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In This Issue:

Agricultural Cooperatives

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Western Economics Forum

Letter from the Editors:

The agricultural sector is complex due to the interactions of the biological, ecological, economic and institutional systems associated with it. WEF focuses on these issues with relevance and importance to the Western United States. To this end, the WEF provides a forum for economists and other thought leaders to participate in such discussions with articles related to food, farms, ranches, resources, institutions, communities and other related and applicable topic areas.

Guest editors are invited on an issue-by-issue basis. WEF is a semi-annual publication with each issue intended to address a specific topic area. Individuals and groups are encouraged to contact any member of the WEF editorial team with their ideas or proposals for an upcoming issue. If you know a group or want to become a guest editor, please call, email or visit with us at a meeting. We, the editors, are excited to work with you to help you be a guest editor, develop your topic and produce an issue. Topic areas must be relatable and relevant to the Western United States. This does not mean that the research, case study, or work occurred in the region, but that it has applicability and connectivity to Western US agricultural and natural resource issues. For instance, a series of papers about water might include the impact of various water policies throughout the world and how they relate to similar challenges in the Western US.

Individual papers may be submitted and are referred to as guest submissions. These guest submissions are welcomed but subject to space availability and the editorial team's approval. Individual submissions must be accompanied with at least two viable recommendations for potential referees including their contact information.

Authors should generally follow the formatting guidelines for the Journal of Resource and Agricultural Economics, <http://www.waeaonline.org/publications/jare/submission-guidelines>). Submissions must be in MS WORD with authorship only identified on a cover page. All submissions are subject to double-blind review. Reviewers may receive a PDF version, a cleaned MS WORD document or other format with authorship removed. Guest editors are responsible for making sure the papers authored by their group are peer reviewed.

Articles are normally expected to be approximately 2,500 words (maximum and minimum length is at the discretion of the editors). There is no fee for submissions or publication. Papers and topics may cover any issue related to agriculture and natural resources including but not limited to production, marketing, financial, business, institutional, food and specialty crops, regulatory issues etc. All works of the journal should be created to appeal to a wide audience of many different backgrounds, education and disciplines. As a professional forum, it is implicit that all works are original, professional and defensible based on current scientific standards.

Foreword

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The first two decades of the 21st century have seen a rapid realignment of the food and agriculture sectors with significant implications for cooperatives (co-ops). The pace of these changes are remarkable in terms of their breadth and depth. Consolidation has accelerated at each link in the value chain, from the producer all the way to the retailer; international markets have become the destination for an ever-growing share of U.S. agriculture; and consumer demands are driving change all the way down to the farm gate.

Co-ops have not been immune to any of these trends. As we look toward the 100th anniversary of the Capper-Volstead Act in 2022, co-ops are evolving as rapidly now as at any point in the past century. However, throughout this period, providing value to their producer-owners remains at the core of the co-op model. The essays in this volume put a spotlight on how co-ops are accomplishing this in the 21st century and form a valuable resource to help guide co-ops and their members going forward.

Value of Migratory Bird Recreation at the Bosque del Apache National Wildlife Refuge in New Mexico

Christopher Huber¹ and Natalie Sexton²

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Abstract

Each fall, thousands of Rocky Mountain Sandhill Cranes and other migratory birds congregate at the Bosque del Apache National Wildlife Refuge in New Mexico's Rio Grande Valley in search of wintering habitat. As such, this refuge is known as one of the premier destinations for bird viewing and photography in the United States. Using contingent valuation data, this case study quantifies the value associated with migratory bird recreation at this refuge to be \$7.5 million in 2010. It is estimated that this annual value increased by more than \$6.4 million in 2017 due to growth in annual refuge visitation.

Key Words: Bosque del Apache National Wildlife Refuge, contingent valuation, migratory birds, willingness to pay

