Perceptions of Academic and Government Expert Groups in Watershed Management: A Case of the Cimarron River Watershed

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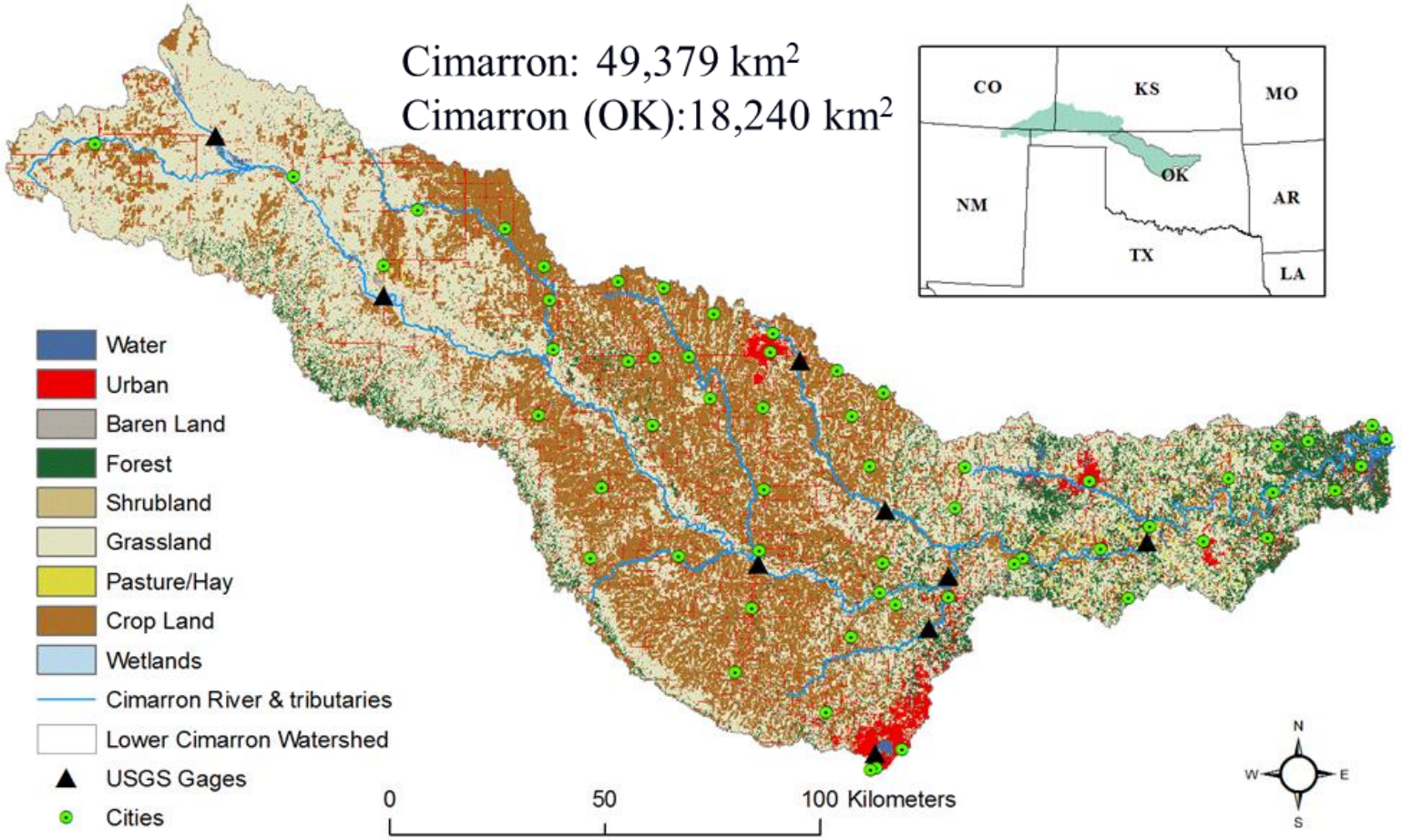
Cimarron River Watershed



- 1950-2011: 6,000 km² cropland lost to grass, range and urban areas
- Since 1999: grassland encroached by woody plants (red cedar)
  - Reduced streamflow (Zou et al. 2015)

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- Cimarron River Watershed Symposium
  - November 17, 2016
  - 33 individuals (state, federal agencies/organizations and university researchers)
- Objective(s)
  - To discuss ongoing research and extension outreach efforts in the watershed
  - To establish Strengths Weaknesses Opportunities and Threats framework in the management of watershed

