton production was isolated into separate behavioral equations for cotton area harvested and cotton yields. On the demand side, a two-stage procedure was implemented where the first stage consists of total fiber consumption, and the second stage was delineated by the cotton share of total fiber consumed. Subsequently, the estimation of an ending stock behavioral equation allowed for the computation of the change in cotton stocks. Finally, the closing of the model was achieved through the calculation of net cotton trade. Net cotton trade was determined by the difference between cotton production and cotton consumption plus or minus the change in cotton stocks.

Price transmission relations were additionally built for farm cotton prices, mill cotton prices, and soybean prices in Mexico. These transmission relations are primarily used in the model to forecast domestic prices in Mexico, and to incorporate the international market effect into the model. Linkages between Mexico and the U.S. cotton industries were established based on their trade patterns. The effects of the ATC textile quota elimination were incorporated through the "total fiber consumption" behavioral equation and a textile and apparel price index in the United States. For a more comprehensive description of the model refer to Figure 1.

The projections on international commodity prices are taken from FAPRI. FAPRI's compilation of variable projections such as income, price indexes, and exchange rates are also utilized. The historical patterns of the series are also considered to compute compound growth rates for the remaining exogenous variables.

Results and Discussions

Estimated own and cross price elasticities of supply and demand variables are summarized in Table 1. On the supply side, cotton yield elasticity estimates with respect to fertilizer use and pesticide prices are provided. On the demand side, it is interesting to notice how income dominates fiber consumption over

the other explanatory variables. The textile and apparel price index was the second most important factor affecting total fiber consumption.

The estimated model was utilized to generate a baseline forecast for cotton production, total fiber consumption, cotton consumption, and net imports of cotton in Mexico. Forecasted values are shown in Table 2. Cotton production is forecasted to remain at low levels of around 100,000 million pounds. Fiber and cotton consumption are estimated to slowly increase from the year 2003 to the year 2005. Increases in fiber and cotton consumption were found to be primarily driven by increases in Mexican income. Furthermore, net imports under baseline conditions were forecasted to follow a slow-growth pattern to the year 2005.

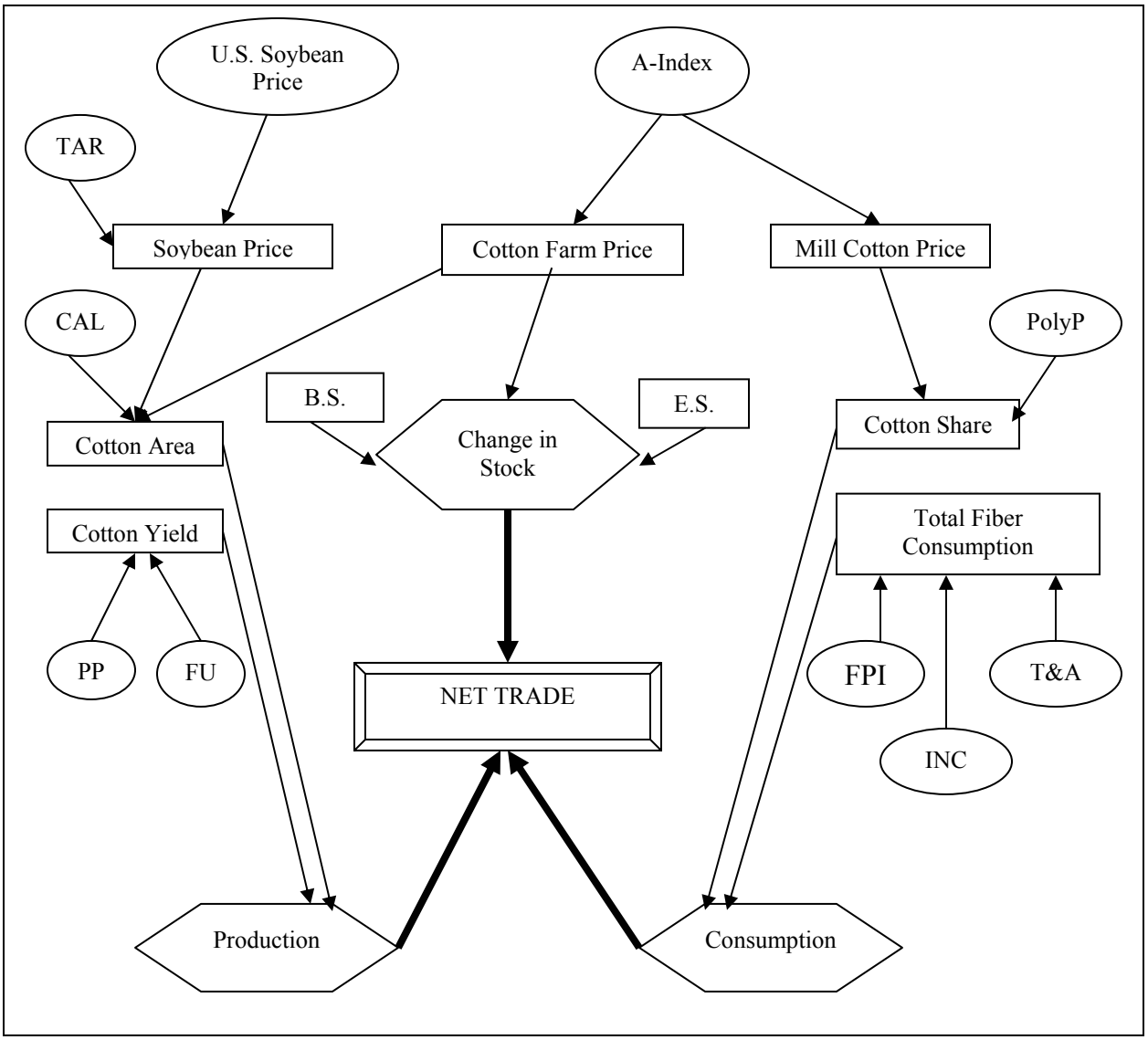

Figure 1. Simplified graphical representation of the implemented model.

Note: TAR stands for NAFTA tariffs; CAL stands for cotton area lagged one period; PP stands for weighted average pesticide prices; FU stands for fertilizer use; B.S. and E.S. stand for beginning and ending cotton stocks, respectively; PolyP stands for polyester price; FPI stands for fiber price index; T&A stands for textile and apparel price index; and INC stands for income.

Table 1. Relevant supply and demand elasticity estimates at mean level derived from the model.

	Area Harvested	*Cotton Yields*	*Fiber Consumption*	*Cotton Share*
Farm Cotton Price	0.66			
Soybean Price	-0.42			
Pesticide Price index		-0.18		
Fertilizer Use		0.20		
Fiber Price Index			-0.0011	
U.S. Textile and Apparel Price Index			1.21	
Income in Mexico			1.48	
Mill Cotton Price				-0.10
Mill Polyester Price				0.12

Table 2. Baseline model forecast for the variables of interest for the years 2003 to 2005.

