

Submitted Article

Managing the Commons: How Extension Facilitates Local Participation to Manage Natural Resources

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Abstract *Extension promotes volunteerism and facilitates community involvement in the informed decision-making process required for managing natural resources; Extension also enhances local social capital. This important role does not receive as much attention in the literature on Extension and its scope as does its traditional role of information provision. We conducted a study to examine the need and demand for Extension programs in a rural community comprised entirely of islands and tangibly dependent on natural resources. We found that affiliation with Extension has a strong impact on the willingness to pay for Extension programs. Thus, we provide evidence that supports the argument that Extension is an important service and an appropriate use of public funds for economic development. This finding is in line with Elinor Ostrom's theory in new institutional economics that well-designed, robust local entities that stimulate local participation can assist in managing natural resources.*

Key words: Extension, willingness to pay, public support, volunteers, natural resources.

JEL codes: H4, H7, Q5.

The late Elinor Ostrom won the Nobel Memorial Prize in Economics in 2009, jointly with Oliver Williamson, for their study of institutional arrangements and economic governance.¹ Williamson's work focuses on the nature of transaction costs in explaining the boundaries of a firm in the presence of asset specificity and individual opportunism (Williamson 1975 and 1985). Ostrom's theory presumes that collective agreement, monitoring, and

¹See Earl and Potts (2011) for a succinct description of Williamson's and Ostrom's theories, and the critical differences between their methods and theories.

punishing those who violate the agreement are possible at the local level through effective communications between agents and institutions that facilitate the agreement (Ostrom 1990). Ostrom examined how communities cooperate to share common pool resources such as forests, fisheries, and irrigation systems, and how they achieve collective benefits from maintaining long-term sustainable resource yields.² Using data from field studies around the world (e.g., in Nepal, Kenya, Switzerland, Guatemala, and Turkey) and within the United States, Ostrom refuted Hardin's theory of the "tragedy of the commons" and offered eight principles for effective commons governance (Ostrom 1990). In this article, we specifically refer to Ostrom's work on governing the commons as we discuss the role of the Cooperative Extension System (Extension) in local communities.³ We find commonalities with Ostrom's perspective when discussing the value of Extension as an institution that facilitates local participation and volunteerism towards the sustainability of natural resources.

The history of the establishment of land-grant universities and the inclusion of Extension as a critical mission of land-grant universities is well documented (McDowell 1988). Extension is a cost-effective platform to provide information on new techniques, skills, and practices to those who would not otherwise be able to access and afford them, or perhaps not recognize the benefits of them. For instance, through youth development programs in under-served communities Extension is able to provide private goods to those who benefit the most but have low ability to pay (Kalambokidis 2004). Brown, Otto, and Quart (2006) discuss the increase in demand for expertise from Extension specialists on private good programming, or a combination of public and private good programming by smaller, well-defined audiences. However, Extension plays another important role that is often overlooked, but is clear when one applies Ostrom's insights and theories in new institutional economics. Extension is embedded in local communities, and forges partnerships with community members to develop localized Extension programs and train local volunteers to deliver programs.⁴ Extension's ability to facilitate collective action through training and organizing volunteers to maintain and sustain natural resources is an extremely important contribution that is often taken for granted. The accrued benefits of volunteering are often ignored when evaluating the value of Extension. The relationship between Extension and the volunteers is symbiotic; volunteers from within the community of interest are integral to the development and delivery of many Extension programs. On the other hand, volunteers participate because they value the research-based knowledge and evidence-based skills that they learn from specialists from an institute of higher education and research.

The goals of this article are two-fold. First, we provide a brief summary of the literature on common pool resource management and discuss Extension's role in the management of natural resources through

²The term "common pool resource" is used frequently in this article. Common pool resources can be natural resources (such as fisheries) or human-made resources (such as irrigation systems).

³According to the USDA's National Institute of Food and Agriculture, there is at least one land-grant university in each state (mainland United States, Alaska, and Hawaii). Available at: <https://nifa.usda.gov/partners-and-extension-map?state=All&type=All>

⁴According to the National Institute of Food and Agriculture, there is an Extension office "in or near most of the nation's approximately 3,000 counties. . .". Available at: <https://nifa.usda.gov/cooperative-extension-system>.

meaningful Extension–community partnerships. Second, using data from Island County in the State of Washington, we examine the factors that affect the demand for Extension services and programs, and for Extension as a whole. With increasing scrutiny over the funding of Extension programs and services, Extension faculty, administrators, and staff are under continued pressure to exhibit the efficacy of their programs and to justify why Extension services should be sustained through public funding, even in unfavorable financial climates. Extension is funded through federal, state, and local taxes. Thus, it is helpful to understand whether and how much residents are willing to pay through tax dollars for an Extension office in their community, and for specific Extension programs available in their community. We use the discrete choice contingent valuation method to examine a community’s demand for Extension services. A multitude of previous studies have used this method to calculate willingness to pay for specific programs (e.g., Whitehead, Hoban, and Clifford 2001; Blaine, Lichtkoppler, and Stanbro 2003; Roe, Haab, and Sohngen 2004; Blaine and Smith 2006). In addition to estimating the willingness to pay (WTP) for specific Extension programs, we calculate the demand for Extension, as a whole, in Island County, Washington.