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Introduction and Background

The United States Fish and Wildlife Service (USFWS) in the Department of the Interior (Interior, DOI) manages more than 560 wildlife refuges within the National Wildlife Refuge System (Refuge System). Many of these refuges represent critical stopovers between winter and summer habitats for migratory birds. The USFWS is directed by the National Wildlife Refuge System Improvement Act of 1997 to recognize the importance of wildlife-based recreation at national wildlife refuges, including migratory bird watching and photography. The quality of migratory bird recreation opportunities at refuges depends on the availability and quality of habitat at the refuge and other breeding and nesting sites along species' migratory corridors. This concept can be thought of as a "spatial subsidy" and is defined as the migratory services in one location being subsidized by ecological conditions and processes in other locations (Semmens et al. 2011). Beyond recreational uses, migratory wildlife also provide a variety of spatial subsidy benefits for ecosystem functions, including contributions to seed dispersal, pest control, and nutrient cycling (de Groot et al. 2002; Duffy 2009). In 2017, the United States Secretary of the Interior signed Secretarial Order 3356 to expand access and increase public involvement in outdoor recreation opportunities on DOI managed lands, increase migratory waterfowl populations using voluntary perpetual grassland and wetland conservation easements, expand habitat and water conservation of wintering habitat, and utilize sound scientific evidence in conjunction with landowner and stakeholder input. Having a clearer understanding of the economic benefits of migratory birds as a spatial subsidy can help the USFWS and other Interior bureaus move forward with prioritizing investments in migratory bird habitat and access. This paper presents a case study on the economic benefits of migratory bird-related recreation at one USFWS managed refuge: the Bosque del Apache National Wildlife Refuge (NWR).

Bosque del Apache NWR is known throughout the bird viewing community for the opportunity to witness and photograph the congregation of thousands of migratory birds, including Rocky Mountain Sandhill Cranes (*Antigone canadensis*) and snow geese (*Anser caerulescens*). Located in Central New Mexico, USA, the 57,331-acre Bosque del Apache NWR was established in 1939 to protect important wintering habitat along the Rio Grande River for waterfowl and North American migratory birds. In the summer months, Rocky Mountain Sandhill Cranes find suitable nesting habitat in Wyoming, Central Utah, Northwestern Colorado, Idaho, Montana, and the Province of Alberta in Canada (Mitchusson 2003). In the fall, most Rocky Mountain Sandhill Cranes migrate to New Mexico's Middle Rio Grande Valley (Drewien and Bizeau 1974; Stahlecker 1992). The Bosque del Apache NWR contains the most important winter nesting sites within the Middle Rio Grande Valley and has been found to be used by roughly half of all migrating Rocky Mountain Sandhill Cranes during the winter months (Drewien and Bizeau 1974; Ligon 1961). The refuge also represents important wintering habitat for snow geese, who migrate south in the winter from their summer nesting habitat along the North American Arctic Coast (Mowbray et al. 2000). Other wildlife can be found at the refuge, including numerous other bird species, black bear, mountain lion, fish, and reptiles (USFWS 2008). Bosque del Apache NWR received more than 306,000 visitors in 2017, an 85% increase from the approximately 165,000 visitors in 2010 (based on 2010 and 2017 Refuge Annual Performance Plan data; U.S., Fish and Wildlife Service 2019, written comm.; USFWS, 2019). Most visitation occurs during the winter months to view the congregation of thousands of migratory birds at their winter nesting habitat (Mitchusson 2003). Each November, the six-day *Festival of the Cranes*

attracts roughly 6,000 visitors per year to celebrate the arrival of the Rocky Mountain Sandhill Crane and snow geese seasonal migration to the refuge (Caldwell 2017). In addition to bird viewing, the *Festival of the Cranes* also includes a series of educational workshops, lectures, hikes, field tours, and exhibits.

It can be useful to understand what the two types of economic outcomes from migratory bird recreation and tourism are and how they differ. The first are economic impacts and contributions analyses and measure how money spent by refuge visitors supports jobs and business activities in local communities (Caudill and Carver, 2019; USFWS, 2019). The second, and the focus of this study, is consumer surplus (i.e., economic value) and measures the amount of money an individual is willing to pay for a recreation experience beyond any costs actually paid (Loomis and Walsh 1997). In the context of evaluating publicly funded investments, consumer surplus is the appropriate economic value measure for goods and services that are not be traded in an observable market (Brown, Bergstrom and Loomis 2007). However, without observable market prices, nonmarket valuation techniques must be relied upon to estimate consumer surplus of migratory bird recreation experiences (Champ et al. 2017). Previous research has estimated consumer surplus benefits of migratory bird recreation, including sandhill crane viewing in Nebraska (Stoll et al. 2006), shorebird viewing in New Jersey (Eubanks et al. 2000), and shorebird viewing on the Delaware Bay (Edwards et al. 2011; Myers et al. 2010). The consumer surplus estimates of migratory bird recreation at Bosque del Apache NWR from this current case study adds to the understanding of the benefits of interconnected migratory bird flyways across North America as spatial subsidies. Ultimately, failure to monetize migratory bird recreation values limits the ability to weigh economic outcomes from project investments that may affect migratory bird habitat and migration corridors necessary for the on-site economic benefits to be realized.