	Baseline Quantities in Million Pounds		
Variables of Interest	***2003***	***2004***	***2005***
Cotton Production	85	100	117
Total Fiber Consumption	2638	2813	3005
Cotton Consumption	1214	1284	1358
Net Imports	1111	1186	1247

Furthermore, two plausible scenarios were simulated and compared to the baseline projections. The simulated scenarios assume 20% and 25% decline on U.S. prices for textile and apparel as a consequence of the elimination of the U.S. quotas in 2005 (Malaga and Mohanty, 2003). Given that U.S. textile and apparel prices were found to indirectly induce the amount of total fiber consumed in Mexico, the 2005 forecasted amounts of cotton consumption, and net cotton imports changed according to the two alternative scenarios as illustrated in Table 3.

Table 3. Simulation results for the impacted variables by the 2005 ATC quota elimination.

	Quantities for the Year 2005 in Million Pounds			
Variables of Interest	***20% Impact***	***Percentage Decrease***	***25% Impact***	***Percentage Decrease***
Fiber Consumption	2765	8%	2683	11%
Cotton Consumption	1250	8%	1212	11%
Net Imports	1138	9%	1101	12%

Note: The percentage decrease is with respect to the 2005 baseline level.

Simulation outcomes show that a 20% decrease in textile and apparel prices in the United States result in an 8% reduction in Mexican total fiber and cotton consumption, leading to a 9% reduction on net imports of cotton . Similarly, the simulation of a 25% decrease in textile and apparel prices is estimated to cause an 11% reduction in total fiber and cotton consumption, respectively and a 12% reduction in net cotton imports from the United States with respect to the projected baseline. Using the 1999-2003 average Mexican share of U.S. cotton exports the magnitude of the simulated Mexican import decline would represent no more than a 3% of total U.S cotton exports.

Nevertheless, the elimination of the U.S. quotas will still leave the U.S. T&C tariffs (around 15% for countries other than Mexico) to be reduced within the framework of the current WTO negotiations implying future additional reductions on U.S. T&C import prices and a further decline of Mexican cotton imports. Moreover, although not holding T&C quotas, Mexico's domestic market may be also affected by the inflow of Asian imports if Mexican tariffs are to be reduced. With minor modifications the estimated model could serve to estimate the impact of those eventual scenarios on the future of the U.S. cotton exports to Mexico. Furthermore, the model could also be utilized to assess the effects on cotton supply and imports of eventual Mexican policy changes directed to encourage cotton production. (e.g., subsidies on fertilizer prices and pest control).

References

Food and Agricultural Policy Research Institute (FAPRI). 2003 U.S. and World Agricultural Outlook. Staff Report 1-03. Ames, IA, January 2003.

Instituto Nacional de Estadística, Geografía e Informática (INEGI), "La Industria Textil y del Vestido en Mexico 2002." No. 15, 2002.

Lopez, J. E. "An Econometric and Simulation Model of the Mexican Cotton Industry." M.S. Thesis, Texas Tech University, Lubbock, Texas, 2003.

Malaga J. and S. Mohanty. "Agreement on Textiles and Clothing: Is It a WTO Failure?" Journal of International Law and Trade Policy, 4 (1): 75-85, June 2003.

Mexican Ministry of Economy, The Representative Office for Europe. The Textile and Clothing Industry in Mexico. Brussels , Belgium, 2002.

United States Department of Agriculture (USDA), Economic Research Service web site. Foreign Agricultural Trade of the United States (FATUS) Report. Available at: http://www.ers.usda.gov/data/FATUS.

CONFRONTING LAND FRAGMENTATION: OPPORTUNITIES FOR FEDERAL RESEARCH AND OUTREACH PROGRAMMING PARTNERSHIPS

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Introduction

The most recent U.S. Census indicates that the intermountain, great basin region of the U.S. West has many of the states with the fastest growing populations. Half of the fastest growing counties are also in this region. Counties in Wyoming, for example, are experiencing rapid rural (unincorporated) growth both from intrastate urban-rural, and interstate (extra-regional), migration (Taylor and Lieske, 2002). This growth, as it has elsewhere in the United States, has contributed to subdivision and land fragmentation.

Land fragmentation may be defined as dividing a given (usually agricultural or private forest land) tract into smaller parcels. This changes the size, the characteristics and typically the use of that original tract. Examining land fragmentation may consist of simply measuring the extent of the conversion of agricultural land into other uses. The attendant consequences may also be of import. These may include the loss of productive as well as environmental amenity values that are attributed to a given parcel. Such losses in aggregate may result in a diminution of the flows of public benefits (e.g. resource quality, recreation opportunities and aesthetic values) that stem from the maintenance of goods and services associated with environmental amenities in a region.

The heterogeneity of the land resource by state and region is relevant to an examination of the causes and impacts of land fragmentation. Understanding the changes in demand, as well as supply, for rural lands and the potential land use changes is also relevant to land fragmentation research. Governance and policy responses to land fragmentation are also important to consider. These issues in turn suggest considering how private property rights and the asset value of land resources are affected by land use controls or changes in adjacent land uses and management. Ultimately productive viability and niche marketing as well as farm estate planning may be relevant to the preservation of agricultural lands. It is within this general framework that the task of sorting out research opportunities and outreach programming on a national scale takes place. My goals in considering the issues related to land fragmentation consist of the following:

- Determine what economic research was occurring relevant to land fragmentation;
- Discover the outreach programs that addressed land fragmentation; and
- Indicate shortfalls and subsequent opportunities for the above particularly for the benefit of, and future partnering by, the Cooperative State Research, Education and Extension Service (CSREES) that funded my work in Washington, D.C.

Background

Land fragmentation appears to be a relatively new topic for economic and agricultural economic researchers. The Economic Research Service (ERS) provided some useful national analysis concerning public preferences for agricultural preservation programs, including a valuable synthesis of existing work (Hellerstein et al, 2002). Nearly all of the state-run programs as well as the location in which research has been conducted fall east of the Mississippi River or on the Pacific coast. Other useful sources for understanding the value of unfragmented agricultural lands include a general survey

of private and societal values by Bergstrom (2002); and a related work by Fausold and Lilieholm (2001) that offers direction for a wide range of economic analysis.

Hedonic price modeling (HPM) has been employed to determine valued parcel attributes spatially, using Geographic Information Systems (GIS) data (e.g. Geoghegan et al., 1997; Bastian et al., 2002; Sengupta and Osgood, 2003). Other work examines the effects of adjacent development and target parcel status for various determinants of land use change (e.g. Irwin and Bockstael, 2001; Plantinga, 1996). Policy referenda concerning land use and planning preferences in Wyoming and Colorado have been conducted by McLeod et al (1999) and in Rhode Island by Kline and Wichelns (1995) across a variety of resident and nonresident respondents. Contingent valuation methods (CVM) for open space valuation summarized nicely by Randall (2002) and a summary of willingness-to-pay (WTP) estimates by Bergstrom and Ready (2004) offer important analysis from which welfare measures may be obtained. These broad categories of published work constitute the major areas of analysis.

