

Extended Abstract

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Paper/Poster Title	Are farmers willing to pay for existence value of groundwater? Insights from Western Uttar Pradesh, India
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Abstract prepared for presentation at the 98th Annual Conference of The Agricultural Economics Society will be held at The University of Edinburgh, UK, 18th - 20th March 2024.

Abstract	200 words max
<p>The groundwater governance for irrigation has become an intriguing area of research, particularly in the developing economies like India, where groundwater beneath an individual's land is treated as private property and the aquifers are drying up due to excessive groundwater development for irrigated agriculture. This study endeavors to analyze the preferences of the farmers for different groundwater management alternatives and their willingness to pay (WTP) for the groundwater existence and bequest value thereof through primary data collected from 300 farm households in Western Uttar Pradesh, India. To accomplish the objective, the study employs Contingent ranking analysis with rank-ordered logistic regression model. The findings reveal that the ranking decisions of farmers regarding various alternatives are significantly influenced by attributes such as irrigation facilities from public tube-wells, metered private tube-wells, and government rejuvenation programs. Moreover, the ranking of these attributes is notably determined by factors such as education levels and farm size of the farmers. The findings on farmers' WTP for groundwater suggest that they are not willing to bear the cost of rejuvenation of groundwater but are ready to pay for per unit groundwater utilized, that is, they are willing to install water meters.</p>	
Keywords	Groundwater management; Irrigation Water-use; Willingness to pay; Contingent Ranking
JEL Code	Renewable Resources and Conservation: Water Q25 Environmental Economics: General Q50
Introduction	100 – 250 words
<p>The value of groundwater extends beyond its utilitarian functions; it embodies a non-use value that transcends immediate farming needs and extends to future generations (Arrow et al., 1993; Carson et al., 2001). This intrinsic, non-use value of groundwater, which encompasses its existence and bequest values, remains a topic of paramount significance in the realm of environmental economics and resource management (Hanley et al., 2002; Willis and Garrod, 1991). In various geographical contexts, particularly in the study region, the actual price paid for the groundwater for irrigation pertains to its extraction cost in terms of the tube-well installation and the fixed monthly electricity charges. This cost does not include the opportunity cost; environmental externalities such as the costs of ecosystem deterioration due to lowering groundwater tables and economic externalities, for instance, related to declining water tables resulting in stranded bore-wells (Perrone & Jasechko, 2017) or increased extraction costs for future users (Foster et al., 2015). Whilst there are ample studies that show</p>	

farmers positive response and concern for environment goods like groundwater quality and willing to contribute or accept the concerned policies for the same (Lichtenberg and Zimmerman, 1999; Sivasakthi et al., 2010; Ma et al., 2012; Wang et al., 2015), there is dearth of literature on evaluating the farmers' WTP for sustaining groundwater for future use per se, particularly in the developing economies like India where rural economy is largely dependent upon the groundwater irrigation. The present study intends to contribute to the theme by analyzing the preferences of the farmers for different groundwater management approaches and their WTP for sustaining groundwater.

Methodology

100 – 250 words

The cross-sectional primary data have been collected using a semi-structured interview schedule in two districts of Western Uttar Pradesh (India). The multistage sampling method is employed for pinning down the 300 agricultural households surveyed.

The Contingent Ranking Method (CRM) is followed as the core analytical framework. The CRM method involves presenting respondents with a series of scenarios and asking them to rank these scenarios based on their preferences for their environment improvement attributes and the prices attached as WTP with each scenario. For the present study the farmers were asked to rank different hypothetical policies or situations related to groundwater conservation and management. The choice set was finalized with the help of literature review, pilot surveys and focus group discussions keeping in mind the nature of the respondents. The four alternatives (A, B, C, D) including the status quo with 4 attributes, namely groundwater source, groundwater rejuvenation programs (GRP), Groundwater ecosystem management (GEM) and groundwater fee (GWF) were included for ranking by the farmers. The attributes GRP and GEM are the indicators of bequest and existence value for the farmers and GWF is the cost attribute associated with each alternative to estimate the WTP. The irrigation groundwater source through public tube- well (PTW), metered private tube-well with (MPVTWC) and without community interference (MPVTW) are the indicators of institutions holding the rights of extracting groundwater in the respective alternatives.

The estimation of marginal WTP of the farmers for non-use benefits of the groundwater is done by employing the rank-ordered logit model.

Results	100 – 250 words
<p>In case of the contingent ranking analysis of farmers' marginal WTP for groundwater conservation, the summary of rankings shows that the status quo (present informal groundwater trading) is the least preferred option by the farmers and the alternative with metered private tube-well (MPVTW) and no government rejuvenation programmes (GRP) ranks first. The results show that irrigation facilities by public tube-wells, metered private tube-wells, and government rejuvenation programmes are the major attributes that impact the ranking decision of different alternatives by the farmers. The provision of GRP decreases the marginal utility of the alternative and groundwater fee attribute did not significantly impact the farmers' decision-making.</p> <p>Regarding the socio-economic characteristics, the probability of farmers opting for the alternative with public tube-well increases if they belong to a marginal or small land holding category, have a primary to middle education level, and have a subsidiary source of income. Income or large farm-size is found to be the dominant factor in the case of the higher marginal utility for metered private tubewells alternative. Although the marginal utility in the case of government rejuvenation programmes is negative in the present analysis, education is the significant factor that positively increases the farmers' preference for this attribute.</p> <p>In comparison to the status quo, the farmers' highest WTP is for the metered private tube-well alternative, which is estimated to be Rs. 1718 annually. The negative MWTP for GRP indicates that farmers are willing to pay Rs. 433 less for the alternative with this attribute than without it.</p>	
Discussion and Conclusion	100 – 250 words
<p>The highest coefficient of metered private tube-wells as source of irrigation, despite the highest cost associated with it, implies that the "groundwater source for irrigation" attribute of the alternatives is more important for the farmers than the cost associated with it. Notably, the marginal utility in case of government rejuvenation programs is found to be negative in the present analysis but education is the significant factor that positively increases the farmers' preference for this attribute. This indicates an important role of educating the farmers about sustainable irrigation management practices. The study concludes that farmers are willing to contribute for sustaining the groundwater but their first priority is to keep groundwater extraction rights in their own hands. Further, although WTP estimated through this study seems negligible considering the non-use value of the groundwater per se, it can be a significant step in terms of both organized groundwater governance and developing the positive attitude of farmers for perceiving irrigation groundwater as an economic good. The findings of the study are in line with the field observations where farmers were concerned about the gravity of the problem in the study region and are willing to accept</p>	



the changes in the groundwater water governance but they believe that it should be majorly funded by the government. At policy level, including the economies confronting the similar challenges, it is suggested that a nominal amount can be charged during the registration of tube-well itself, ensuring an inclusive approach wherein all the stakeholders actively contribute in for implementing the groundwater management initiatives.