Governance of Common Pool Resources

Common pool resources (CPR) have two basic characteristics – potential beneficiaries are not excluded, and rivalry in use prevails. The latter characteristic is what distinguishes CPR from pure public goods. The lack of property rights increases overuse or congestion. Excluding non-contributors to a collective benefit is costly: this is known as the collective action problem (Ostrom 2003).⁵ However, real world observations indicate that in many situations, individuals can overcome collective action problems. There exists a vast body of literature on the principles that lead to successful governance of common pool resources, and an underlying criterion is the presence of a local institution or entity that can enhance local participation (e.g. Agrawal 1991; Agrawal and Ribot 1999; Katz 2000; Muldavin 2000; Ostrom 1990; Robbins 2000; Runge 1984). In the last few decades, Ostrom and others have presented numerous case studies, mostly from developing countries, where local management has successfully devised communal arrangements to control and maintain CPR, and have presented theoretically-informed generalizations of the conditions under which self-organized groups can successfully manage common property.⁶ For instance, based on thirty case studies of coastal fisheries around the world, Schlager (2004) notes the importance of exclusion and enforcement of carefully crafted rules in conserving fish stocks. Most importantly, Schlager finds that the specifics of the rules were designed to fit local conditions as well as the fishers’ cultural norms and practices. Similarly, based on a cross-sectional study of thirty-six irrigation systems, Tang (1991) finds bureaucratic systems to be less effective

⁵Olson (1965) adopted the one-dimensional criterion of exclusion as a defining attribute of collective action problems (Ostrom 2003). Thus, Olson posited that self-interested individuals would not contribute to the production of public goods because consumption by one person does not reduce the quantity available to others. This argument is also known as the “zero contribution thesis” (Ostrom 2000).

⁶See Agrawal (2001) and Schlager (2004) for reviews of some of the foundational studies. Schlager has also authored multiple research studies on institutional analyses of water policies and property rights in the western United States (e.g., Heikkila and Schlager 2012; Schlager and Heikkila 2011).

than community systems in managing water resource appropriation to farmers in developing countries, primarily because community arrangements were more sensitive to the end users. Moreover, [Tang \(1992\)](#) notes that governance rules that are specific to the characteristics of the resource environment have better-performing irrigation systems. While the multitude of success stories of community-based collective action have considerably decreased the taste for proposing centralized government intervention or the privatization of property rights over CPR among policy makers and analysts, the onus of crafting complex and complete rules—and monitoring them—become more difficult as the community grows. This complexity and opportunism, while not in the realm of managing natural resources but rather in corporate governance, is the basis of Williamson’s theories of new institutional economics, which propose contracts-based solutions ([Williamson 1975, 1979, and 1985](#)) as opposed to Ostrom’s communications-based solutions ([Earl and Potts 2011](#)).

In developed countries, basic infrastructures and institutions are relatively strong and political systems are relatively stable. In fact, [Tang \(1991\)](#) acknowledges the relevance of government agencies in the construction, production, and distribution of CPR. Yet, dissatisfaction with state-centered policy programs is not uncommon. Imposed management regimes (whether government or private) could alienate local residents and reduce the grassroots energy and motivation for collective action to resolve existing problems. Thus, necessary conditions for successful CPR governance are that those who benefit the most be in close proximity to that resource and be involved in the operational process. Government intervention could not be effective unless supported by affected individuals and communities, as communities can identify their needs and priorities more accurately than external entities. Promoting local participation in decision-making when managing local CPR could increase the effectiveness of monitoring, and consequently reduce transaction costs. Local residents are also more likely to adhere to operational rules when they are involved in making those rules. At the very basic level, it is crucial to develop trust and reciprocity among participants ([Ostrom 1990 and 2010](#)).⁷

The Extension-Community Partnership

Extension is a partnership between the federal government, state governments (and sometimes county and municipal governments), and land-grant universities. Traditionally, Extension’s role has been to provide research-based technological information to farmers who might otherwise be unaware of new techniques, or who might not be able to afford them, to enable these farmers to adopt new skills and techniques, and thus bridge the gap between innovation in research settings and application on farms ([Wang 2014](#)). Over time, this educational role has expanded from stimulating agricultural productivity to facilitating human resource development through programs that focus on nutrition, health, and strengthening family functionalities. In rural communities, whose economies are historically dependent on the extraction of natural resources ([Green 2001](#)), Extension specifically focuses on pursuing sustainable agricultural practices and managing