Land Fragmentation Research and Outreach Program Opportunities

Research Focus and Funding:
One difficulty with understanding how researchers have dealt with land fragmentation is that of scale. Impacts due to land use change may be considered alternatively based on a particular species (habitat approach); on an assemblage of species (ecosystem approach); or on some socio-economic criteria such as land use conflicts (recreation use or access to public lands) or taxation issues (cost of community services). Further complications emerge given a mosaic of land ownership, land management responsibilities and the multitude of jurisdictions that may be acting at cross purposes in any one county. The differences in type and extent of scale manifest themselves in diverging research questions, methods and interpretation of outcomes. Discipline-specific approaches appear to be insufficient in addressing the complexity of land fragmentation. Development of a hybrid approach, or at least an explicit comparison of the research from the above perspectives, is needed.

There appears to be a developing interest in the topic area. Nearly 100 CSREES supported land use analysis projects have been initiated since 1997. The diversity of approaches was compelling and challenging to interpret. Many were newly initiated or in progress with few outcomes to report. The intermountain/great basin west was under-represented, indicating a shortfall of grant awards or funding in a rapid growth, high amenity region. It may also reflect hesitation by faculty to risk pursuing economic analyses of land fragmentation: a decidedly complicated and contentious topic in a rapidly changing region.

Multidisciplinary funding opportunities for researching the causes, consequences, alternatives and remedies of land fragmentation are becoming available from the National Science Foundation (NSF) and the Environmental Protection Agency (EPA). Explicit economic research opportunities pertaining to land fragmentation via the National Research Initiative (NRI) are still scant. They currently consist of parts of the rural development and managed ecosystems announcements. An economic research component might address issues, for example, pertaining to individual incentives, market shifts, and institutional arrangements as well as responses to regulation and compensation existing in resource management efforts.

An internet search of Cooperative Extension Service (CES) programs in the fall of 2003 indicated that every state had a natural resource management program, a community planning program or both. The capacity appears to exist in CES to address land use issues locally. The state of Indiana, for example, formalizes the importance of this capacity to address land fragmentation by requiring county CES educators to serve on local land use and planning boards. University of Wyoming offers the *Wyoming Open Space Initiative* which joins the expertise of several departments to address land and water planning research needs (http://www.uwyo.edu/openspaces/5K.html). The supporting research to

assess the individual or joint impact of land fragmentation policies is required to assist the local planning efforts.

Efforts in providing policy relevant land use outreach and programming tend to be parochial. The author acknowledges that in his state as in other places policy makers often insist that theirs' is a "unique situation." Unfortunately often times the wheel is being re-invented. Work done elsewhere may offer opportunities to increase project efficiency while allowing an advance of understanding in delivery and analysis. One can conclude similarly for land fragmentation research, especially across regions of the U.S. efforts to summarize and disseminate outcomes are needed. Resources should be dedicated to this end.

Private Sector Opportunities:
A search, current as of the summer of 2003, was conducted to determine potential Non-Governmental Organizations (NGO) partners who may offer research, funding, and/or outreach efforts addressing land fragmentation. Some twenty-five possibilities were identified. These operate in multiple regions or nationally and may offer potential future partnerships with land grant institutions and/or federal agencies. Contacts need to be established and trust forged to pursue synergies between public and private efforts.

Land trusts have been in operation throughout the United States to provide public education and help broker conservation easements with landowners. The growing existence of land trusts appears to be a private sector response to a set of issues that the public sector has been slower to address. NGOs, communities and groups of landowners are not waiting for thorough research or outreach programming in many cases. A sense of urgency is being conveyed in this fashion concerning community and landscape changes. The American Farmland Trust, the Nature Conservancy, the Trust for Public Lands and the Land Trust Alliance are all currently active in facilitating education, outreach and land preservation efforts.

Table 1 provides a broad-brush view of the density of land trusts on a population basis in comparison to population density. There is considerable NGO activity and presence that varies across stateliness. This too reveals the existing private sector capacity for partnerships with various levels of government.

Table 1. Population Densities and Number of Land Trusts per 100,000 of Population for Selected States (2003)

Selected State	*Population Density per Square Mile*	*Land Trust per 100,000 Population*
Maine	42.3	3.97
Rhode Island	1,029.8	2.32
New York	406.4	0.40
South Carolina	137.7	0.51
Florida	315.6	0.13
Ohio	279.3	0.33
Minnesota	63.5	0.10
Missouri	82.8	0.21
Texas	84.5	0.08
Montana	6.3	0.88
Idaho	16.5	0.96
Colorado	43.9	0.81
California	227.5	0.34

Source: US Census Quick Facts; Land Trust Alliance

Several general outcomes appear from Table 1 as follows: low population density states (below 50/square mile) such as Colorado, Idaho, Montana and Maine tend to have a high number of land trusts per 100,000 of overall population. High population density states tend to have the opposite (Rhode Island being a notable exception), though there is no accounting here for economies of scale in land trust effort or activities. Intermountain states such as Idaho, Colorado and Montana which can be characterized as having high in-migration rates as well as much public lands and recreation occurring tend to have a high density of land trusts. These also are states that still have wide open spaces that are threatened by encroaching development.

Opportunities Resulting from Federal Agencies Administering Programs:

The 2002 Farm Bill adds an array of conservation efforts to existing programs. These opportunities are largely administered by the Natural Resource Conservation Service (NRCS) and are as follows:

- Conservation of Private Grazing Land (CPGL),
- Environmental Quality Incentives Program (EQIP),
- Farmland and Ranchland Protection Program (FRPP),
- Grassland Reserve Program (GRP),
- Wetlands Reserve Program (WRP) and
- Wildlife Habitat Incentives Program (WHIP).

These opportunities augment US Forest Service (USFS) options. The latter are as follows:

- Forest Legacy Program,
- Forest Stewardship Program and
- Forest Land Enhancement Program.

U.S. Fish and Wildlife (USF&W) provides landowners with Endangered Species Conservation and Partnership for Fish and Wildlife Habitat Conservation. The Farm Service Agency (FSA) manages the Conservation Reserve Program. The ubiquitous activities of NGOs, Land Grant Universities (LGUs) and federal agencies offer opportunities to leverage resources. Public-private partnerships can offer a complementary means to overcome limited resources and knowledge across both program development and administration.

Recommendations for CSREES

CSREES can serve as a broker and conduit of opportunity nation-wide. A potential role for CSREES in addressing land fragmentation and agricultural productive viability may consist of collaborating with the listed entities as follows:

- Working with NGOs involved in resource management issues on private lands as well with community planning professionals;
- Making land fragmentation research and CES land use programming a priority for Regional Rural Development Centers through ear marked resources (for example following the work sponsored by the Northeast Center);
- Encourage multidisciplinary and multi-institutional research requests with an explicit role for economic inquiry to LGU CES and Research units;
- Collaborating with other units in the USDA and federal agencies responsible for resource management and analysis such as the USFS, EPA, USF&W, FSA, NRCS, as well as the National Park Service and Bureau of Land Management in order to incorporate the public and private land management successfully into land fragmentation research and outreach education;

- Working to sort out programs, procedures and outreach opportunities relevant to land fragmentation in CSREES through the vehicle of the internally formed Environment and Natural Resource working group;
- Promotion of workshops such as the Farmland Amenity Workshop (Baltimore 11/03) with varied jurisdictional public and assorted private concerns participating in regions beyond the Northeastern and mid Atlantic states;
- Soliciting input from multi state research projects (MSRP) such as W-1133 "Benefits and Costs associated with the Management of Public and Private Lands" as to researchable issues concerning land fragmentation;
- Reaching out to the *Association of Environmental and Resource Economists* for input on resource related research opportunities related to land fragmentation;
- Soliciting researchable questions concerning land fragmentation issues from the National Association of Counties; geographers; American Planning Association; landscape architects; rural residential developers; ecologists; and many other perspectives;
- Re-invigorating NEC 1001 "Land Use Planning" as a vehicle to develop a joint CES and Research MSRP; and
- Providing a bridge and communication network between these various entities to address issues as they arise through collaboration.

