Exploring the links between values, beliefs, attitudes and social norms and policy preferences for water reallocation in Southern Alberta, Canada

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There is increased demand in semiarid regions of the world for water reallocation to adapt to uncertain future water supply and increased demand for water for urban uses and the environment. Since agriculture accounts for 80% of water use in many such regions, it is inevitable that reallocation will move water out of agriculture. As irrigation is a major creator of jobs and economic activity in such regions, this can have significant socioeconomic impact. To minimize this impact tax revenue will often be used to assist the process. Hence it is important for policy makers to understand how the urban electorates perceive that such reallocation should take place since it has most of the electoral power and provides the biggest contribution to tax revenue. This paper explores this issue based on extensive surveys of urban dwellers in cities and towns across the urban to rural spectrum in Alberta, Canada.

Keywords: water reallocation; policy preferences; Alberta, Canada

INTRODUCTION

Many regions around the world are facing growing pressure on their water resources. Expanding economies, increasing populations and urbanization have resulted in growing demand for resources that are increasingly uncertain in the face of climate change. Meanwhile, increasing environmental concern has resulted in pressure to leave water in the river to ensure ecosystem health. In many arid and semiarid regions, the allocation of water resources has surpassed most estimates of what constitutes an ecologically sustainable level (Dyson et al., 2003). In response, some governments have stopped issuing new rights to extract water and are exploring options for reducing extraction of water for consumptive use as well as facilitating water reallocation to meet new and changing demands.

In many semi-arid regions, irrigated agriculture controls around 80% of allocated water. As a result, much of the water that must be reallocated to emerging urban and environmental uses will come from the irrigation sector. Reducing the irrigation sector's access to water will necessarily decrease their productivity, profitability and property values, generating negative socioeconomic impacts on irrigators. These impacts will be felt throughout irrigation dependent communities, as reduced farm production results in fewer jobs, declining populations and the loss of community services and businesses. The severity of these impacts will depend on the policies and instruments used to facilitate water reallocation.

Market-based solutions for water reallocation are widely accepted as a viable means of reallocating water resources more efficiently between existing users as well as between existing and new users. Water markets allow voluntary reallocation to take place between willing buyers and sellers. In such cases, buyers presumably fully compensate sellers for the losses associated with decreased access to water. This mechanism allows water to move to more efficient and high value uses. Even water that remains in irrigation will presumably be used to produce higher value crops, reducing the negative impacts of reallocation on an area. The same mechanisms can also be used to secure water for environmental purposes, whether allocations are purchased by the government or private or non-governmental organizations to be left in rivers for the environment. Despite these benefits, externalities unaccounted for in the selling price of the water may accrue to the environment and those not directly involved in the transaction.

More authoritarian means of reallocation that may or may not address these concerns could also be implemented. For example, a government could conceivably i) withdraw an allocation held by one user and grant it to another user or the environment; or ii) decide how much water the environment needs and

not allow consumptive users access to water until those needs are met. In some jurisdictions these processes could take place within current legislation, while legislative changes may be required in others. In both cases, however, the issue of whether and how to compensate previous allocation holders might be raised.

Political opposition to both means of resource reallocation exists: particularly in their most extreme forms. If necessary reallocation is to be successful, a balance must be reached between deregulated markets and government command and control, keeping in mind that public opinion of a proposed solution will have a significant impact on its political acceptability.

Governments around the world are facing similar issues related to all manner of natural resources. Water reallocation in Southern Alberta provides an excellent case study for considering resource management and allocation between competing rural and urban uses and the environment. This paper will communicate the preliminary findings from an extensive survey of urban and rural households not directly involved in irrigated agriculture. The survey investigated residents' level of agreement with a variety of policy proposals related to water management in addition to a wide variety of value and attitude objects, social factors, and socio-economic indicators expected to influence policy preferences. The City of Calgary and the Town of Strathmore were chosen as case studies due to their differing social and physical proximity to irrigated agriculture.

ALBERTA CONTEXT

Canada has an international reputation as a resource rich nation. This perception extends to the country's freshwater resources. However, water is unevenly distributed across the country. Water is abundant in Central and Northern Canada and along the West Coast, and while the southern Prairie Provinces are relatively dry, nowhere is scarcity more of an issue than in the South Saskatchewan River Basin (SSRB) in Southern Alberta, home to some 60% of all irrigation in Canada (Statistics Canada, 2007).

Alberta is the westernmost of Canada's Prairie Provinces, situated just east of the continental divide marked by the Rocky Mountains. The mountains obstruct moist air coming off of the Pacific Ocean, limiting the annual precipitation to their east. As a result the majority of the province has a dry continental climate, but benefits from a relatively steady supply of fresh water year-round as a result of the snowmelt that supplies the province's major river systems. Since precipitated water is limited, surface water is used extensively for agricultural and other uses (Alberta Environment 2008). The varying topography is also partly responsible for the climate, soils, vegetation and settlement patterns throughout the region, in particular influencing the agricultural possibilities that shaped Alberta's early development and growth (AMEC, 2009).

