Brief #5: Predicting Participation

Identifying Factors Associated with Farmer Willingness to Participate in Regional Water Conservation Programs

Supplemental Information

Background and Motivation

Widespread agricultural water conservation programs have yet to be implemented on Colorado's West Slope. There is limited qualitative research evaluating water users' opinions about participating in such programs (Bennett et. al, 2023). Quantitative data on participation rates in response to different practice options, policy and program attributes, economic conditions, or environmental contexts is lacking. This absence of information makes it difficult to estimate how likely users are to take part in proposed conservation efforts. As a result, expectations for the effectiveness of large-scale programs—in reducing the risk of a Compact Call, mitigating drought impacts, etc.—remain speculative.

Arriving at meaningful outcomes in terms of water conserved will depend on voluntary participation from a wide range of individuals and groups. The complexities involved are not unlike those arising in other areas of natural resource management, where local context plays a critical role. An individual's decision to participate in any given year is likely mediated by personal attitudes, the characteristics of their natural environment, financial considerations, and the nature of their social networks. Many of these factors change over time, adding further complexity to the situation. Research that probes how social, environmental, and economic contexts interact with individual decision-making can yield new insights into potential water conservation program participation rates under different policy and program scenarios.

Study Approach

To examine the factors influencing potential participation in water conservation programs among diverse agricultural water users on Colorado's West Slope, a survey questionnaire was developed with two main components. The first gathered information on respondents' demographics, farm characteristics, and personal attitudes toward water conservation. The second part featured a Discrete Choice Experiment (DCE) where respondents were asked to choose between alternative water conservation programs, each defined by unique combinations of policy and program attributes. In the DCE, each respondent encountered twelve choice sets. Each set consisted of two water conservation alternatives and a status quo (no conservation) option. The water conservation alternatives varied based on unique policy and program attributes designed to reflect various risks and benefits from the perspective of agricultural water users. The assessed policy and program attributes included:

- Conservation Action – The type of irrigation reduction activity to be enacted for a single irrigation season: full-season limited irrigation, split-season curtailment, full-season curtailment.
- Compensation - Payment received for land placed under water conservation ranging from $150 to $1,600 per acre.
- Conserved Acreage - The portion of a user's irrigated land affected by conservation program activities, ranging from 25% to 100%.
- East Slope Match – A binary option indicating the inclusion of a 1:1 match in conserved consumptive use water volume by curtailment of trans-mountain water diversions to the Front Range.
- Water Shepherding/Protection – A binary option indicating the presence of administrative water shepherding to ensure that any conserved water moves downstream past other junior users and is controlled by Upper Basin states to help reduce the risk of a Compact Call on the Colorado River.

The survey generated 573 high-quality responses. Demographic data from survey participants was compared to similar data from the 2022 U.S. Department of Agriculture Census. This qualitative comparison helped assess how well the sample represents the broader population of Western Slope producers. Most respondents reported irrigated water use

tied to hay/grass pasture production (Figure 1), consistent with water use patterns on Colorado's West Slope when viewed by land areas under various crop types.

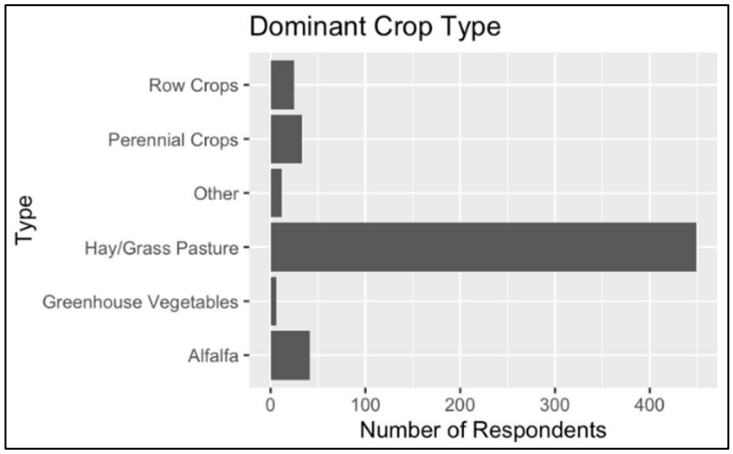

Figure 1.Distribution of irrigated area by crop type, among survey respondents.

Survey responses were analyzed by coupling a pair of Bayesian statistical models fitted to different portions of the data. One model evaluated the role of demographics and farm/ranch characteristics in predicting attitudes toward water conservation. The second model assessed conservation program opt-in probabilities based on these attitudes and the inclusion of various policy and program attributes. This approach allowed investigators to estimate the probability that a water user would choose to participate in a conservation program based on their demographic profile, farm or ranch characteristics, and the specific attributes of the proposed program (as defined in the DCE). The results also highlighted the relative influence of each attribute in shaping participation decisions by reporting 'marginal means' of opt-in probabilities for each level of each attribute. The marginal mean calculated for a given level of any attribute reflects the average probability of opting in to a conservation program possessing that level, holding the effects of all other attributes constant.