Methods

Using survey data collected in 2010 at Bosque del Apache NWR, consumer surplus is estimated for migratory bird recreation using the contingent valuation method (CVM) (Boyle 2017; Flores 2017). Data are drawn from the National Wildlife Refuge visitor survey administered by the U.S. Geological Survey (USGS) for the USFWS (Sexton et al. 2012a; b). The questionnaire was administered to refuge visitors during two sampling periods from August 16-30, 2010 and November 16-30, 2010. The second sampling period in November covered the annual *Festival of the Cranes*. The sampling periods and intercept locations were selected by refuge staff to best reflect the diversity of use and specific visitation patterns of the refuge. Eight sampling shifts of three to five-hour time bands were randomly selected within the two sampling periods. Every tenth visitor willing to participate provided their name, mailing address, and specified whether an online or mail survey was preferred. A postcard was then mailed within ten days of the initial on-site contact asking them to complete the questionnaire online, even if they selected the paper option. Visitors who chose not to complete the online version were then sent a paper version one week after the postcard. Two additional contacts were made by mail, including a postcard reminder one week after the initial survey and a second paper questionnaire another two weeks after the reminder postcard (Dillman 2007). Each mailing included instructions for the online questionnaire or a pre-paid envelope for returning the paper version of the questionnaire. A total of 300 visitors agreed to participate after being contacted on-site

and 229 questionnaires were returned for a response rate of 76%. The majority (80%) of questionnaires were completed online. Of the 229 completed survey respondents, 66% were contacted during the *Festival of the Cranes* event in November, while the remaining 34% were contacted during the earlier sampling period in August.

Survey respondents were asked a series of questions to characterize their trip, including group size, primary recreation activity, demographics, satisfaction of visit, and trip purpose (Sexton et al. 2012a; b). Finally, to capture the consumer surplus of refuge recreation, all survey respondents were asked the following CVM question: “As you know, some of the costs of travel such as gasoline, hotels, and airline tickets often increase. If your total trip costs were to increase, what is the maximum extra amount you would pay and still visit this Refuge?” Respondents were asked to circle the highest dollar amount from a list of options ranging from \$0 to \$250 (Table 1).

This type of CVM question format (i.e., payment card) eliciting the respondent’s consumer surplus provides a bound around where their true consumer surplus value lies. For example, if a respondent selects \$10, it is assumed their true value is greater than or equal to \$10 but less than \$20. We model consumer surplus as a linear function of independent explanatory variables:

$$(1) \quad \ln(\text{consumer surplus}) = x'\beta + e \quad \text{where } e \sim N(0, \sigma^2)$$

Where x' is the independent explanatory variable hypothesized to influence the individual’s consumer surplus, and e is the random error term. Variables tested in the full-unrestricted model include *age, education, gender, income*, and primary recreation activity (*bird viewing, wildlife viewing, and photography*). The regression also includes a variable to test for differences in consumer surplus between respondents who were sampled during the *Festival of the Cranes* in November and those who were contacted during the prior sampling period in August. If the respondent’s true consumer surplus is assumed to lie within the interval defined by lower and upper bound z_{li} and z_{ui} , then for a given observation, the probability that the consumer surplus falls between any two price thresholds is $\Phi(Z_{ui}) - \Phi(Z_{li})$, where Φ is the cumulative standard normal density function (Cameron and Huppert 1989). The log-likelihood function is:

$$(2) \quad \ln L = \sum_{i=1}^n \log[\Phi(Z_{ui}) - \Phi(Z_{li})]$$

Using the method of maximum likelihood and assuming a lognormal conditional distribution for consumer surplus, the unknown parameters, β and σ , are estimated. Mean consumer surplus is $\exp(x'\beta + \sigma^2/2)$, where σ is an estimate of the true population error variance.