A natural region of grasslands makes up approximately 63% of the land area in the South Saskatchewan River Basin, extending from just west of Calgary to the Saskatchewan border (AMEC, 2009). The area's brown to black chernozemic soils provide a rich source of nutrients for the irrigated agriculture that characterizes much of the region. Dry-land agriculture is also prominent in the area, with cattle grazing increasingly widespread towards the East, where the lack of precipitation and irrigation make the land unsuitable for cropping. The basin itself is composed of four major sub-basins: the Red Deer and Bow Rivers, whose headwaters are located entirely in Alberta, and the Oldman and Lower South Saskatchewan Rivers, both of which have a portion of their headwaters in Montana. Portions of these basins are home to some of the most intensive agriculture in Canada, which relies on irrigation to produce. Upwards of 60% of the irrigation undertaken in Canada is situated in the South Saskatchewan Basin (Bjornlund, 2010), where irrigation accounts for approximately 84% of the water used (AMEC. 2009). As a result, irrigated agriculture has been very important to the province's historic development as well as for the current agricultural economy. It holds a special place in the hearts and minds of many Albertans—even those who are not producers themselves.

Historically, new demand for water in Alberta has been met by allocating water rights to users under a prior allocation, or first-in-time, first-in-right (FITFIR), system. Over time, many of the sub-basins within the SSRB have been fully or over allocated, with many of the largest and most senior water licences provided for the purpose of irrigated agriculture. In fact, 22 of 33 main rivers are suffering moderate environmental effects from water stress caused by current levels of water extraction, 5 more are suffering heavier environmental losses and 3 are environmentally degraded (Alberta Environment, 2005). The efficient allocation and use of fresh water is especially pressing in the face of uncertain future water supply due to

climate change. To help protect water users and the environment, sub-basins in the SSRB were closed to new applications for water rights in 2005. As a result, water users seeking new or expanded allocations must acquire them from existing users via transfers, made possible by the revised Water Act in 1999.

Since irrigation accounts for 72% of the water allocated and 84% of that used in the SSRB, it is inevitable that reallocation will move water out of agriculture. The expected consequences of such reallocation vary widely: significant direct and indirect economic effects have been identified (Howe et al., 1990) and other social and environmental effects of varying significance may result (Gould, 1988).

Two recent developments in Alberta have illustrated the opposition throughout the community to water trading as a mechanism for water reallocation. The first occurred in 2007, when a developer proposed the development of a shopping centre, race track and casino north of Calgary. When the City of Calgary refused to supply the water the developer sought to source it from the Red Deer River, where new licences were still being issued; however, the ministerial consent necessary to approve this inter-basin transfer was not obtained due to public opposition. In the end, the developer was able to purchase a 2,500 ML allocation from the Western Irrigation District for 15 million dollars. The district then used the proceeds of the sale to line a leaking canal, thereby saving a quantity of water greater than the 2,500 ML originally sold. Despite its appearance as a win-win scenario, the transfer raised significant opposition among irrigators (who only approved the transfer by a narrow margin), environmentalists, and other industry groups.

The second case was an attempt by the Eastern Irrigation District (EID) to amend two of its licences to allow the district to supply 940,000 ML for uses other than irrigation. Under current legislation, irrigation districts are allowed to supply water to other users, provided the new use is allowed by their licence, while enabling the district to maintain ownership over the allocations itself. This arrangement addresses a primary concern that many irrigators expressed in the context of the Balzac transfer, namely: nervousness about relinquishing the long-term control over their licenses. Other districts have been granted the required amendments, however when the EID submitted its application it met strong opposition from the environmental sector. The argument against the amendment was that such amendments allowed the district to provide water to any user willing to pay while providing a way of circumventing the environmental assessments required for the formal transfer of a water licence. The campaign to block the changes was successful and the amendment process was suspended pending further investigation by the government. The transfer was finally approved in October 2010 but is now challenged in the courts.

Although both of these cases were very much in the spirit of the Government's water management strategy and the idea that water must be reallocated to align with society's changing needs and values is widely accepted by scholars and policymakers alike (Baron et al. 2002; Alberta Environment 2008; Bjornlund 2010), how this reallocation should take place is still under debate (Brewer, 2008). In particular, the use of markets for reallocating water is seen as problematic by some (Christensen and Droitsch, 2008), a feeling which has gained significant support within the wider community (Percy, 2005; Brewer, 2008).