Study Findings

Compensation rates and an East Slope water match drove the largest differences in participation probabilities among the evaluated policy and program attributes. Increasing compensation from $600 to $1,200 per acre drove about a 10% increase in opt-in rates. Notably, measures of attitude toward water conservation were also major drivers of participation likelihood (Figure 2). Water users with a favorable attitude toward water conservation were more than four times as likely to indicate a willingness to participate than users with an unfavorable attitude, holding other attributes constant. While favorable views toward water conservation programs significantly increased participation probabilities, only a small fraction of the surveyed population reported favorable or very favorable views.

The structure of the coupled statistical models also provided investigators with an avenue for exploring the interactions between policy and program attributes, demographic characteristics, and attitudes. For example, compensation rates positively affected opt-in rates up to $1,200/acre but, within a given compensation rate, the required conservation activity produced predictable differences in the likelihood of participation (Figure 3). For a $600/acre compensation rate, a program requiring full-season irrigation curtailment depressed opt-in likelihoods by approximately 5-8% compared to programs that required split-season curtailment or limited full season irrigation. Across all compensation levels, the inclusion of an East-Slope match drove about a 10% increase in participation probability. Conversely, compensation rates had relatively little effect on opt-in rates among users with unfavorable attitudes toward water conservation (Figure 4), suggesting the need for other non-financial means to attract these users to conservation programs.

Overall, predicted opt-in rates for various combinations of policy attributes and attitudinal characteristics exhibited a wide distribution, centered around a mean of approximately 6%. A hypothetical conservation program requiring split-season irrigation at a compensation rate of $600/acre and lacking an East-Slope match returned about a 2% opt-in rate among users with a neutral attitude toward water conservation. Opt-in rates increased to above 37% among the same users for a conservation program that required split-season irrigation at a compensation rate of $1,200/acre and included an East-Slope match, indicating the positive effect of these policy attributes. However, when the more favorable policy was presented to users with an unfavorable attitude towards water conservation programs, participation probability fell to about 1%. These results suggest a significant role for attitudes in determining the likelihood of program participation. That is, increasing compensation rates induced relatively little corresponding increase in program participation among users with an unfavorable view of water conservation programs.

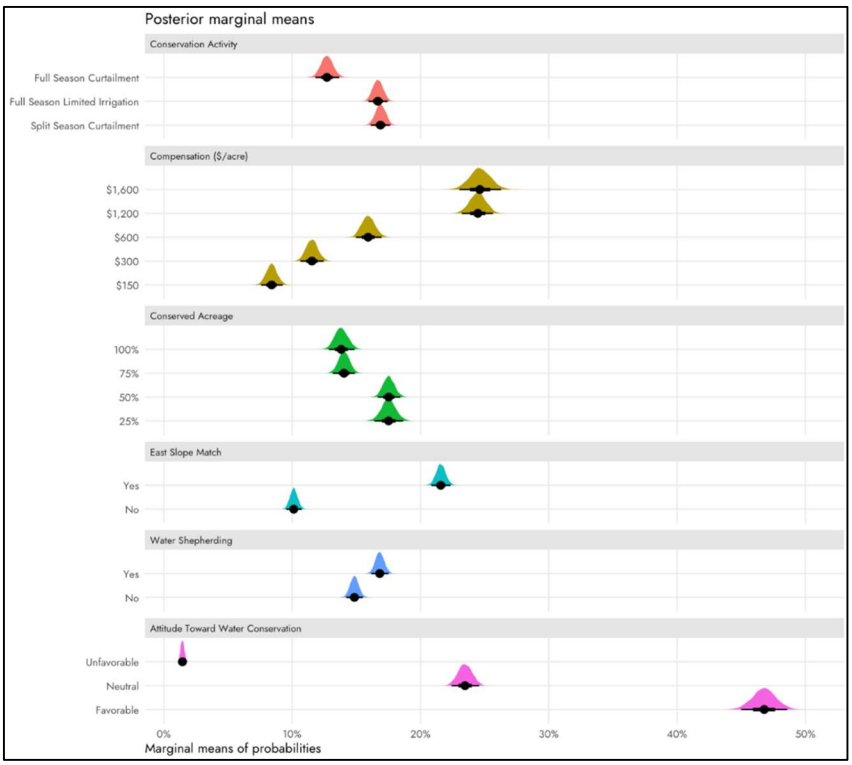

Figure 2. Marginal means (black dots) and attendant distributions (colored areas) of water conservation program opt-in likelihood assessed for a suite of policy, attitudinal, and farm/ranch related attributes.