CSREES offers and institutional framework to assist CES programming and university research efforts. The tasks provided above are not without difficulty. The following challenges exist for CSREES:

- Dollars for research and outreach need to be discovered and leveraged between federal agencies, NGOs, states, counties, and foundations;
- The non-coastal US West is vastly under-represented in most phases of the operation, support, and working knowledge of CSREES. This is particularly critical given the quantity of federal lands therein, the overall size of the area, the large and rapid loss of agricultural land, the critical array of recreation, cultural, water, forest, rangeland and energy resources as well as the rapid population growth occurring there; and
- Determine ways to share resources, particularly personnel between CSREES, LGUs, NGOs and other federal agencies, to provide a more holistic approach to collaborative efforts.

The above opportunities and challenges point to potential improvements in the voice that the land grant institutions can have in informing the debate concerning land fragmentation. Continuing liaison with federal and NGO partners can only strengthen the ability to conduct timely and policy-relevant research, outreach and resident instruction. Public resources are available for communities and landowners via federal land conservation and protection programs. A broad portfolio of land stewardship programs exist: analysis concerning their effectiveness and outreach strategies to educate the public should continue to be pursued.

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References

American Farmland Trust. 2004. http://www.farmland.org/ accessed 11/08/04

Bastian, C., D. McLeod, M. Germino, W. Reiners and B. Blasko. 2002. "The Contribution of Environmental Amenities to Agricultural Land Values: Hedonic Modelling Using Geographic Information Systems Data." Ecological Economics. 40(3): 337-349.

Bergstrom, J. 2002. "Postproductivism and Rural Land Values." Paper presented at Conference on Land Use Conflicts and Problems sponsored by the NE Rural Development Ctr. 2/2002. Orlando, FL

Bergstrom, J. and R. Ready. 2004. "Economic Valuation of Farm and Ranch Land Amenities: What Economists Have Learned About Public Values and Preferences" Published Proceedings from *What the Public Values about Farmland: a workshop to develop a ranking tool for program managers*. USDA-ERS, Farm Foundation and CSREES. Baltimore, MD. November 13-14, 2003.

Fausold, C. and R. Lilieholm. 1999. 'The Economic Value of Open Space: A Review and Synthesis." Environmental Management. 23(3): 307-20.

Geoghegan, J., L. Wainger, and N. Bockstael. 1997. "Spatial Landscape Indices in a Hedonic Framework: an Ecological Economics Analysis using GIS." Ecological Economics. 23: 251-64.

Hellerstein, D. C. Nickerson, J. Cooper, P. Feather, D. Gadsby, D. Mullarkey, A.Tegene, and C. Barnard. 2002. "Farmland Protection: The Role of Public Preferences for Rural Amenities." Economic Research Service. Agricultural Economic Report AER815. 74 pp. http://www.ers.usda.gov/publications/aer815/

Irwin, E. and N. Bockstael. 2001. "The Problem Of Identifying Land Use Spillovers: Measuring The Effects Of Open Space On Residential Property Values." Amer J Agric Economics. 83(3): 698-704.

Kline, J. and D. Wichelns. 1996. "Public Preferences Regarding the Goals of Farmland Preservation Programs." Land Economics. 72(4): 538-49.

Land Trust Alliance. 2004. http://www.lta.org/, accessed 11/08/04

McLeod, D., J. Woirhaye, and D. Menkhaus. 1999. "Factors Influencing Support for Rural Land Use Control: A Case Study." Agricultural and Resource Economics Review, 28(1): 44-56.

The Nature Conservancy. 2004. http://nature.org/, accessed 11/08/04

Northeast Regional Center for Rural Development. 2004. http://www.cas.nercrd.psu.edu/Land_use.htm, accessed 11/08/04.

Plantinga, A. 1996. "The Effect Of Agricultural Policies On Land Use And Environmental Quality." Amer J Agric Economics. 78(November): 1082-91.

Randall, A. 2002. "Valuing the outputs of multifunctional agriculture." European Review of Agricultural Economics. 29(3): 289-307.

Sengupta, S. and D. Osgood. 2003. "The Value of Remoteness: A Hedonic estimation of Ranchette Prices." Ecological Economics. 44: 91-103.

Taylor, D. and S. Lieske. 2002. "Population Change in Wyoming, 1990-2000." University of Wyoming Cooperative Extension Service Bulletin. April 2002. B-1121. http://www.uwyo.edu/ces/PUBS/B1121.pdf

Trust for Public Land. 2004. http://www.tpl.org/, accessed 11/08/04

US Census 2004. http://quickfacts.census.gov/qfd/states/00000.html, accessed 11/08/04

US Department of Agriculture. CSREES. 2004. http://www.csrees.usda.gov/, accessed 11/08/04

US Department of Agriculture. Natural Resources Conservation Service. 2004. http://www.nrcs.usda.gov/programs/, accessed 11/08/04

US Forest Service 2004. http://www.fs.fed.us/spf/coop/library/, accessed 11/08/04

US Fish and Wildlife Service. 2004. http://www.fws.gov/landowner.html, accessed 11/08/04

THE INCREASING ROLE OF DIRECT MARKETING AND FARMERS MARKETS FOR WESTERN US PRODUCERS

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Farmers markets have a rich history in the development of agriculture in the United States. They represented an important community food distribution system long before the rise of the retail agribusiness system, and began to re-emerge (after years of decline) after the passage of the Farmer-to-Consumer Direct Marketing Act of 1976. Some argue that they are now integral part of the food community linking consumers and producers through business and social relationships, while others view markets as an appropriate marketing channel for entrepreneurial and small farmers who strive to establish a loyal customer base through personal selling and quality differentiated (vs. low margin commodity) marketing strategies.

Still, direct markets, including farmers markets, are seldom studied. For market analysis, it is important to understand supply side (number of producers, mix of products and marketing channels) and demand side (growth in sales, as well as number and types of potential consumers) factors, as well as how direct marketing activities influence the financial performance of farms that adopt such business strategies.

The objectives of this article are to summarize the findings of some recent analyses of farmers market and direct marketing by agricultural producers, including the US Ag Census, USDA's Agricultural Marketing Service (AMS) 2000 study of Farmers markets and Farmers market data collected every two years by the USDA-AMS. By examining trends in the number of farmers markets, sales made directly by producers and how direct marketing strategies relate to other farm characteristics, one can assess the potential role of such channels in agricultural development, especially for small farms or producers with specialty and value-added agricultural products.