CONCEPTUAL MODEL

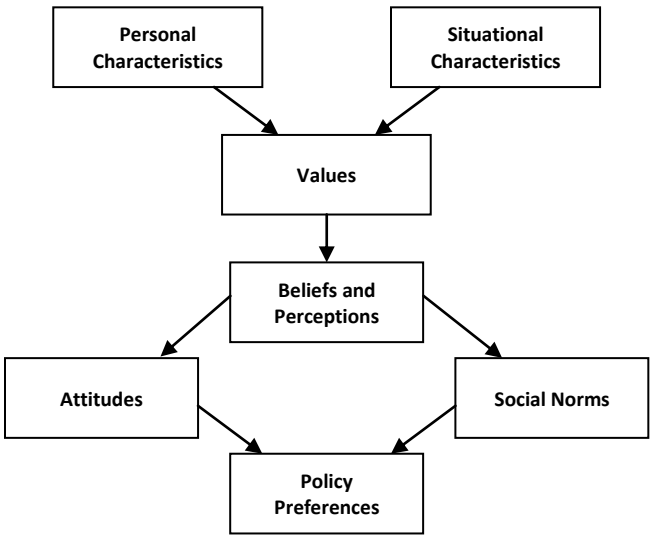
Canadians overwhelmingly rank fresh water as the country's most important natural resource (Nanos, 2009); however, the general public is neither assumed nor expected to have a strong understanding of the intricacies of water resource management on which to base their water policy preferences (Dolnicar et al*.,* 2010). Instead, individuals' decisions to support or oppose particular policies are likely to be based on psychological variables such as their values, beliefs, attitudes, and social norms (Routhe et al*.,* 2005; Thorvaldson, 2010). If necessary water reallocation is to gain sufficiently wide acceptance to be politically feasible, we must develop an understanding of how these domains influence preferences for water management policy.

Notable research in the field of values and attitudes was undertaken by Rokeach (1968), who argued that the situation-transcendent and ranked nature of values allowed for decision making in a wide variety of scenarios. This allows people to form attitudes toward value objects with which they are only minimally informed. The link between values, beliefs and attitudes was further established by other authors (Fishbein, 1967; Stern et al*.,* 1999), and extended to include behavioural intention and behaviour (Fishbein and Ajzen, 1975). Likewise, social norms are expected to have a significant influence on policy

preferences. In particular, social and physical proximity to irrigated agriculture may influence agro-environmental concern and thereby have an impact on policy choices impacting agriculture (Sharp and Adua, 2009).

The Theory of Reasoned Action (TRA) provides a model for understanding behaviour as a function of behavioural intent, which is determined by attitudes and subjective norms (Fishbein and Ajzen, 1975). Since end behaviours were not measured in this study, we will halt our analysis at the level of intent, understood to be the conative expression of preferences (Dunlap and Jones, 2002; Routhe et al., 2005). By linking the TRA to value orientations, beliefs, and the socioeconomic variables that influence them (Figure 1), we aim to better understand how individuals' water reallocation policy preferences are formed, as well as how they differ with varying social and physical distances from agriculture.

Figure 1: Conceptual framework for resource management preferences



METHODOLOGY

This paper is based on a mail-out survey sent to randomly selected households in Calgary and Strathmore, Alberta. The initial mail-out consisted of 3,000 surveys mailed to Calgary, which has a population of 1,071,515 in 414,185 occupied dwellings (Calgary, 2010), and 2,338 mailed to Strathmore, with its population of 12,139 in 4,483 occupied dwellings (Strathmore, 2010). A systematic random sample was selected from all available addresses for Calgary. For the Strathmore sample, all available addresses obtainable through a list broker were selected. The initial mailing included a cover letter explaining the project and requesting participation, the survey instrument, an entry form for a cash prize incentive and a postage-paid return envelope. Respondents were informed that the survey was voluntary and that it was expected to take 15 to 20 minutes of their time. Following the initial mail-out, three reminders were mailed at three week intervals to encourage respondents to participate (Dillman, 2000). The final reminder included a web address at which respondents could complete the questionnaire online.

In total, 2,693 surveys were delivered in Calgary with the remainder returned as undeliverable due to incorrect address provided by the list broker. For the same reason, 2,216 surveys were delivered in Strathmore. Of the surveys delivered, 476 responses were received from Calgary and 347 from Strathmore, resulting in a response rate of 16.8%. After removing surveys with incomplete information as well as respondents who had self-identified as irrigators, 422 completed responses remained from Calgary and 302 from Strathmore. Census data was used to test that the respondents were representative of the population. Given that this is a household and not a resident survey, the respondents are not representative of the population with respect to age and gender. The case study methodology used for this study allows for a sample size sufficient to be representative of Calgary and

Strathmore households. As a result strong conclusions can be drawn about respondent preferences in each location, and the differences in determinants of those preferences can be compared across cases.

The questionnaires collected information on demographics (17 items); values, attitudes and beliefs with respect to water and the environment (49 items); social factors (19 items); and policy preferences (10 items). The value, attitude and belief statements, in addition to policy preference statements and some social factor statements utilized a five-point Likert scale to measure agreement to the statements provided. Statements referenced a range of topics relevant to the water reallocation discussion as identified in the literature and in personal interviews with key informants involved in water policy, environmental issues, municipal and health issues and irrigation.