⁷For instance, [Tang, Callhan, and Pisano \(2014\)](#) discuss how local government fiscal sustainability may be analyzed as a CPR problem, and stress the role of developing trust and reciprocity.

environmental systems. Another impetus for rural economic development is the increasing consumer value of natural resources to the local economy in retirement and tourism areas (ibid.). Based on a study of 2,358 non-metro counties, McGranahan (1999) found that the rural county population change from 1970 to 1996 had been uneven across counties, and that counties high in natural amenities were more likely to enjoy stronger population growth, as well as better development of rural recreation and retirement-destination areas compared to counties low on the natural amenities index. In this regard, Extension plays a key role in the management of common pool resources that, perhaps, does not receive as much attention in the literature as does its traditional role of information provision.

Extension serves as a key agent in the management of CPR in rural communities. Extension is a go-between for the local residents, government agencies, and occasionally the private sector. By being part of the land-grant university system, Extension embodies institutional durability, stability, reputation, and trust. Extension also generates original research or has access to research-based knowledge that can be applied to unique local problems. Equally important is that by being physical entities in communities of interest, Extension offices are accessible to local residents and Extension specialists are in a better position to identify local needs and issues. This way Extension plays the role of an “honest broker” (Orbach 2001) in identifying and resolving local problems.⁸ Extension may also serve as a low-cost intermediary between local residents and external entities to resolve practical problems related to environment and property rights. Cullen (2010) presents a case study where Extension specialists, Wisconsin farmers, and several other communities of interests partnered to solve a unique practical problem relating to wildlife damage to agriculture.

One of the tenets of successful governance of common pool resources is local participation, and Extension facilitates this by promoting volunteerism and community involvement in managing natural resources, and by garnering support and building consensus for programs within the community of interest. In this regard, the relationship with local partners is indispensable. Additionally, repeated exchange between community members, stakeholders, and Extension staff builds bonds of trust, familiarity, and reciprocity, which can help coordinate collective actions more efficiently and effectively over time. Volunteerism and collective action are not synonyms. However, both volunteers and those who participate in collective actions are motivated by the same goal—shared benefits to others besides themselves.⁹ Once a problem is identified and a solution proposed, the supply of volunteers to the program reflects their shared interest in resolving the issue at hand. After completing training, volunteers organize educational events and assist with the delivery and evaluation of programs. Based on the nature of the program, volunteers could also be involved in monitoring the use and quality of a natural resource, and in collecting relevant data for government agencies. Volunteers contribute their time to programs, enhance Extension’s public relations in the community, and reduce the cost of

⁸To our knowledge, the term “honest broker” was first used by Orbach when discussing the role of universities in resolving conflicts between the business and public sectors. Cullen (2010) used the term when discussing the role of Extension in solving local problems.

⁹The literature on the decision to volunteer is expansive. See, for instance, Carpenter and Myers (2010), Freeman (1997), Lilley and Slonim (2014), and Linardi and McConnell (2011).

Extension programming in real dollars. [Overdevest, Orr, and Stepenuck \(2004\)](#), for instance, discuss the role of volunteers in monitoring local natural water resources. The authors find that volunteer monitoring programs could have positive effects on developing local capacities to solve community environmental problems, and could have positive spillover effects in generating more active civic participation when addressing public issues.

In the following sections we present the findings from a survey on how residents of a small community value Extension, and the differences and similarities between the views of non-volunteers and volunteers. We compare the influence of four distinct factors on willingness to pay for Extension: affiliation with the university that administers Extension, volunteering in community organizations that are not related to Extension, volunteering in Extension-related efforts, and knowledge of Extension and its Outreach efforts through interactions with Extension staff and volunteers.

Island County Study

Background

Island County is a rural community located approximately twenty miles northwest of Seattle, Washington. The county, which has two inhabited islands (Whidbey, with a population of approximately 50,000, and Camano, with a population of 30,000) has a large number of retirees. The Extension programs and outreach efforts, which primarily focus on environmental and natural resources programming, reflect the interests and demographics of the county.¹⁰ Like many small-county Extension programs, the Island County Extension programs are interdependent and reliant on each other to effectively deliver their programming. This is especially true with the budget reductions that followed the 2007–2009 recession. County support for Extension has fallen in recent years, which corresponds to declining federal and state funding for Extension services throughout the United States ([Shields 2013](#)). County funding fell from a high of over \$300,000 in 2008, to less than \$100,000 in 2012 and 2013.¹¹ While fiscal restraints have eased somewhat in the recent budgetary cycle, it is important to demonstrate to county leadership, and to the community as a whole, the collective value of Extension programming and the extent of support for Extension services within the community.