Direct Marketing by Producers

Data on direct marketing from the 2002 Ag Census show some interesting trends in the US and Colorado. For the US, the value of agricultural products directly sold by producers increased from $591,820,000 to $812,204,000 between 1997 and 2002 (Table 1), an increase of 37% compared to a slight decline in total revenues sold through all channels. The number of farms direct marketing also increased from 110,639 to 116,733 (5.5% growth in farms) at the same time total farm numbers declined from 2.2 million to 2.1 million (5% decline). Although revenue from direct sales on the average farm is very small in absolute terms, it increased from $5349 to $6958 (30% higher). This represents a little over 7% of average revenues per farm ($94,245).

The increase in direct marketing among most Western states is even more dramatic (Table 1). Between 1997 and 2002, 1, 266 farms began direct marketing in this region (26,149 up from 24,833) so that 8.5% of all farms now do some direct marketing (compared to 5.5% for the US as a whole). The greatest share of farms direct marketing are in Oregon (15.9%) and Washington (12.6%), suggesting strong institutions and consumer support in those states. The greatest growth in number of farms direct marketing was in Nevada (48% growth since 1997) and Wyoming (35% since 1997).

Table 1-Direct Marketing Trends in Western US States

	Direct Marketing (Farms, 2002)	*Direct Marketing % of Farms, 2002*	*Direct Marketing (Farms, 1997)*	*Direct Market Value, 2002 (,000)*	*Share of Value Direct Marketed, 2002*	*Direct Market Value, 1997 (,000)*	*Direct Market Sales Growth (1997-2002)*	*Direct Market Value/Farm, 2002*	*Direct Market Value/Farm, 1997*
Arizona	711	9.7%	592	$3,911	0.2%	$3,707	5.50%	$5,501	$6,202
California	6,436	8.1%	7,268	$114,356	0.4%	$78,712	45.28%	$17,768	$10,830
Colorado	2,343	7.5%	1,866	$17,406	0.4%	$6,926	151.31%	$7,429	$3,712
Idaho	1,632	6.5%	1,408	$5,889	0.2%	$3,306	78.13%	$3,609	$2,348
Montana	1,164	4.2%	1,048	$4,523	0.2%	$2,181	107.38%	$3,886	$2,081
Nevada	246	8.2%	166	$1,606	0.4%	$707	127.16%	$6,528	$4,258
New Mexico	1,071	7.1%	1,111	$6,582	0.4%	$4,648	41.61%	$6,146	$4,183
Oregon	6,383	15.9%	5,461	$21,411	0.7%	$15,696	36.41%	$3,354	$2,874
Utah	1,115	7.3%	1,148	$6,983	0.6%	$6,609	5.66%	$6,262	$5,757
Washington	4,527	12.6%	4,428	$34,753	0.7%	$16,540	110.11%	$7,677	$3,735
Wyoming	521	5.5%	387	$2,381	0.3%	$871	173.36%	$4,570	$2,251
US	116,733	5.5%	110,639	$812,204	0.4%	$591,820	37.24%	$6,958	$5,349

Source: USDA Ag Census, 2002

This increase in activity resulted in an 80% increase in direct sales revenues for the region as sales jumped from $139,903,000 to $219,801,000 in 2002. Similarly, the average sales per farm increased from $4,385 to $6,612 (50% growth). These revenues include a number of marketing channels (farmers markets, roadside stands, CSAs and pick-your-own) and illustrate a notable shift in marketing strategies by Western producers.

Not surprisingly, California accounts for over one-half the direct marketing revenues, but Oregon, Washington and Colorado also exceed $10 million dollars. The greatest growth in direct marketing revenues was reported among farms in Wyoming (173%), Colorado (151%) and Nevada (127%). Although Colorado and Nevada's large population growth may be fueling the consumer demand, Wyoming's growth appears to be supply driven (given the high growth in farms choosing this marketing strategy). The average sales per farm grew by over 100% in Colorado, Washington and Wyoming, while the average sales per farm increased by an average of 56% across the whole region.

All of the top ten counties with respect to total direct marketing revenues are in California, which is not surprising given its longer seasons and climates that can produce a wide variety of consumer-ready products (fruits, vegetables, nuts). Still, the highest growth in direct marketing activities is in states, such as Colorado, Washington, Montana and Utah, where there is upwards of 1000% growth as producers go from nearly zero direct marketing to significant revenues in 2002. Table 2 shows the largest direct marketing counties in each state (ranked by total direct marketing revenues) and the county with the highest growth in direct marketing revenues in each state (conditional on at least $200,000 in sales since highest growth was often in counties with a very small revenue base in 1997).

Table 2: County in each State with Greatest Revenues from Direct Marketing and Greatest Growth in Direct Marketing between 1997 and 2002

State/County	*Direct Mkting Revenues (,000s)*	*State/County*	*Growth in Direct Mkting Revenues (1997-2002)*
Arizona\Maricopa	$1,248	Arizona\Cochise	188.9%
California\San Joaquin	$8,165	California\Modoc	1064.7%
Colorado\Adams	$3,187	Colorado\Rio Grande	1973.9%
Idaho\Canyon	$775	Idaho\Lemhi	354.5%
Montana\Lake	$620	Montana\Ravalli	177.0%
Nevada\Clark	$551	Nevada\Washoe	719.3%
New Mexico\Bernalillo	$1,141	New Mexico\Lea	720.7%
Oregon\Lane	$2,327	Oregon\Benton	291.1%
Utah\Cache	$2,938	Utah\Cache	1680.6%
Washington\Skagit	$3,695	Washington\Pacific	5690.7%
Wyoming\Park	$317	Wyoming\Sheridan	1371.4%

Source: USDA Ag Census, 2002

Similar to the states themselves, there is a great degree of difference in the direct marketing revenues among the counties, with the Pacific Coast showing the greatest direct marketing activity, but high population growth states such as Colorado and Utah also appear to have significant direct marketing activity and growth.

Direct Marketing and Farm Characteristics

To look for more generalizable trends between direct marketing and other farm structure, location and profitability factors, a correlation was calculated across the cross-section of all Western counties. First, the correlation between direct marketing revenues and several variables, including number of farms in different sales categories, total income from farm-related sources, net farm income, value of organic sales, the urban continuum code and the natural amenity index (available from USDA-ERS data sources). Then, the same correlations were estimated against the total market value of products sold across counties.

First, it is interesting to note that there is a positive correlation between value of direct marketing sales and net farm income, total farm income, and total organic sales. Moreover, direct marketing revenues appear to be positively correlated with more urban-adjacent counties with a high natural amenity index. This could suggest both demand (a large number of interested consumers) and supply (favorable climate for growing a diverse set of products) effects.

Statistical comparisons of correlations between total market value and direct market value are even more interesting. Gross market sales values are positively correlated with income, as expected. But, pairwise comparisons suggest that gross farm income is more highly correlated with direct marketing revenues, while net cash farm income is less strongly correlated to direct marketing activity. Organic sales value is also more positively related to total market sales value (suggesting scale economies), but less correlated with direct marketing revenues which counters the usual argument that organics are relatively more likely to be marketed directly. Although all revenues are enhanced by proximity to urban areas and natural amenities, the relationship is stronger with direct-marketed agricultural sales. This not only confirms that concentrated populations assist producers who want to direct market, but also, those drawn to high amenity areas may also prefer to buy direct from producers (perhaps to support open space in amenity rich areas).