A number of factor analyses were performed on the collected data to reduce the number of variables for analysis. Questions falling under the policy preferences domain of the conceptual model were reduced to a three factor solution (Table 1). A four factor solution was found for each of the four domains related to: value orientations (Table 2); beliefs and perceptions (Table 3); attitudes (Table 4); and social norms (Table 5). In each case, factor solutions were evaluated based on their consistency with theoretical expectations gleaned from a review of the relevant literature and a series of key informant interviews. In addition, any items with factor loadings below .4 were excluded from the analysis. Although there is no widely accepted cut-off based on factor loadings, factor loadings above .3 with few cross-loadings are generally seen as acceptable for social science research (Costello and Osborne, 2005). Following the factor analyses, Pearson correlations were calculated between the policy preference factors and all other extracted factors to identify relationships between factors. In future studies, the factor scores will be utilized as dependent and independent variables in a series of linear regression equations for each case.

FINDINGS AND DISCUSSION

The policy preferences domain will serve as the dependent variable in future analysis. The ten policy statements in this domain collapsed into three factors (Table 1). The first of these comprises statements related to increased government control over water reallocation, ranging from government power over setting prices in a market-based system to direct government power over the redistribution of water rights including the right to appropriate allocated water that is going unused. Respondents who score highly on this factor are supportive of a greater government role in water reallocation and are likely to oppose policies advocating decreased regulation or an increased role of the market in water reallocation. The second factor comprised policy statements consistent with pro-environmental preferences, whether via market-based means or investment in efficiency improvements. Respondents who believe that water is most valuable when used to meet environmental needs will score most highly on this factor. The third factor includes policy statements consistent with pro-economic preferences and support for honoring all existing water licenses. Respondents scoring highest on this factor are those most likely to prefer strong individual water rights and see consumptive uses as the most beneficial and productive uses of Alberta's water supplies.

Table 1: Policy preference factor analysis

	1	2	3
Factor 1: Government control policy			
1. GOVT_SET_PRICE	**0.809**	0.081	0.103
2. GOVT_DISTRIBUTE	**0.780**	-0.068	-0.190
3. GOVT_EXPROPRIATE	**0.560**	0.106	-0.138
Factor 2: Environmental/conservation policy			
4. GOVT_BUY_FOR_ENVIRO	-0.022	**0.714**	0.141
5. EFFICIENCY_TO_ENVIRO	0.203	**0.650**	-0.079
6. PRVT_BUY_FOR_ENVIRO	-0.145	**0.589**	-0.094
7. PBLC_FNDS_EFFICIENCY	0.170	**0.469**	0.261
Factor 3: Economic/use policy			
8. SAVED_WATER_ECON	0.060	0.021	**0.773**
9. HONOR_ALL_RIGHTS	-0.242	0.143	**0.559**
10. NO_MIN_FLOWS	-0.278	-0.387	**0.469**
Statistics			
EIGENVALUE	1.807	1.690	1.299
VARIANCE EXPLAINED	18.1%	16.9%	13.0%
CUMULATIVE	18.1%	35.0%	48.0%

Extraction method: Principal Component Analysis.
Rotation method: Varimax with Kaiser Normalization.

1. If water is to be traded among irrigation districts and/or municipalities, the government should set the price.
2. The government, rather than market forces, should decide who gets to use Alberta's water.
3. If an irrigation district or municipality is not using all of the water it has been allocated, then the government should be able to take that water for environmental purposes without compensation.
4. The government should buy water from current water licence holders, such as irrigation districts, so that more water can be left in the river for the environment.
5. Public funds should be used to improve irrigation systems only if the water that is saved is left in rivers.
6. Private individuals and groups should be able to hold water licences for environmental protection.
7. Public funds should be used to help larger water users (irrigators, industries and municipalities) to become more water efficient.
8. Water that is saved through improved water use efficiency should be used to increase economic activity.
9. All water licences, no matter when they were issued or for what purpose, must be honoured.
10. Minimum flows of water should not be set for all rivers, and all water should be available for economic purposes such as irrigation.

The remaining psychological domains will serve, alongside personal and situational characteristics, as the independent variables in future analysis. The first of the four factors derived from the value orientation domain (Table 2) measures what is identified in the environmental psychology literature (Stern et al.1993; Snelgar 2006) as a biospheric value orientation. Those with a strong biospheric value orientation are more likely to identify environmental concerns as guiding factors in their lives. The second factor includes statements consistent with an egocentric value orientation. Respondents with a strong egocentric value orientation are primarily concerned with how a particular issue will affect them personally, as opposed to how it may affect the environment or others. Respondents scoring highly on the third and fourth factors are primarily concerned with effects on other people. Such a value orientation is frequently labeled 'altruistic' in the literature. In this survey, the altruistic value orientation was further split into an agricultural-altruistic orientation, in which respondents stressed the importance of agriculture; and a domestic-altruistic value orientation, concerned with basic human and domestic needs. In each case, a higher factor score corresponds with greater importance placed on that value construct.