Survey Questions on Demand for Extension

We developed a survey instrument to examine the value placed on Extension in Island County.¹² Survey instruments were mailed in early October 2013 using a modified Tailored Design method (TDM), or the

¹⁰*In this study, we refer to the Extension services provided by the Washington State University Extension, which is the sole provider of Extension services in Island County.*

¹¹*These dollar values reflect the amounts received by the Washington State University Extension from Island County.*

¹²*The survey instrument was developed and validated with assistance from academic survey specialists within several land grant institutions, Extension faculty, and local community leaders. Scale questions within the instrument were tested for internal consistency. The Cronbach's alpha was 0.9; a value above 0.7 is considered acceptable ([Kline 2013](#)). We also conducted three focus group interviews. Findings from the interviews with program coordinators, volunteers, and business and community leaders are available from the corresponding author upon request.*

Table 1. Descriptive Statistics: Frequencies or Mean (Standard Deviation)

Variable	AP subsample	GP subsample
Male	36.84%	33.33%
Age < 60 years	28.87%	43.48%
Some college education or less	19.93%	30.98%
Associate degree or Bachelor’s degree	42.66%	47.28%
Post graduate degree	37.41%	21.74%
Annual income < \$50,000	30.38%	33.97%
Annual income between \$50,000 and < \$75,000	25.01%	24.36%
Annual income between \$75,000 and < \$150,000	21.15%	23.08%
Annual income \$150,000 or higher	23.46%	18.59%
Currently working for pay	35.19%	46.99%
Household size	1.91 (0.82)	2.21 (1.40)

Dillman approach (Dillman, Smyth, and Christian 2014) to collect data on how residents of Island County view Extension overall, as well as various Extension programs individually. To circumvent the issue of endogeneity, we considered two subsamples of the population. Endogeneity exists because the error term in the underlying behavioral model of those affiliated with or more informed about Extension is likely to be correlated with the error term in the willingness to pay estimating equation (Whitehead 2005). First, from the list of 3,135 Island County residents who had previously volunteered in at least one of Island County Extension’s programs, or were Washington State University (WSU) alumni, or had participated in an Extension event in the past, 547 households were randomly chosen to receive the survey instrument. With forty-four incorrect addresses, the sample size was reduced to 503. Henceforth, this subsample will be called the Affiliated Population (AP). Second, from the list of 27,775 residences drawn from the Island County Assessor’s office of residential properties with an improvement value of \$10,000 or more, 616 households were randomly selected to receive the mail survey. From this list, 138 were returned as bad addresses, resulting in a total of 478 recipients. Henceforth, this subsample will be called the General Population (GP). From the AP subsample, 293 (58.25%) responses were received, while from the GP subsample, 198 (41.42%) responses were received. Comparisons were made between early and late responders within each subsample of respondents who completed and returned the survey in the last half against those who responded in the first half of the survey period. No significant difference was found between the early and late responders in either subsample, allowing us to generalize to the entire population of Island County (Lindner, Murphy, and Briers 2001).

The survey instrument was comprised of fifty-three questions, including questions on demographic background and household characteristics. Table 1 presents the descriptive statistics of both subsamples. Compared to the GP subsample, the respondents within the AP subsample were older, were more likely to have a post-graduate degree, were less likely to have an annual income of less than \$50,000, were more likely to have an annual income of \$150,000 or higher, and were more likely to be retirees. We expected these trends as many individuals of the AP subsample were university alumni and retirees.

Figure 1. Importance of Extension office in Island County community

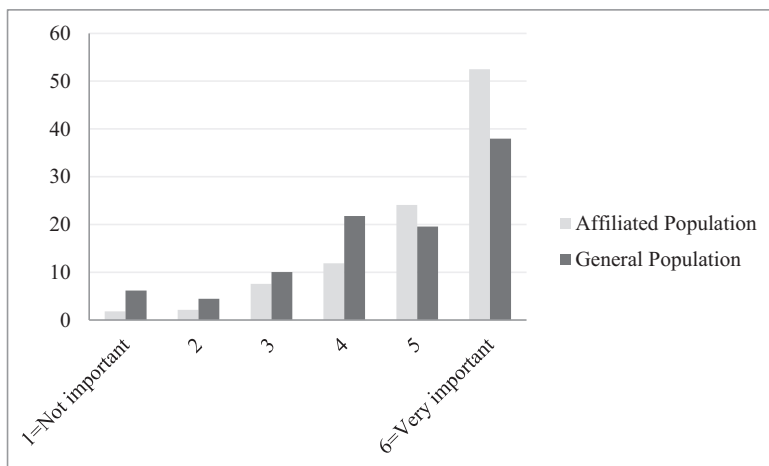
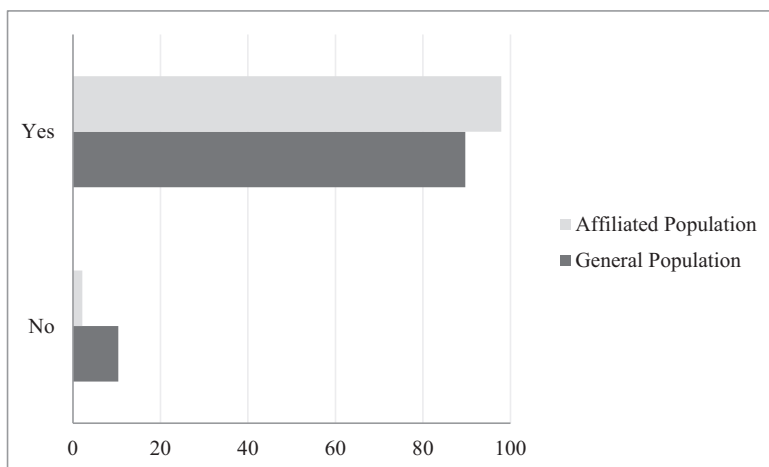