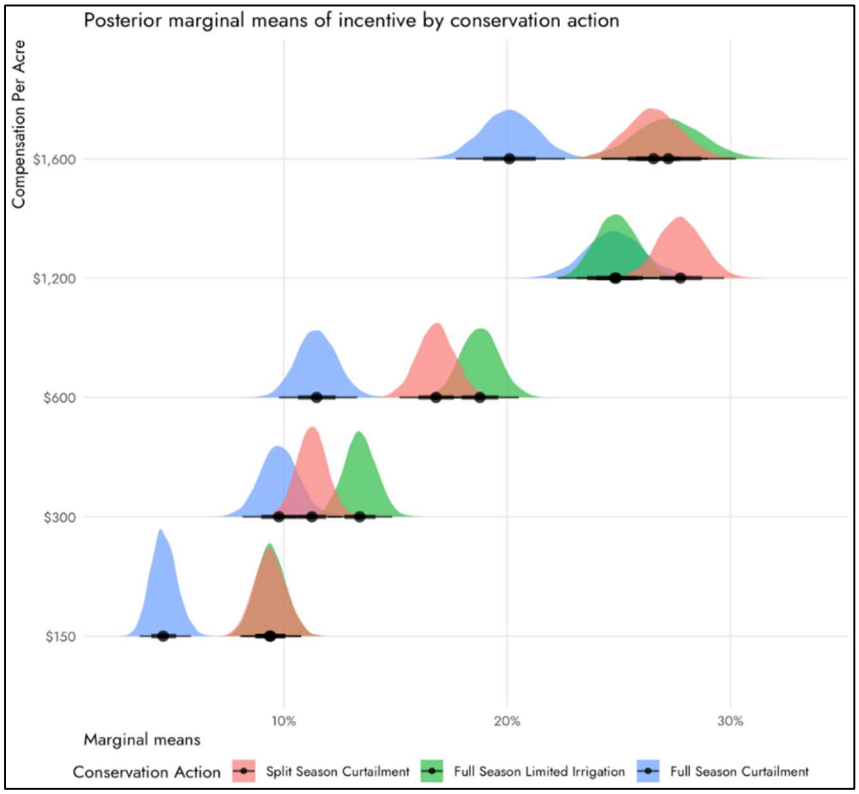

Figure 3. Marginal means (black dots) and attendant probability distributions (translucent and overlapping colored areas) of water conservation program opt-in likelihood assessed across a range of a range of compensation rates and conservation action policy attributes, holding all other attributes constant.

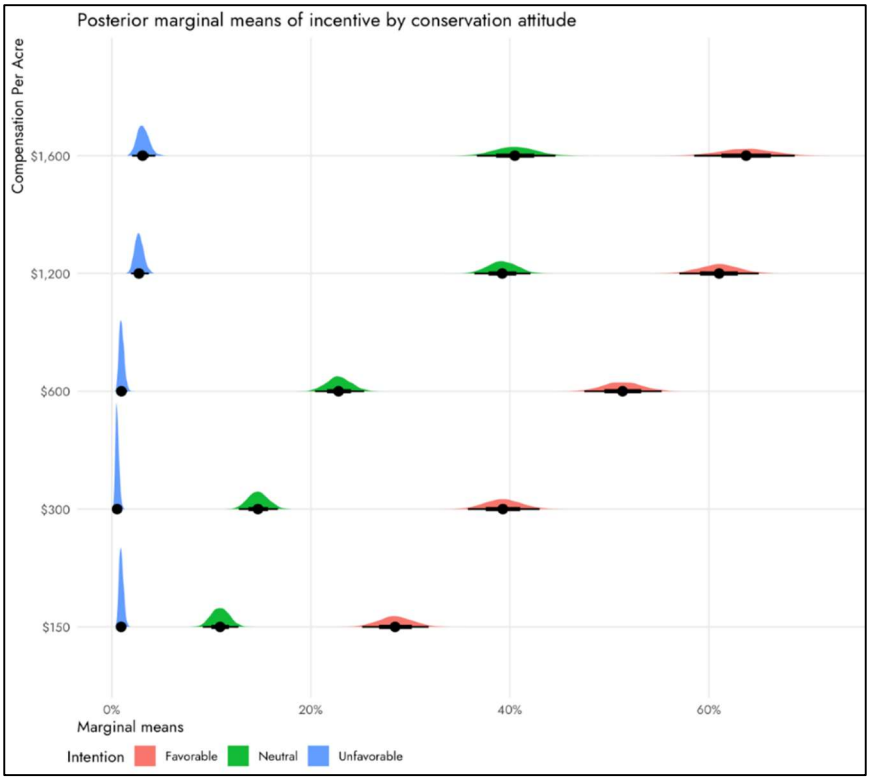

Figure 4. Marginal means (black dots) and attendant probability distributions (colored areas) of water conservation program opt-in probabilities assessed across a range of compensation rate and attitudinal factors, holding other attributes constant.

Insights

The scale of the regional challenges facing water users in the Upper Colorado River Basin is widely recognized by policy makers, water administrators, and academic researchers (e.g., Udall and Overpeck, 2017). The magnitude of projected water conservation needs in western Colorado (Colorado River Water Conservation District, 2019) suggests that the beneficial impacts of voluntary, temporary, and compensated water conservation programs will be greatest when high levels of program participation are sustained over the medium to long term. Achieving such sustained participation will, in turn, require thoughtfully designed policies that reflect the preferences and perceptions of water users on Colorado's West Slope. This study helps identify the policy attributes most likely to influence water conservation program participation rates. Policymakers can use these findings as they work to design conservation programs that appeal to the broadest range of water users. Importantly, the results also suggest that addressing widespread negative perceptions of water conservation programs may be as critical—if not more so—than adjusting program attributes like compensation rates if the aim is to significantly boost participation.

References

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