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Representation from 12 different institutions and organizations

- U.S. Geological Survey
- Oklahoma Water Resources Board
- Oklahoma Cooperative Fish and Wildlife Research Unit
- Oklahoma Conservation Commission
- Burns & McDonnell
- Oklahoma Department of Wildlife Conservation
- Cushing Economic Development Foundation
- U.S. Fish and Wildlife Service
- Oklahoma Corporation Commission
- Natural Resources Conservation Service
- Oklahoma State University
- University of Oklahoma

33 Representatives

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- What we did?
  - Performed Strengths, Weaknesses, Opportunities and Threats (SWOT) Analysis
    - Individuals identified factors in each SWOT categories
  - Conducted online survey
    - Round 1: pairwise comparison between the identified factors in each SWOT category
    - Round 2: pairwise comparison of highly ranked factors in each SWOT category (from Round 1)
  - Extended SWOT with Analytical Hierarchical Process (AHP)
    - Assigning relative priority value to each SWOT factor
    - Determine overall judgement consistency

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Analytic Hierarchy Process (AHP)

- Introduced by Thomas Saaty (1980)
  - A decision making tool for decision makers: set priorities between criteria (options)
    - Make a series of pairwise comparison between the alternatives (factors)
    - Captures both subjective and objective aspects of a decision
  - A technique for checking the consistency of the comparisons/evaluations
    - Reduces biases in the decision making process
  - It generates weight for each evaluation criterion/option based on the decision maker's pairwise comparison of the criteria/options
    - Higher the weight (score), the more important the corresponding criterion (option)
  - It combines the criteria weights and the options scores to determine a global score for each option

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Analytic Hierarchy Process (AHP)

- Checking Consistency
  - A consistency ratio (CR) = CI / RI
    - RI is a random consistency index obtained from randomly generated reciprocal matrix using the scale 1/9, 1/8, ….1, ….8,9
    - CI is consistency index

    CR < 10% is considered acceptable

    CR = 0 % is the consistent judgement

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Results:
SWOT factors obtained from the Cimarron River Symposium participants

Strengths	**Weaknesses**
S1: Willingness to work together	W1: No platform to share data
S2: Amount of historical data	W2: Social perception is unknown
S3: Informing policy based on science	W3: Inability to track water use
S4: Stream & biological monitoring activities	W4: Underutilization of data

Opportunities	**Threats**
O1: Incentives for water & wetlands conservation	T1: Uncertainty with regulations and policies
O2: Enforcement of water uses	T2: Increased water use for energy and irrigation
O3: Stronger stakeholder collaborations	T3: Lower funding priority
O4: Data use in decision support system	T4: Climate change/drought

Issues identified: streamflow (quantity), woody plant (eastern redcedar) encroachment, drought, oil and gas, lack of conservation efforts (wetlands and wildlife), increased water use by permit holders, sedimentation, salinity

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Results:

Consistency of responses between the stakeholders

Survey	**SWOT factors**	**Government**	**Academia**
I.	Strengths	4.1	2.2
	Weaknesses	0.5	9.6
	Opportunities	1.0	5.0
	Threats	2.0	0.0
II.	Ranking of highly ranked factors from Survey I*	1.5	0.6

* In Survey II, the participants were asked to make a pairwise comparison of the SWOT factors that were ranked the highest in Survey I.