Figure 2. Is Extension office of value to Island County community?



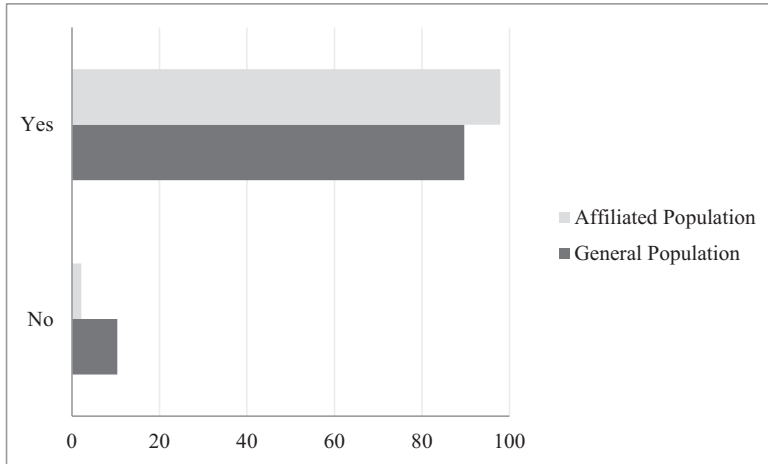
In order to examine the demand for Extension, we inquired about the respondent’s familiarity with Extension, their support for Extension in Island County, and their willingness to pay for Extension using double-bound valuation choices. The questions asked about the following:

Question 1. The importance of having an Extension office in Island County. The response was measured on a Likert Scale ranging from 1 (not important) to 6 (very important). **Figure 1** shows the distribution of the responses. Only 6.1% of respondents from the GP subsample and 1.8% of respondents from the AP subsample said that having an Extension office in Island County was not important, while 38% and 52.5%, respectively, said it was very important.

Question 2. Whether having an Extension office in Island County is of value to the community.

The response could be “Yes” or “No”. **Figure 2** shows the distribution of the responses. Fully 89.7% of respondents from the GP subsample and

Figure 3. Is it appropriate to use public dollars to support Extension?



97.9% of respondents from the AP subsample said that an Extension office in Island County is of value to the community.

Question 3. Whether county support for Extension is an appropriate use of public dollars.

Response could be “Yes” or “No”. *Figure 3* shows the distribution of the responses. There was also large support for using public dollars to support Extension programming, with 85.6% of the GP subsample and 94.6% of the AP subsample supporting this view. Overall, a higher proportion of the AP subsample compared to the GP subsample had a favorable view of Extension. Additionally, as *figures 1–3* show, even within the GP subsample a majority of the respondents reported that Extension is important and valuable to the community, and that county support for Extension is an appropriate use of public dollars.

Question 4: Willingness to pay for an Extension office in Island County through annual tax dollars. The choices were \$0, \$0.01 to \$0.99, \$1.00 to \$2.49, \$2.50 to \$4.99, \$5.00 to \$7.49, \$7.50 to \$9.99, \$10.00 to \$14.99, \$15.00 to \$20.00, and more than \$20.00. We also asked how much one would be willing to pay for each specific program; the choices were \$0, \$2.50, \$5, \$7.50, and \$10, or any other optional amount. At the time of the survey, eight programs were being offered.¹³ In presenting the results of the survey we categorize the programs based on the nature of information provided and the targeted resource or good into CPR or public good, merit good, and private good.¹⁴

¹³The Beach Watchers program imparts marine and near-shore environmental awareness; the Waste Wise program provides information on recycling, compost, and waste reduction; the Shore Stewards program provides educational awareness for property owners on or near the shoreline; and the Forest Stewards Program provides information to wood lot owners who want to manage their property for timber production, recreational activities, or wildlife enhancement. The Admiralty Head Lighthouse Docent program is a joint effort of Washington State Parks and Extension to provide education and cultural experience on Washington’s lighthouses.