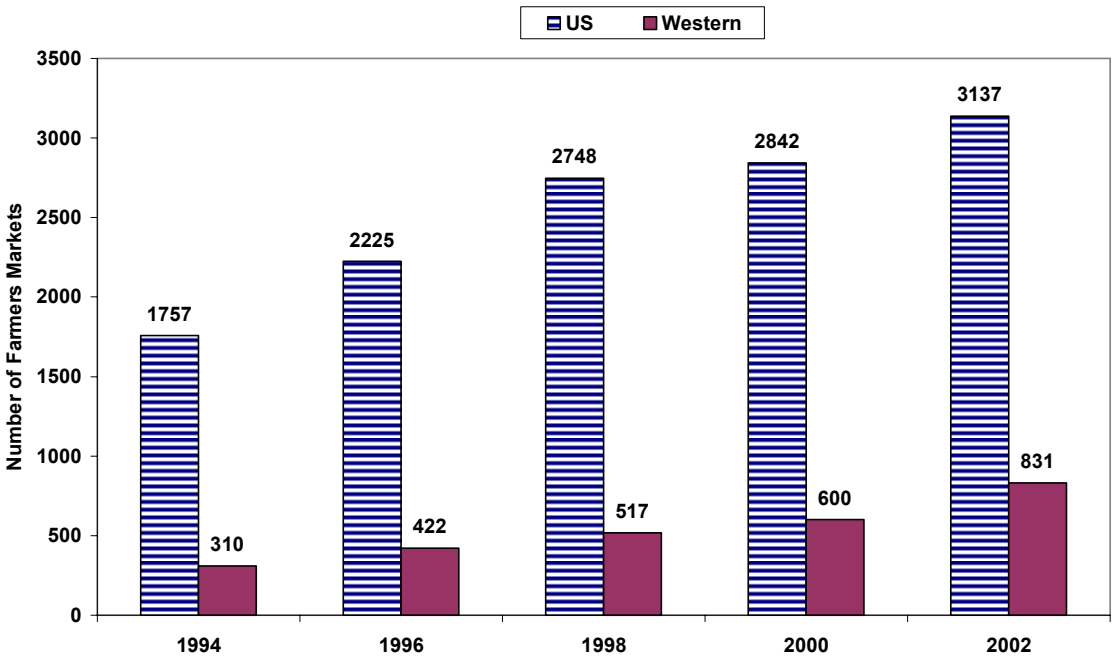
In terms of market structure, there are few surprises. The positive correlation between direct marketing sales and number of farms is always positive, but it is relatively higher than the correlation with total market sales value for only farms below $25,000. The number of larger farms is more strongly correlated with total market value of ag products sold. So, it is clear that direct marketing is far more likely to be a marketing strategy for the very smallest of operations.

Farmers Market Trends

The presence of farmers markets is one of the most apparent signals of consumer and producer interest in developing direct markets, since there are some organizational costs in establishing such markets, and such markets will only continue or develop in the presence of sufficient consumer demand (and proven sales records by participating vendors). The USDA's Agricultural Marketing Service states that, "Farmers markets, now an integral part in the urban/farm linkage, have continued to rise in popularity, mostly due to the growing consumer interest in obtaining fresh products directly from the farm."

The number of farmers markets in the United States has grown dramatically, increasing 79 percent from 1994 to 2002, with over 3,100 farmers markets operating in the United States (Figure 1). Table 3 shows the number of farmers markets in Western states has grown even more dramatically, with over 831 markets, representing 168% growth since 1994 (or about 20% annually). It is interesting to note that this growth is very similar to that seen in the value of sales marketed directly by producers in the Western region.

Figure 1: Growth in US and Western Farmers Markets, 1994-2002



Source: Brown (2002) and USDA-Agricultural Marketing Services (2002)

Table 3: Farmers Markets Numbers by State, 1994-2002

	1994	1996	1998	2000	2002
US	1757	2225	2748	2842	3137
Western Region	310	422	517	600	831
Arizona	5	5	12	12	32
California	169	249	305	340	443
Colorado	29	30	34	39	62
Idaho	19	20	21	24	26
Montana	7	7	7	16	28
Nevada	0	0	4	10	17
New Mexico	19	23	27	27	42
Oregon	18	24	36	44	64
Utah	3	3	3	8	19
Washington	35	55	62	74	87
Wyoming	6	6	6	6	11

Source: Brown (2002) and USDA-AMS (2002)

According to a 2000 USDA study on farmers markets, such markets are likely the most important direct marketing channel for US producers (Payne, 2002). Moreover, with recent growth in revenues from farmers markets, the importance of farmers markets to farm income is expected to rise. In 2000, 19,000 farmers reported selling their produce only at farmers markets. Yet, farmers markets are not necessarily an exclusive marketing channel for producers, as 69% of farmers market participants also have retail and wholesale markets to which they sell higher volumes of product at lower margins (Payne 2002). Looking at direct marketing of agricultural products in the broader context of farm sales growth and number of farms participating in these activities may indicate the relative importance of direct marketing activities.

Payne (2002) also found that the Pacific Coast and Rocky Mountain regions exhibited the largest growth in the number of producers involved in each market (10% vs. 6% nationally), and a higher share of producers who use markets as their only method of sales. Still, the rapid population growth in Western states is not clearly beneficial to farmers markets. In the Western region, producers are far more likely to drive over 50 miles to markets (20%) than the national average (12%), suggesting less proximate market access. But, this is supported by the higher share of producers who make over $25,000 in annual sales at Western region markets (11% vs. 7% nationally).

The Role of Farmers Markets in Local Food Systems

There are broader community and policy issues that relate to farmers markets and direct marketing as well. Hilchey, Lyson and Gillespie suggest that farmers markets enhance producers' business opportunities, foster business skills and have positive effects on producer-vendor families. For the broader community, the conclude that markets may have spillovers to other adjacent businesses on market day, support entrepreneurial start-ups in ag and food industries and support food nutrition, security and educational goals.

Because of the broader economic and social benefits, there are some who believe that public support for farmers markets should grow. The USDA found that 82 percent of markets are already self-sustaining and market income is sufficient to pay for all costs associated with the operation of the market (not including grant or in-kind support). But, this may be misleading, as the study focused on existing markets, and there is no information on what other markets might exist if public support were available. This is especially true in more rural areas, where there is an insufficient consumer base relative to what is necessary to support a market's overhead.

Farmers markets appear to play a significant role in food security and assistance. According to the USDA, 58 percent of markets participate in WIC coupon, food stamps, local and/or state nutrition programs, but the participation rate is lower in the Western region. To support more localized assistance efforts, 25 percent of markets participate in gleaning programs that assist food recovery organizations in the distribution of food and food products to needy families in local communities. In 2000, Western region markets reported over one million pounds of donated food, averaging 5900 pounds per market, which is lower than the national average.