Table 2: Value orientation factor analysis

	1	2	3	4
Factor 1: Biospheric value orientation				
1. FUTUR_ENVIRO	**0.727**	-0.102	0.016	-0.057
2. ECOSYS+QOL	**0.659**	-0.080	0.069	-0.080
3. NAT_BEAUTY	**0.630**	-0.064	0.122	0.089
4. ENVIRO>HMN	**0.568**	0.100	-0.123	-0.467
5. ENVIRO_FIRST	**0.551**	-0.372	-0.194	0.032
Factor 2: Egoistic value orientation				
6. WASH_VEHICLE	0.040	**0.704**	-0.214	0.032
7. GREEN_LAWN	-0.149	**0.678**	0.175	0.005
8. ENTITLEMENT	-0.057	**0.585**	0.112	0.056
9. LIVELIHOOD	-0.190	**0.519**	0.015	0.292
Factor 3: Agricultural/Altruistic value orientation				
10. FRM_HERITAGE	0.132	0.074	**0.768**	0.052
11. AGRI+QOL	-0.043	0.036	**0.761**	0.102
Factor 4: Domestic/Altruistic value orientation				
12. BASIC_NDS>ALL	0.112	0.076	0.066	**0.836**
13. DMSTC>ENVIRO	-0.219	0.399	0.125	**0.547**
Statistics				
EIGENVALUE	2.128	1.908	1.351	1.337
VAR EXPLND	16.3%	14.7%	10.4%	10.3%
CUMULATIVE	16.3%	31.%	41.4%	51.7%

Extraction method: Principal Component Analysis.
Rotation method: Varimax with Kaiser Normalization.

1. I want future generations to be able to experience aquatic environments in southern Alberta that are healthier than the ones we have now.
2. Healthy aquatic ecosystems add to the quality of life in the province of Alberta.
3. The environment is important to me because of its natural beauty.
4. A healthy, functioning aquatic environment should always take priority over human uses of water.
5. When I think about the potential consequences of water markets the impact on the environment is the first thing that comes to mind.
6. I use water for washing my vehicle even if doing so may harm the river where the water comes from.
7. I enjoy having a lush green lawn and/or garden even if doing so may cause environmental harm to the river where the water comes from.
8. I am entitled to use as much water as any other resident of the province of Alberta.
9. I'm more concerned about my livelihood than I am about the environment.
10. Alberta's traditional farming heritage is an important part of the province's identity today.
11. Overall, irrigated agriculture positively contributes to the quality of life in southern Alberta.
12. Water for basic human needs should have priority over all other water uses.
13. Domestic uses of water such as washing, cooking and cleaning should take priority over the needs of a healthy aquatic environment.

According to value-belief-norm theory (Stern et al., 1999), perceptions and beliefs mediate the impacts of values on attitudes. The first factor in the belief and perception domain comprises statements linked to the belief that transfers will be harmful to the economy, the environment or farmers (Table 3). Respondent scoring highly on this factor believe transfers will be more harmful than beneficial. The second factor consists of statements related to perceptions of farmers and irrigation. Respondents scoring highly on this factor widely perceive irrigated agriculture as benefiting them personally and the province in general. As a result, they are likely to express greater concern for irrigators' rights if water transfers are to take place. The third factor includes statements related to knowledge and awareness of Alberta's current water management framework and issues. Respondents with high factor scores on this factor perceive that they have greater knowledge about the water policy context in Southern Alberta. The final factor in the beliefs and perceptions domain groups statements related to awareness of the need for water reallocation,

including specific environmental concerns and more general concerns related to the current system being out of line with wider society's values. Respondents scoring higher on this factor perceived the need for reallocation as more pressing.

Table 3: Beliefs and perceptions factor analysis

	1	2	3	4
Factor 1: Believe transfers are harmful				
1. HARM_ENVIRON	**0.794**	0.001	-0.019	0.260
2. HARM_ECONOMY	**0.782**	-0.035	-0.046	-0.026
3. HARM_FARMERS	**0.732**	0.190	0.082	0.071
Factor 2: Perceive agriculture/farmers as good				
4. HEALTHY_FOOD	-0.082	**0.733**	0.002	0.097
5. FARMER+ECON	0.221	**0.650**	-0.036	0.003
6. AG_STEWARDS	-0.011	**0.641**	0.116	-0.307
7. IRRIGAT_PROFIT	0.022	**0.636**	-0.133	-0.161
Factor 3: Perceived knowledge of management issues				
8. AWARE_TRANS	-0.056	-0.027	**0.821**	-0.040
9. AWARE_AMEND	0.030	0.059	**0.777**	-0.037
10. UNDERSTANDING	0.020	-0.083	**0.688**	0.118
Factor 4: Perceived need for water reallocation				
11. AQ_ENVIRO_BAD	0.249	-0.245	-0.097	**0.678**
12. DRIER_AREA	-0.180	0.144	-0.004	**0.630**
13. SYS_OUTDATED	0.186	-0.188	0.055	**0.617**
14. AWARE_IMPACT	0.330	-0.101	0.377	**0.540**
Statistics				
EIGENVALUE	2.076	1.950	1.947	1.750
VAR EXPLND	14.8%	13.9%	13.9%	12.5%
CUMULATIVE	14.8%	28.7%	42.6%	55.1%

Extraction method: Principal Component Analysis.
Rotation method: Varimax with Kaiser Normalization.