¹⁴Beach Watchers, Waste Wise, and Admiralty Head Lighthouse are categorized as “CPR or public goods” because these programs deliver information and skills related to the management of well-defined natural resources all of which have the property of non-excludability. 4H Youth Development, Forest Stewards, and Shore Stewards are categorized as “merit goods” as these educational programs produce substantial external benefits to the community in addition to participants’ private benefits. Master

Table 2. Willingness to Pay for Specific Programs

Program or workshop	Estimated WTP (SD)		t-test of difference in WTP (SE)
	AP subsample	GP subsample	
CPR or public goods	\$5.63 (1.23)	\$3.90 (1.05)	1.738*** (0.081)
Merit goods	\$6.84 (1.72)	\$5.51 (1.01)	1.335*** (0.099)
Private goods	\$4.27 (1.11)	\$3.88 (1.04)	0.389*** (0.077)

Note: Asterisks indicate the following:

***= $p < 0.01$,

**= $p < 0.05$, and

*= $p < 0.10$.

Initial Willingness to Pay Estimates for Specific Programs

We estimate the willingness to pay for each type of Extension program using the contingent valuation method. This is commonly used in calculating benefit-cost analysis or cost-effectiveness, or other types of program evaluation. For instance, [Roe, Haab, and Sohngen \(2004\)](#) found that the private benefits of participating in agricultural economics Extension programming from the Ohio State University outweigh the costs of producing the program by a ratio of 1.07–1.74 to 1. [Whitehead, Hoban, and Clifford \(2001\)](#) found that the estimates of household WTP for food production research and Extension programs from North Carolina State University range from \$77 to \$142, and for water quality research and Extension programs, they range from \$89 to \$247.

The average willingness to pay estimates for programs providing CPR or public good, merit good, and private good are shown in [table 2](#).¹⁵ The independent variables in the Tobit regression models include respondents' gender, age, education, household size, and income. In the analysis of the GP subsample, we include an additional covariate—whether an individual had knowledge of the program or not.¹⁶ In the WTP estimating equation for the AP subsample, we do not include the knowledge variable since knowledge of Extension or of the programs is most likely to be correlated to the error term in the estimating equation ([McConnell 1990](#)).

The AP subsample has a greater WTP compared to the GP subsample in terms of both inclination to pay (not shown in [table 2](#)) and the average amount they were willing to pay for each type of program. In the last column we present results from mean comparison *t*-tests to show the difference in average WTP estimates between the AP and GP subsamples. Overall, the magnitude of difference in WTP between the AP and GP subsamples was largest for CPR or public goods, and lowest for private goods.¹⁷ Given that

Gardeners and Small Farm Agricultural Education programs cater to specific audiences in meeting their demand to enhance the value of their private properties, and are termed as "private goods".

¹⁵Complete regression results from the Tobit models for all covariates, not presented in [table 2](#), are available from the corresponding author upon request. Willingness to pay was estimated for each of the eight programs separately, and then aggregated into estimates for CPR or public goods, merit goods, and private goods.

¹⁶We observe a positive dollar value when an individual is willing to pay and a zero dollar value otherwise. While treating the data as incidentally truncated would be preferable, we have few regressors and lack excluded variables in the selection equation.

¹⁷The WTP for 4H Youth Development program was the highest among all Extension programs offered in Island County in both AP and GP subsamples. Additionally, the WTP estimates for 4H Youth

the GP subsample captures the views of a random sample of Island County residents, we expect the results from the GP subsample to be closer to the true WTP values for Extension programs compared to the AP subsample. The estimated WTP values from the AP subsample is likely to be biased upwards in the absence of any endogeneity correction. However, comparing the WTP estimates from the GP and AP subsamples can reveal the role of institutional affiliation on how individuals value Extension programs.

Volunteerism, Affiliation, and Willingness to Pay for Extension

A necessary condition for the successful management of common pool resources is that those who benefit the most be involved in the operational process. We use two characteristics of our sample—affiliation and volunteerism, to proxy for “involvement in the operational process” of Extension, and examine whether involvement affects willingness to pay for Extension. Additionally, we examine if knowledge of Extension can affect the willingness to pay among those in the general population who are not directly involved in Extension.