Current trends suggest that farmers markets will continue to grow in popularity as producers seek to personally connect with consumers. Yet, some markets are already experiencing difficulties in attracting producer-vendors who must balance marketing activities with their production obligations. Still, this growth does motivate the need to further explore the relationship between direct marketing, local economic development, farm financial performance and producers' ability to differentiate their products.

References

Brown, A. 2002. Farmers' market research 1940 to 2000: An inventory and review. *American Journal of Alternative Agriculture* 17(4).

Hilchey, D., T. Lyson and G. Gillespie. 2004. "Farmers Markets and Rural Economic Development." Community and Economic Development Toolbox. http://www.cdtoolbox.org/agriculture_economic_development/). (Accessed December 2004).

Payne, T. 2002. US Farmers Markets—2000: A Study of Emerging Trend. Agricultural Marketing Service, USDA, Washington, DC (http://www.ams.usda.gov/directmarketing/)

USDA Agricultural Census. County Level Data. Volume 1. http://www.nass.usda.gov/census/census02/volume1/index2.htm

USDA Agricultural Marketing Service. Farmers Market Directory. http://www.ams.usda.gov/farmersmarkets/map.htm (Accessed August 2004)

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RANGELANDS AND THE ACADEMY: OPPORTUNITIES FOR ECONOMISTS IN THE WEST

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Over twenty years ago land grant universities began partnering with the livestock industry to develop the concept of Integrated Resource Management (IRM). While each participating state has its own flavor of IRM, the National Cattlemen's Beef Association (NCBA) describes the general effort in most states by defining IRM as "a producer-focused initiative to enhance the management of all resources to profitably raise beef in a consumer friendly manner with sound environmental and food safety practices through a viable business plan" (NCBA, 2004). In the West, IRM generally focuses on settings where rangeland provides the principal feed resource.

Colorado State University, an IRM pioneer, has maintained an active and vital IRM program over the last two decades that has been sustained through collaborative work among faculty administered in traditional disciplinary units of Agricultural Economics, Animal Science, Range Science, and Veterinary Medicine. In the early years, the program focused on extension education where interdisciplinary teams demonstrated "best practices" to livestock producers throughout the state. Over the last decade, attention has turned to developing resident instruction programs at both the undergraduate and graduate level. Most recently, attention has expanded to the development of coordinated IRM research. This essay is an outgrowth of recent attempts to develop this interdisciplinary research program.

One important component of the IRM research program is the development of mathematical models that simultaneously treat plant, animal, and human behavior and fully account for their complex interactions. This requires participation from each discipline for the quantitative dimension necessary to construct these models. In seeking individuals to participate, it became clear that the Range Science discipline is undergoing significant change. Two years ago the Department of Rangeland Ecosystem Science at Colorado State was eliminated and the range faculty was absorbed into the multidisciplinary Department of Forest, Rangeland, and Watershed Stewardship. Concurrent with this reorganization, the focus of the range-oriented faculty members also began to evolve as retirements were replaced with a "new breed" of scientist or were not replaced at all. Further investigation reveals that this is not just a Colorado State phenomenon, but is indicative of a nation-wide change with significant implications for economists in the West.

Range Science and the Academy

Range management has identifiable origins in land grant universities around the beginning of the 20th century. In the face of widespread overgrazing, soil and plant scientists began to identify means to control grazing to stop the deterioration of rangelands and to initiate their improvement. The discipline of range management continued to develop in this vein until the 1950's when science was brought to the range as never before. During the 1950's, more range research was conducted than all previous years combined (Holechek, 1981). This science provided the basis for the paradigm that was to persist until the early 1970's.

During this period range science focused on increasing livestock production through manipulation of the range environment. Conservation practices were largely focused on rangeland productivity. Interventions

such as brush control, seeding, water development, and rotational grazing became tools of choice (Holechek, 2001). In recognition of the inherent systems-nature of managing range for grazing purposes, many range science departments began to employ animal scientists and economists who focused on these interactions in devising management approaches. In doing so, range science became one of the few disciplines to organize in such an interdisciplinary fashion around a specific application.

During the 1970's a different paradigm for range science began to evolve that mirrored the general shift in public awareness and perceptions of the natural environment (Kothmann, 2001). For public lands in particular, other rangeland uses began to be considered that included wildlife habitat, recreation, and watershed services. This evolution has continued to the present where livestock production has become a minor focus relative to the broader set of non-consumptive uses and intrinsic values. Today, more and more attention is directed toward "designing landscapes" for many different purposes including the provision of open space by both private and public rangelands near urban corridors.

Faculty members in range sciences in each of the 17 western continental states were surveyed to determine the extent of the changes inferred above. Respondents answered open-ended questions to characterize range-focused academic units at their institution. The instrument was designed to discover the focus of the unit's activity, and describe how this focus has changed over the last thirty years. Several respondents indicated their departments had recently changed names or merged with other units to reflect a broader scope of activity beyond range. Today, only 10 of the 17 western states support administrative units that maintain the word "range" in the name. Only three of these host a unit that is identified as solely a "range" department (Texas, Oregon, and Idaho).

Two related issues seem to be driving these administrative changes. First, respondents cited increasing difficulty to secure financial support within their institutions for traditional range science programs. Historically, Hatch funds and the State Experiment Stations funded range research programs. Federal and state legislatures have chosen to fund these endeavors well below historic levels if at all. As institutions become more dependent on grant and contract revenue, it is difficult for the special-purpose department to compete when focused largely on the private interests of a client base that is shrinking in numbers and influence. Consolidation allows for cost savings in administration and allows a broader base for generating required funds.

Second, there is clearly a shift in the scope of problems that faculty are interested in addressing. This is partly a necessary response to the budgetary issue raised first. Several respondents said that their departments saw the best opportunities to pursue funding through nontraditional sources directed toward larger public values associated with topics such as general ecology and ecosystem restoration. Public funding has been increasingly redirected away from livestock grazing issues, *per se*, and toward broader social issues that reflect public values. Investigation of the larger issues associated with these public values, such as ecology and ecosystem restoration, seems to carry its own reward. Respondents indicated greater scientific prestige and perceived relevance of these areas of study as compared to traditional grazing issues. Coupled with the budgetary climate, this disciplinary shift contributes toward the trend of departments that will encompass a broader set of problems than the grazing management focus of the traditional range science discipline.

These observations are consistent with the open dialog that has been documented in recent range science literature. Over the last five years a number of articles have appeared in *Rangelands*, the non-technical outlet for the Society of Range Management, posing the questions of the future of the discipline. These articles have been a blend of views from the traditionalists who seem resigned to losing what once was, and those who welcome the prospect of broadening their horizons beyond "range." The discipline is clearly at a crossroads.

Implications of Change in Range Science

For years, range science departments have been the major source of investigation and information in the arena of grassland and shrubland ecology and associated practices and uses. As noted previously, many of these departments served as integrators that brought the relevant disciplines together in one department to work toward a common goal. However, as range science units reorganize—in many cases being absorbed into larger, broader units—will the common focus remain? While a broader department allows for a greater set of questions to be addressed, the trade-off results in a loss of focus on the traditional issues and problems. It was that very focus that originally led to the integrated nature of the discipline.