Results

The sample of Bosque del Apache NWR visitors are 48% male and 52% female, primarily U.S. citizens (98%), well-educated (77% reported having at least a bachelor’s degree), identify as white (94%), have a mean age of 58.4 years, and more than one third (36%) report a household income of more than \$100,000 per year (Table 2). With respect to trip characteristics, 74% indicate visiting Bosque del Apache NWR is the primary reason for making the trip, 18% view the refuge as one of many equally important reasons, and the remaining 8% say the visit was an incidental stop. Bird viewing (49%) is the most frequently reported primary activity on their most recent trip to Bosque del Apache NWR. An additional 15% of respondents indicate that attending the *Festival of the Cranes* is the primary purpose for visiting the refuge, followed by wildlife viewing (10%) and photography (10%). The

majority of respondents (59%) spent less than one day at the refuge on their most recent trip (averaging 4.4 hours). Those who stayed more than one day at the refuge reported an average visit of 3.5 days. During the past year, respondents visited Bosque del Apache NWR an average of 2.9 times and other refuges within the Refuge System an average of 3.3 times. Lastly, the mean visitor group size is 3.6 people (n=165).

Interval regression results of consumer surplus for refuge visitation are presented in both restricted and unrestricted models in Table 3. The restricted model contains variables for *Age*, *Income*, and the *Crane Festival Attendance* dummy variable. The likelihood ratio χ^2 test statistic for the restricted model indicates a high level of overall model significance ($\chi^2(3)=26.720$; $\text{Prob}>\chi^2=0.000$). *Age* is positively and statistically significant at the 1% level of significance. *Income* is also positive and significant at the 5% level of significance. The statistically significant, positive effect of the *Crane Festival Attendance* dummy variable on consumer surplus implies how the value of refuge recreation is influenced by the quality of the experience through festival events and denser bird populations relative to the earlier August sampling period. Additional variables in the unrestricted model include *Education*, *Gender*, and dummy variables for primary recreation purpose (*bird viewing*, *wildlife viewing*, or *photography*). Neither *Education* nor *Gender* are found to be statistically significant in the unrestricted model. Similarly, no statistically significant effect on consumer surplus is found among the primary purpose activity dummy variables. One possible explanation for this result is how similar the reported primary activities are, given the setting and situation experienced at Bosque del Apache NWR. A likelihood ratio test confirms that the restricted model is preferred over the unrestricted model ($\chi^2(5)=6.856$; $\text{Prob}>\chi^2=0.232$), as does the lack of statistical significance on the additional variables included in the unrestricted model.

The restricted model is used to calculate consumer surplus per trip to Bosque del Apache NWR for both visitors who attended the *Festival of the Cranes* event and those who did not (Table 4). Confidence intervals for mean consumer surplus estimates are calculated using the bootstrap method with 1,000 replications. Restricted model results indicate at a 5% level of significance, respondents who attended the *Festival of the Cranes* are predicted to be willing to pay 35% more per trip than respondents who did not, all else equal. Setting the *Crane Festival Attendance* variable to 1 yields a mean consumer surplus of \$118.59 per person per trip. Setting the same *Crane Festival Attendance* variable to zero yields a mean willingness to pay of \$87.72 per person per trip for respondents who visited outside the festival time period.

Dividing estimated mean consumer surplus per trip by the average number of days per trip yields a consumer surplus per day. This value can then be used to aggregate the economic benefits over total annual visitation to the refuge. Respondents who visited during the *Festival of the Cranes* stayed an average of 2.30 days, while those who were contacted during times outside the *Festival of the Cranes* reported an average of 1.42 days. This results in a value of \$51.56 per person per day during the *Festival of the Cranes* and a \$61.77 consumer surplus per day for visitors during the remainder of the year. Approximately 306,000 people visited Bosque del Apache NWR in 2017, representing an increase of 141,000 annual visitors since 2010. Subtracting crane festival visitation estimates (6,000 people per year) from annual visitation yields total non-festival visitation of roughly 300,000 visitors in 2017 and 159,000 visitors in 2010. Assuming 74% of visitors made sole-purpose trips (the same proportion as our sample), multiplying per day values (i.e., *Festival of the Cranes* and

the remainder of year values, respectively) yields a total annual value of approximately \$7.5 million in 2010, which increased to \$13.9 million in 2017 without adjusting for inflation. This represents an increase of \$6.4 million in economic benefits since 2010.