Econometric Methodology

The data corresponding to the demand for Extension are interval censored. We use interval regression to estimate the willingness to pay (y) for Extension as a whole. Suppose the data consist of observations (Y_i, \mathbf{X}_i) , $i = 1, 2, \dots, n$, where X represents the vector of independent variables and the continuous outcome variable Y is unobserved such that $I_1 \leq Y \leq I_2$ where I_1 and I_2 are known. Furthermore, Y are assumed to follow a linear model, where $\mu_i = E(Y_i | \mathbf{X}_i) = \sum_{j=1}^k \beta_j X_j$ and there are k regressors. Assuming that $Y | \mathbf{X} \sim N(\mu, \sigma^2)$, then the likelihood function is

$$L(y_1, y_2, \dots, y_n) = \prod \left(\Phi \left(\frac{I_2 - \mu}{\sigma} \right) - \Phi \left(\frac{I_1 - \mu}{\sigma} \right) \right).$$

and Φ is the standard normal cumulative function. The maximization of the above likelihood with respect to β_j involves solving the equations

$$\sum_{i=1}^n (y_i^* - \mu_i) x_{ij} = 0, \text{ where}$$

$$y_i^* = \mu_i - \sigma \frac{\Phi \left(\frac{I_2 - \mu_i}{\sigma} \right) - \Phi \left(\frac{I_1 - \mu_i}{\sigma} \right)}{\Phi \left(\frac{I_2 - \mu_i}{\sigma} \right) - \Phi \left(\frac{I_1 - \mu_i}{\sigma} \right)}, i = 1, 2, \dots, n.$$

Development are not statistically different between the two subsamples (\$9.40 in the AP subsample and \$9.38 in the GP subsample). This could indicate the community's recognition of the substantial external societal benefits of youth development programs.

Table 3. Estimated Coefficients from Interval Regression Models and Willingness to Pay Estimates for Extension Office

Variable	GP subsample			AP subsample	
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
Volunteer	3.43 (2.29)**	-	-	4.24 (3.08)***	-
Non-Extension volunteer	-	1.90 (1.25)	1.50 (0.96)	-	3.26 (2.30)**
Extension volunteer	-	6.37 (2.53)**	-	-	4.40 (2.90)***
Extension knowledge	-	-	3.79 (2.47)**	-	-
Sample size	144	144	129	237	237
<u>Estimated willingness to pay:</u>					
Sample	\$12.43	\$12.45	\$11.87	\$15.50	\$15.51
Volunteer	\$13.44			\$16.84	
Extension volunteer		\$16.72			\$17.53
Non-Extension volunteer		\$13.11	\$12.54		\$16.79
Non-volunteer	\$11.36	\$11.36	\$11.32	\$12.81	\$12.81
Extension knowledge			\$12.43		
Likelihood ratio χ^2	17.02**	19.97**	24.15***	19.75**	21.13**

Note: Asterisks indicate the following:

***= $p < 0.01$,

**= $p < 0.05$, and

*= $p < 0.10$.

In the WTP estimating equation for the AP subsample we do not include the knowledge variable as before. It is also possible that the act of volunteering for (non-Extension) community or Extension programs is correlated with the error term in the WTP estimating equation. We find that the percentage of individuals volunteering in community programs (39%) in the GP subsample is similar to the percentage of individuals volunteering in community programs (37%) in the AP subsample. Again, there was no difference between early and late responders within each subsample of respondents who completed and returned the survey in the last half against those who responded in the first half of the survey period based on volunteering. Since we do not have any information regarding the characteristics of the non-responders, it is not possible to correct for any inconsistencies that might result from the specific attribute of volunteering on willingness to pay estimates. However, we present results based on different types of volunteer (non-volunteer, Extension volunteers, and non-Extension volunteers) within each subsample to present a spectrum of WTP estimates.

Results and Discussion

Results from different model specifications are presented in table 3. Covariates in all models include gender, age, education, household size, and income.¹⁸ Models (1)–(3) use observations from the GP subsample only. Thus, estimated WTP values from these regression models are expected to

¹⁸Complete regression results from the interval regression models for all covariates, not presented in table 2, are available from the corresponding author upon request.

represent the community's WTP in general. Models (4) and (5) use observations from the AP subsample only, and estimates from these regression models are representative of views held by WSU affiliates and Extension volunteers.

In models (1) and (4), the primary independent variable is a binary variable that indicates whether the respondent had volunteered in the last twelve months in any community organization (i.e., a "volunteer"). In models (2) and (5), three indicator variables capture an individual's volunteering behavior—whether the individual had volunteered in any community organization not related to Extension (i.e., a "non-Extension volunteer"), whether an individual had volunteered in any Extension program (i.e., an "Extension volunteer"), and whether an individual had not volunteered in the past twelve months (i.e., a "non-volunteer"). Approximately 45% of the GP subsample and 64% of the AP subsample were volunteers, 9% and 31%, respectively, were Extension volunteers, and 39% and 37%, respectively, were non-Extension volunteers. In model (3) the primary independent variable is a binary variable that indicates whether an individual knows of Extension. In this regression, the data are limited to non-Extension volunteers and non-volunteers. Approximately 40% of the individuals in the GP subsample had some knowledge of Extension.