Experience with interdisciplinary work elsewhere, such as IRM, teaches us that it is not administrative organization that fosters successful integrative work, but rather a focus on a common, well-defined problem. Historically this has been the case for the study of range science. The main focus had centered on range management for what are primarily private benefits. While the biology of range-livestock systems is complex, the production orientation draws a very distinct objective to guide management. The problem becomes narrowed as attention is generally drawn to the economic production of a single animal species for which there are commonly understood control points in the system. The human dimension is also simplified as profit is the overriding motive in most of these management schemes. This leads to the opportunity for focused integrative approaches common in the traditional range science unit.

As the focus of range science broadens beyond traditional range management to encompass preservation and restoration, the problem becomes much more complicated. Now, the understanding of all plant and animal organisms associated with a given site becomes important. These complications require markedly different understanding and approaches than traditional livestock management. Most survey respondents indicated that their academic units have recognized this and are shifting toward more restoration ecologists and basic biologists on their faculty with less emphasis on livestock production.

The human dimension also becomes much more complicated as the focus expands because the objectives are motivated by public benefits in addition to the private benefits noted before. Now people near and distant from rangelands become stakeholders who must be considered when contemplating uses of these resources. None of the survey respondents, however, indicated that their unit planned to hire any social scientists to address these issues. In fact, several departments indicated that retiring economists who had been in their units would not be replaced.

The expanded dimensionality of the “new range” problem necessitates that many more forms of expertise are required that will be embodied in more faculty. With each individual having a lesser stake in the overall problem and less focus in terms of the general application, there is likely to be less commitment to contribution beyond the area of specialty. Ultimately, with less cross-disciplinary expertise available within the range units and concurrent expansion of sub-disciplines necessary, there is danger of no longer having the critical mass of faculty to work across disciplinary and sub-disciplinary lines to maintain the necessary level of integration to adequately address rangeland issues.

Opportunities for the Western Economist

As discussed previously, range science has traditionally served as a catalyst and bridge builder in the integrated analysis of rangeland issues. However, with the broadening scope of rangeland issues and the changing composition of range science units, the natural synergisms that lead to fully integrated analysis may no longer exist internally. If so, there is a need for leadership to develop these synergies outside of the traditional range units. Economics is uniquely suited to facilitate the broader integration and to provide the basis for useful analysis of these complex problems, bridging the gap between the traditional and emerging uses of rangeland.

Economics is not new to range science. A number of economists have built careers around the traditional aspects of rangeland management and policy and many of them are evolving to the new, broader focus (see Torell et al, 2003 as representative example). However, as range science becomes more focused on the biological and ecological aspects of rangelands, there is an opportunity for economics to become the leader in appropriately integrating this science to address questions of land use policy for both public and private rangelands.

The first step to building these bridges is to help our range colleagues better understand what economics has to offer. Because of traditional roles in production economics, most range scientists tend to equate "economics" with "accounting", reducing their view of the discipline to a mere summarization of profit and loss for the private entities concerned. Inevitably, the statement is made that the range problem is about "more than economics", implying that the public and social dimensions lie beyond the scope of economics. Most of the confusion seems to arise from the selection of monetary units as the common metric for economic comparison. Economists must take leadership in demonstrating economics as a science of choice that can be used to address both public and private decisions.

Economists must take the initiative to strike up relationships with the appropriate biological scientists. If we wait to be invited, we will likely be cast in the narrow role of accounting for private monetary effects—if we are invited at all. By initiating dialog before roles are defined, an informal discussion can be conducted to identify potential questions for investigation. This provides the economist an opportunity to explain how economics can be used to evaluate resource allocation from a variety of viewpoints (e.g. private, public, local, national) and how those viewpoints can be reconciled. Further, the continuum of potential analytical approaches can be described in terms of resource and data requirements and respective explanatory power. This discussion also provides the reciprocal benefit of establishing the importance and role of the biophysical science in useful economic analysis. This open discussion should result in relevant, jointly-designed research projects that make appropriate use of economics.

There are several important payoffs to economists providing leadership in range research. First, a significant amount of capital has already been built to solve traditional range problems in an integrated fashion. This knowledge base focuses on what are primarily private benefits. While the public dimension is gaining popularity at the expense of the private, private benefits will always be an important component of any public analysis. However, if the current trend continues, much of the current research capacity for grazing management will be lost as personnel change. Once lost, it is questionable whether the threshold can be regained to reestablish a viable working base. Economists are in a unique position to lead research efforts that leverage the historic capital of traditional integrated grazing management research and to marry it with the newer ecosystems research in order to answer the broader social questions now in demand. This approach provides a synergism that underscores the need for the coexistence of the "new" and "old" range science which is not apparent currently.

There should also be direct reward for those economists who expand into rangeland research. The application of economics to addressing the public values associated with the myriad of rangeland uses is well aligned with the redirection of financial resources previously noted. Project proposals that appropriately address these social and environmental concerns will fare much better than traditional range science activities or those focusing on only the biological dimension. Further, increased involvement by economists in rangeland issues should also provide a general benefit for the discipline. As people encounter useful economic analysis, it creates goodwill for the discipline which can translate into additional resources for further investigation.

The prospect for significant contribution for rangeland analysis extends through all of the sub-discipline areas of economics. In the traditional sense, there are many opportunities to leverage the increased biophysical (ecosystems) understanding as this scientific information can be leveraged for greater modeling opportunities to evaluate grazing decisions in a dynamic setting. Agribusiness and marketing economists can contribute toward the evaluation of specialty and niche marketing of meat and fiber as well

as amenity-based products. In the more public dimensions, natural resources and environmental economists can contribute toward resolving public and private trade-offs by measuring values attached to public dimensions of rangeland. An understanding of the economics of community and regional development would be useful for investigating public policy mechanisms that balance both private and public values such as conservation easements and other land use policies.

Rangelands, public and private, are an important resource in the West. These lands dominate this part of the continent and support many economic activities. Many of the arguments provided to justify leadership on the part of economists could be applied to other natural resources in many other settings. What differentiates rangeland issues is the state of change in the range science discipline. The discipline is at a crossroads and significant resources are currently available to support the study of both traditional livestock grazing management and ecosystem science, though the former is dwindling. Economists have a unique opportunity to leverage these available resources in order to play a vital role in reconciling the public and private interests, and to contribute meaningfully to the dialog around western rangeland policy. However, like so many opportunities, this one won't last.

References

Holechek, Jerry L. 2001. "Western Ranching at the Crossroads." *Rangelands,* 23(1):17-21.

Holechek, Jerry L. 1981. "A Brief History of Range Management in the United States." *Rangelands,* 3(1):16-18.

Kothmann, Mort. 2001. "Where Have We Come From? Where Are We, and Where Are We Going?" *Rangelands,* 23(6):47-48.

National Cattlemen's Beef Association. 2004. "IRM Vision." Retrieved December 1, 2004 from http://www.beef.org/dsp/dsp_locationContent.cfm?locationId=27.

Torell, L.A., J.A. Tanaka, E.T. Bartlett, N.R. Rimby, and L.W. Van Tassell. 2003. "An Evaluation of the Federal Grazing Fee Formula." *Journal of Range Management,* 56(6):577-584.

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