1. I expect that an increase in water transfers will harm rather than benefit the environment.
2. I expect that an increase in water transfers will harm rather than benefit Alberta's economy.
3. I expect that an increase in water transfers will harm rather than benefit Alberta's farmers.
4. Irrigated agriculture produces locally grown, healthy food for me and my family.
5. Alberta's economy will suffer if the province continues to lose farmers.
6. Alberta's farmers are good stewards of land and water.
7. Irrigated agriculture is the most economically profitable use of water in southern Alberta.
8. I am aware that water licences can be transferred in Alberta.
9. I am aware of the conflict surrounding the amendment of irrigation district water licences.
10. I have a better understanding of how water in southern Alberta is managed than do most of my neighbours.
11. The aquatic environment in Alberta is unhealthy.
12. I live in a drier environment than most Canadians.
13. The way we manage water in our rivers in Alberta is outdated and not in line with society's current values.
14. I am aware that the majority of rivers in southern Alberta are environmentally impacted or degraded.

While values are constructs that are general and transcend different situations, attitudes are situation specific evaluations about whether a particular attitude object is good or bad. The factor solution for the attitude statements resulted in four factors (Table 4). The first factor includes statements related to pro-environmental attitudes including limiting development and industrial or agricultural expansion if this would damage the environment. This factor also includes measures related to concern that aquatic habitats are not receiving enough protection. Respondents scoring highly on the pro-environmental factor are more likely to prioritize environmental uses of water over economic uses. The second factor in the

attitude domain groups items measuring respondents' level of agreement with allowing buyers and sellers to set the price of water, and hence allow price to determine who gets the right to use water. This factor includes statements, which are supportive of an increased role of market-based systems in water allocation, so the respondents scoring high on this factor are those who exhibit pro-market attitudes.

Pro-use statements make up the third factor within the attitudes domain, including questions concerned with making productive use of water resources as opposed to leaving water in the river. Respondents who score highly on this factor are more likely to feel that using water is more beneficial to themselves and society than keeping water in rivers for non-use purposes such as serving the environment. The final factor for the attitudes construct relates to respondent's attitudes toward government trustworthiness and level of responsibility for protecting the environment. Respondents who score highly on this factor believe the government is both trustworthy and responsible for the health of the aquatic environment in Alberta. Respondents who perceived government as responsible but not trustworthy or vice versa scored moderately and those who saw the government as neither responsible nor trustworthy received low factor scores.

Table 4: Attitude factor analysis

	1	2	3	4
Factor 1: Pro-environmental attitude				
1. NO_DVLPMNTS	**0.761**	-0.049	0.019	0.033
2. HBTT_CNCRN	**0.733**	-0.155	-0.087	-0.083
3. ENVIRO>AGRI	**0.603**	0.055	-0.374	0.256
4. ENVIRO>ECON	**0.557**	-0.220	-0.464	-0.060
Factor 2: Pro-market attitude				
5. MARKET_PRICE	-0.076	**0.794**	0.106	0.119
6. MKT_CMMDTY	0.006	**0.758**	0.213	0.058
7. DISTRBT_PRICE	-0.218	**0.648**	-0.044	-0.261
Factor 3: Pro-use attitude				
8. PUBLIC_SPACES	0.032	0.102	**0.819**	0.026
9. IRRIGATION	-0.369	0.130	**0.665**	0.052
Factor 4: Pro-government attitude				
10. GOVT_RSPNSBL	0.205	-0.231	-0.069	**0.746**
11. TRST_GOV_ENV	-0.219	0.265	0.155	**0.663**
Statistics				
EIGENVALUE	2,070	1.853	1.565	1.162
VAR EXPLND	18.8%	16.8%	14.2%	10.6%
CUMULATIVE	18.8%	35.6%	49.8%	60.4%

Extraction method: Principal Component Analysis.
Rotation method: Varimax with Kaiser Normalization.

1. New subdivisions should not be allowed in this region if supplying the water they need would cause harm to the environment.
2. I'm concerned that aquatic habitats in southern Alberta are not receiving enough protection.
3. The environment's needs for water should be met before water is used for human economic purposes such as industry and agriculture.
4. Water should be made available for environmental uses before the economy.
5. Buyers and sellers of water licences should be the ones who decide the price of water.
6. I think that water is a commodity that individuals and private groups should be able to buy and sell.
7. Water from rivers should be used to provide benefits to those who can afford to buy water licences, not to the whole community.
8. Using water to create green and lush public spaces adds more to my quality of life than leaving the water in the river.
9. I would rather see Alberta's economy grow through more irrigated agriculture as opposed to having more water in the rivers.
10. The government should be responsible for ensuring that water quality and quantity are good enough to ensure a healthy environment.
11. I trust the government to manage water in ways that are best for the environment.

The social norm statements also reduce to four factors, the first of which measures social ties to agriculture (Table 5). Incorporated into this factor are items measuring frequency of social contact or conversation with farmers or farm families. Additional items loading on this factor include having friends or family employed in agriculture or related fields. Those scoring highly on the factor expect to be more concerned about the impacts of water transfers on farmers and exhibit greater support for policies protecting irrigator's rights. The second factor contains items related to contact with rural amenities including using rural areas, rivers, lakes and reservoirs for recreation or purchasing produce from a farmer's market or farm gate. Respondents who score highly on this factor are more likely to encounter rural people and places, which may influence their preferences for rural to urban water transfers.