In both models (1) and (4), we find that volunteers had a higher willingness to pay than non-volunteers. Controlling for age, gender, household size, and income, a volunteer in the GP subsample was willing to pay about \$3 more than a non-volunteer, while a volunteer in the AP subsample was willing to pay about \$4 more than a non-volunteer. Following the regression analysis, we calculated the average estimated WTP for various subgroups conditional on the observed values of the regressors. The average estimated WTP among the GP subsample was \$12.43, and it was significantly lower (p -value < 0.01) than the average estimated WTP among the AP subsample (\$15.50). Similarly, the \$3.40 difference in average estimated WTP among volunteers from the AP and GP subsamples is statistically significant (p -value < 0.01). On the other hand, the \$1.45 difference in average estimated WTP among non-volunteers from the two subsamples is not statistically significant.

Next, in models (2) and (5), we further categorize the volunteers into Extension and non-Extension volunteers. In so doing, we find that the statistically significant difference in average estimated WTP between the AP and GP subsamples is driven by the non-Extension volunteers (\$3.68, p -value = 0.011). In both models those who volunteer in Extension programs have higher WTP compared to non-volunteers. However, non-Extension volunteers also have higher WTP compared to non-volunteers in the AP subsample, while there is no statistical difference in the GP subsample. Thus, those who volunteer in Extension programs are estimated to have similar willingness to pay irrespective of whether they were randomly sampled from the community or whether they were randomly sampled from a selected list of university affiliates and volunteers. Here we would like to note that the number of Extension volunteers in the GP subsample is quite small ($n = 14$), and results from hypothesis tests based on properties of large samples may not be robust. Thus, while the similarity in willingness to pay is expected, it is not necessarily verified as being statistically equal.

Finally, in model (3), we examine the effect of knowledge of Extension on willingness to pay for Extension. In this analysis, Extension volunteers are

excluded because they would have prior knowledge of Extension. For the same reason, this analysis is not possible for the AP subsample. We find that those who have knowledge of Extension have significantly higher WTP compared to those who do not know of Extension, but whether or not they also volunteer in community organizations does not affect WTP. Rounding out the WTP estimates from Models (1)–(3), a typical local resident was willing to pay about \$12 per year to have an Extension office in the community. According to the U.S. Census Bureau, the population estimate of Island County in 2012 was 78,801, with 63,592 adult residents (eighteen years or older) and around two persons per household. Thus, there were approximately 31,796 households. Assuming all households were tax-paying households, a tax of approximately \$10.80 would balance the Island County Extension budget of \$343,222 in 2012. Thus, the declining trajectory of funding for Extension might necessitate restructuring Extension programs, implementing various revenue generation schemes, and adopting certain cost containment measures.

In summary, the core finding from these estimations is that those with institutional affiliation—for example, a university alumni, Extension volunteer, or Extension participant—have the highest estimated WTP for Extension programs. Specifically, WTP is higher if they volunteer, whether in non-Extension community activities or in Extension programs, compared to those who do not volunteer in any community activity. In other words, those involved in the operational process of managing resources in the community associate a higher value with the resources. Additionally, knowledge of Extension has a positive impact on the willingness to pay for the programs, even among non-volunteers.

Concluding Remarks

For the successful management of common pool resources it is important that those who benefit the most be in close proximity to that resource and be involved in the operational process. The relevance of government agencies in the construction, production, and distribution of CPR is irrefutable. More importantly, when transaction costs of agreeing to and abiding by informal community rules are high, or when informal community norms break down, formal state intervention is required to avert losses to common pool resources (Olson 1965; Libecap 2008). However, government intervention in the management of CPR might not be cost-effective unless it is supported by affected individuals and communities. Local residents can identify their needs and priorities more accurately than external entities, and are also more likely to adhere to the operational rules when they are involved in making those rules. The governance of common pool resources entails using rules or institutions to influence the behavior of agents who consume common pool resources. Extension, we posit, is one such institution that involves local residents in managing and monitoring CPR in a cost-effective manner without the seeming patriarchy of state and federal regulations. Being a physical part of the local community, local Extension faculty and staff regularly interact with community members, identify needs, forge partnerships, and involve local residents to develop practical solutions. By encouraging and facilitating local residents to volunteer for programs that they deeply care about, Extension enhances local social capital.

Using quantitative survey data we show that collective support for a county-level Extension office is quite strong, in part due to a direct local connection to university programming and a recognition that such an association adds value to the community. In comparing the estimates of willingness to pay for an Extension office in Island County among various subgroups of individuals in the community, we note the positive impacts of institutional affiliation, volunteerism (in community activities), and knowledge of Extension. The impact of affiliation and volunteerism on willingness to pay is especially interesting, and can be explained by invoking Ostrom's literature on institutional arrangements in the governance of common pool resources. Those who participate in Extension programs, volunteer to deliver Extension programs, or are affiliated with the institution that provides the programs view Extension as a stable, reputable, and trustworthy institution that can coordinate solutions to problems related to the use of many environmental and natural resources. Even among the non-affiliated general population, the knowledge of what Extension is and its activities increases willingness to pay for Extension.

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