Discussion and Conclusions

Mean consumer surplus per trip to the Bosque del Apache NWR is estimated to be between \$87 and \$118, which translates to a value of \$51 to \$61 per person per day depending on seasonal effects and length of stay. These results are comparable to estimates from previous studies. Cooper and Loomis (1991) found bird viewing in California to be approximately \$73 per person per trip (in 2010 dollars). Viewing migratory shorebirds on the Delaware Bay has an estimated value of \$38 per person per trip using a travel cost model (Edwards et al. 2011) and between \$40 to \$60 per day trip when relying on the contingent valuation method (Myers et al. 2010). The most comparable study is Stoll et al. (2006) who found bird viewers were willing to pay an estimated \$412.65 per person per year to view migratory sandhill cranes in the Platte River Valley of Nebraska (in 2010 USD). This translates to a value of \$80 per person per trip and is within the 90% confidence interval [\$69.35, \$109.74] for the mean non-festival time period estimated in our case study (\$87 per person per trip). Better accounting of the economic benefits of migratory bird recreation opportunities can be used to help evaluate investments aimed at improving bird habitat and migration corridors. Measuring the benefits derived from wildlife viewing and photography is especially important because each are documented areas of growth in wildlife recreation participation in the U.S. In fact, more than 86 million American adults participated in some form of wildlife viewing in 2016—representing an increase of more than 20% from ten years prior (DOI-DOC 2018). However, these on-site recreation value estimates represent only a small portion of the total economic value of this migratory system. This refuge protects some of Rocky Mountain Sandhill Crane's most important wintering habitat, and as a result, supports larger system-wide benefits beyond the refuge boundary. People benefit from indirect services provided (e.g., seed dispersal and nutrient cycling) and recreation activities at other locations along the migratory route, including fall staging areas in Southern Colorado's San Luis Valley. Lastly, many people may place a high value on ensuring that this important habitat exists in a relatively unaltered state regardless of whether they personally visit the Refuge or not.

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Table 1
Frequency of Survey
Responses by Dollar Amount
(n=214)

Dollar Amount	Frequency Rate
\$0	2%
\$10	9%
\$20	17%
\$35	9%
\$50	14%
\$75	4%
\$100	20%
\$125	2%
\$150	7%
\$200	7%
\$250	9%

Table 2

Survey Respondent Demographics and Trip Characteristics	
Primary activity	
Bird watching	49%
Crane Festival Attendance	15%
Wildlife viewing	10%
Photography	10%
Gender (n=221)	
Female	52%
Male	48%
Residence (n=223)	
United States	98%
Other	2%
White	94%
Hispanic	7%
Education (n=221)	
Some high school or less	1%
High school diploma/GED	4%
Some college	18%
Bachelor's degree	20%
Post-bachelor or graduate degree	57%
Income (n=202)	
less than \$10,000	2%
\$10,000-\$24,999	4%
25,000-\$34,999	8%
\$35,000-\$49,999	10%
\$50,000-\$74,999	27%
\$75,000-\$99,999	13%
\$100,000-\$149,999	22%
\$150,000-\$199,999	6%
\$200,000 or greater	8%

Table 3

Interval Regression of Willingness-to-Pay for Additional Costs to Make Current Trip Possible

Variable	Unrestricted Model (N=190)		Restricted Model (N=191)	
	<i>Coefficient</i>	<i>Robust std. error</i>	<i>Coefficient</i>	<i>Robust std. error</i>
Age	0.016***	0.005	0.017***	0.005
Education	0.011	0.030		
Gender (1 if female, 0 otherwise)	0.016	0.131		
Income	0.00000348**	0.00000149	0.00000371***	0.00000138
Crane Festival Attendance (1 if yes, 0 otherwise)	0.298**	0.150	0.301**	0.151
Participated in photography (1 if yes, 0 if otherwise)	0.168	0.254		
Participated in wildlife viewing (1 if yes, 0 if otherwise)	-0.061	0.252		
Participated in bird viewing (1 if yes, 0 if no)	0.022	0.161		
Constant	2.613***	0.574	2.732***	0.315
<i>sigma</i>	0.901*	0.050	0.910*	0.050
Log likelihood	-425.952		-429.380	
chi ² statistics	30.75		28.400	
Prob > chi ²	0.000		0.000	

*: p<0.10, **: p<0.05, ***: p<0.01

Table 4Consumer Surplus of Non-consumptive Recreation
per Person per Trip at Bosque del Apache NWR

	Mean WTP [90% CI]
<i>Remainder of year</i>	\$87.72 [69.35, 109.74]
<i>During Festival of the Cranes</i>	\$118.59 [103.25, 140.07]