Table 5: Social norm factor analysis

	1	2	3	4
Factor 1: Social ties to agriculture				
1. SOCIALIZE_AG	**0.854**	0.187	0.021	-0.029
2. CONVERS_FRMR	**0.840**	0.225	0.013	-0.023
3. DIRECT_AG_EMP	**0.823**	0.089	0.019	-0.015
4. INDRCT_AG_EMP	**0.788**	0.024	-0.064	-0.006
Factor 2: Contact with rural amenities				
5. RIVERS_FOR_REC	0.045	**0.797**	-0.055	-0.028
6. RURAL_FOR_REC	0.247	**0.746**	-0.059	-0.016
7. FARM_PRODUCE	0.114	**0.621**	0.037	-0.002
Factor 3: Community cohesion				
8. COMMUN_GOALS	0.070	0.010	**0.755**	0.033
9. COMMUN_AGREE	-0.085	-0.145	**0.724**	0.020
10. ENVIRO_EXPCTN	0.010	0.245	**0.416**	-0.387
Factor 4: Community approval of transfers				
11. SO_APPRV_MRKT	0.042	-0.051	-0.153	**0.770**
12. COMMUN_MRKT	-0.095	0.081	0.230	**0.733**
Statistics				
EIGENVALUE	2.832	1.761	1.357	1.284
VAR EXPLND	23.6%	14.7%	11.3%	10.7%
CUMULATIVE	23.6%	38.3%	49.6%	60.3%

Extraction method: Principal Component Analysis.
Rotation method: Varimax with Kaiser Normalization.

1. How often do you socialize with people whose primary source of income is agriculture related?
2. How often do you have a conversation with a farmer or member of a farm family?
3. How many of your friends or family work in an agriculture related field?
4. How many of your friends or family work directly in irrigated agriculture?
5. How often do you use rivers, creeks or reservoirs near where you live for commercial, domestic or recreational purposes?
6. How often do you travel to rural areas for recreational purposes, including visiting with family and friends?
7. How often do you purchase farm produce at a farmer's market, roadside stand or farm gate?
8. I want the same things from my community as other local people.
9. People in my community agree on water issues.
10. Supporting environmental causes such as maintaining minimum levels of water in the river is expected of me.
11. People in my life whose opinions matter to me approve of water markets.
12. People in my community support using markets to reallocate water.

The third and fourth factors aggregate items into groups representing social cohesion and social approval of water transfers. Items ranking on the social cohesion factor included those related to community agreement with respect to water policy, as well as the respondents' impression that society

expects them to support environmental causes. Respondents who score highly on this factor perceive their communities as being united with respect to water policy and environmental issues, and as such are likely to feel greater social pressure to conform their own views to those of their communities. The social approval factor reflects how the respondents perceive support for water markets among their communities and significant people in their lives. Respondents with high factor scores on the fourth factor feel that those around them support using markets to reallocate water. When combined, the social cohesion and social approval measures will result in an index of perceived social norms toward market-based water reallocation, which expects to influence respondents' policy preferences.

Following the factor analyses described above, Pearson correlations between the factors extracted from the policy preferences domain and all other extracted factors were calculated (Table 6). Significant correlations exist in many cases. As was predicted by the literature, specific attitudes significantly correlate to policy preferences, although significant correlations also exist between the biospheric value orientation factor and each policy preference factor.

Factors positively and significantly correlated with preferences for increased government control over water reallocation include those related to pro-environmental values and attitudes. Also positively and significantly correlated are the beliefs that transfers would be harmful and the perceived need for water reallocation. A pro-government attitude is also predictably significantly correlated with the preference for greater governmental control. Negatively and significantly correlated measures for this factor include the agricultural/altruistic value orientation, pro-market and pro-use attitudes, and level of community cohesion.

In the case of preferences for policy aligned with environmental or conservation goals, pro-environmental values and attitudes are once again significantly and positively correlated. Beliefs that transfers are harmful, favourable perceptions of farmers and strong perceived need for transfers are also positively correlated, as are pro-government attitudes and high levels of contact with rural people and amenities. Egoistic and domestic/altruistic value orientations and social ties to agriculture share a weak negative correlation with environmental policy preferences, while holding pro-use attitudes have a somewhat stronger negative correlation.

With respect to policy options most concerned with economic development and the continued use of water resources, the egoistic and agricultural/altruistic value orientations are positively correlated, while the biospheric value orientation is negatively correlated. Also negatively correlated are beliefs that transfers will be harmful and the perceived need for water reallocation. Among attitude factors, pro-environmental attitudes are negatively correlated with economic policy, while pro-market, pro-use and pro-governmental attitudes are positively correlated. Social ties to agriculture, community cohesion and community approval of transfers are likewise positively correlated while contact with rural amenities is negatively correlated with the economic focused policy factor.

Table 6: Pearson correlations between policy preference factors and determinants

	Government control policy factor	Environmental/ conservation policy factor	Economic/use policy factor
Value orientation factors			
Biospheric value orientation	.235**	.356**	-.155**
Egoistic value orientation	-.035	-.080*	.193**
Agricultural/altruistic value orientation	-.135**	-.025	.223**
Domestic/Altruistic value orientation	.074	-.094*	.055
Beliefs and perceptions factors			
Believe transfers are harmful	.165**	.106**	-.109**
Perceive agriculture/farmers as good	-.067	.110**	.277**
Perceived knowledge of management issues	.058	-.032	.025
Perceived need for water reallocation	.102**	.212**	-.280**
Attitude factors			
Pro-environmental attitude	.125**	.341**	-.263**
Pro-market attitude	-.252**	.039	.170**
Pro-use attitude	-.117**	-.113**	.296**
Pro-government attitude	.273**	.077*	.089*
Social norm factors			
Social ties to agriculture	-.042	-.087*	.123**
Contact with rural amenities	.073	.197**	-.166**
Community cohesion	-.186**	.008	.113**
Community approval of transfers	.012	.072	.174**

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

CONCLUSIONS

The findings presented here provide a valuable step toward gaining a better understanding of the policy preferences of non-irrigators for water reallocation. Links between various psychological variables and general environmental concern or behavior are well-established (Stern and Dietz, 1994), and similar links are theorized with respect to resource management preferences. By identifying the relevant factors underlying these variables with respect to water reallocation we can draw links between related branches of the literature and better inform policy to ensure its widespread acceptance and adoption.

This study identified three principle policy orientations for future water reallocation, which were consistent with those identified by the key informants in interviews that informed the survey design process. Likewise, the attitude factors extracted were consistent with what many interviewees identified as likely to be important to the general population when it came to water reallocation. The factors extracted from the attitudes domain were also consistent with the primary concerns voiced by those opposing the Balzac transfers and the amendment of irrigation district licenses.

The remaining domains explored in this paper is not as specifically related to water reallocation, allowing for a more direct comparison with specific findings in the literature. This study confirms, for example, the biospheric, egoistic and altruistic value orientations identified as contributing significantly to environmental behavior (Stern et al., 1993; Snelgar, 2006). It extends the concept, however, by splitting the altruistic orientation into concern for agricultural users and concern for domestic users—a distinction that may be important to consider when the impacts of water reallocation schemes are presented to the public.

The breakdown of the beliefs and perceptions domain was also consistent with that proposed in the literature. Beliefs about the need for and effect of change were identified by Stern et al. (1999) as important mediators between values and norms, while Thorvaldson et al. (2010) found preferences for water policy to be conditional on knowledge of water supply, scarcity and variability, and the institutions governing water rights. Since it is necessary that water be transferred from rural to urban and environmental uses, perceptions of agriculture are also expected to influence preferences, as was found by Sharp and Adua (2009).

Sharp and Adua noted the difference between social and physical distance from agriculture in the formation of related environmental concern. Brehm et al. (2006) also noted the importance of the social aspects of community attachment as a predictor of environmental concern. The in-depth interviews conducted for this research also provided anecdotally evidence to support. These findings are consistent with the extraction of a factor measuring social ties to agriculture within the social norms domain and should influence policy preferences.

In addition to confirming the breakdown of psychological variables explored by other authors within the context of water reallocation in Alberta, we find significant correlations between each of the policy orientations explored and many of the other factors extracted. Respondents in favour of greater government control over water reallocation predictably expressed concern about using markets to reallocate water, as well as increasing water use rather than keeping water in the river. This is consistent with this groups' tendency to identify strongly with environmental values and attitudes and recognise the need for transfers to environmental uses. Notably, this group is less likely to perceive irrigators as good stewards of land and water, and less likely to feel that there is agreement in their community as to how water reallocation should take place. In both cases, relying on the government to decide how to manage water reallocation seems preferable to letting buyers and sellers decide.

Those who respond favourably to policy aligned with environmental concerns are also more likely to express pro-environmental values and attitudes. The perceived need for reallocation is high among those who ranked environmental policies as most favourable, as are perceptions that Alberta's farmers are good for the province, despite social ties to agriculture being relatively low.

There are significant correlations between the economic policy orientation and pro-agricultural values and attitudes as well as strong social norms, especially concerning ties to agriculture. This orientation is also correlated with the belief that water reallocation was largely unnecessary. These relationships are consistent with the hypothesis that those with close ties to agriculture will primarily be concerned with the effects of reallocation on the irrigation industry, and less concerned with environmental impacts. As a rule, they will prefer that water allocations remain in the hands of irrigators.

Policy makers and water managers should consider the insight into these constructs when designing and implementing new policies and mechanisms to reallocate water to new consumptive users or the environment. These findings could also influence social marketing tools used to inform and sway public opinion about necessary water reallocation, helping to reduce social conflict and leading to more predictable policy outcomes.

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