Survey Results- SWOT-AHP

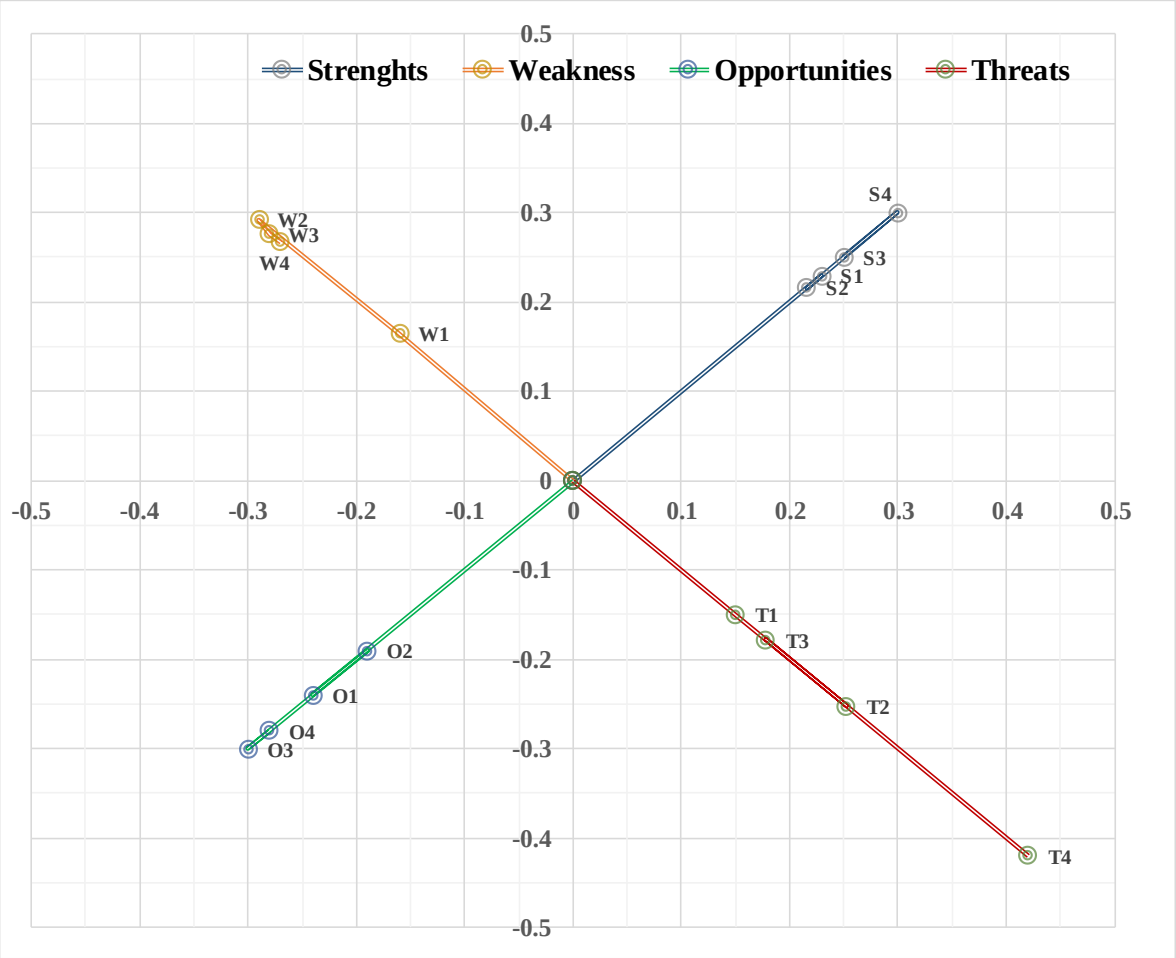
***Kharel et al.* submitted to Environmental Management**

SWOT categories	Factor priority score		Global priority score	
	Government	Academia	Government	Academia
Strengths			**0.252**	**0.223**
S1. Willingness to work together	0.172	0.229	0.043	0.051
S2. Amount of historical data	0.220	0.216	0.056	0.048
S3. Informing policy based on science	0.282	0.254	0.071	0.057
S4. Stream & Biological Monitoring	**0.326**	**0.301**	0.082	0.067
Weaknesses			**0.363**	**0.167**
W1. No platform to share data	0.193	0.165	0.070	0.027
W2. Social perception is unknown	0.165	**0.292**	0.060	0.049
W3. Inability to track water use	**0.479**	0.276	0.174	0.046
W4. Underutilization of data	0.163	0.268	0.059	0.045
Opportunities			**0.166**	**0.225**
O1. Incentives for conservation	**0.337**	0.235	0.056	0.053
O2. Enforcement of water uses	0.319	0.185	0.053	0.042
O3. Stronger stakeholder collaborations	0.192	**0.302**	0.032	0.068
O4. Data use in decision support system	0.152	0.277	0.025	0.062
Threats			**0.219**	**0.385**
T1. Uncertainty with regulations and policies	0.157	0.150	0.034	0.058
T2. Water use for energy and irrigation	**0.328**	0.252	0.072	0.097
T3. Lower funding priority	0.250	0.178	0.055	0.069
T4. Climate change/drought	0.264	**0.420**	0.058	0.162

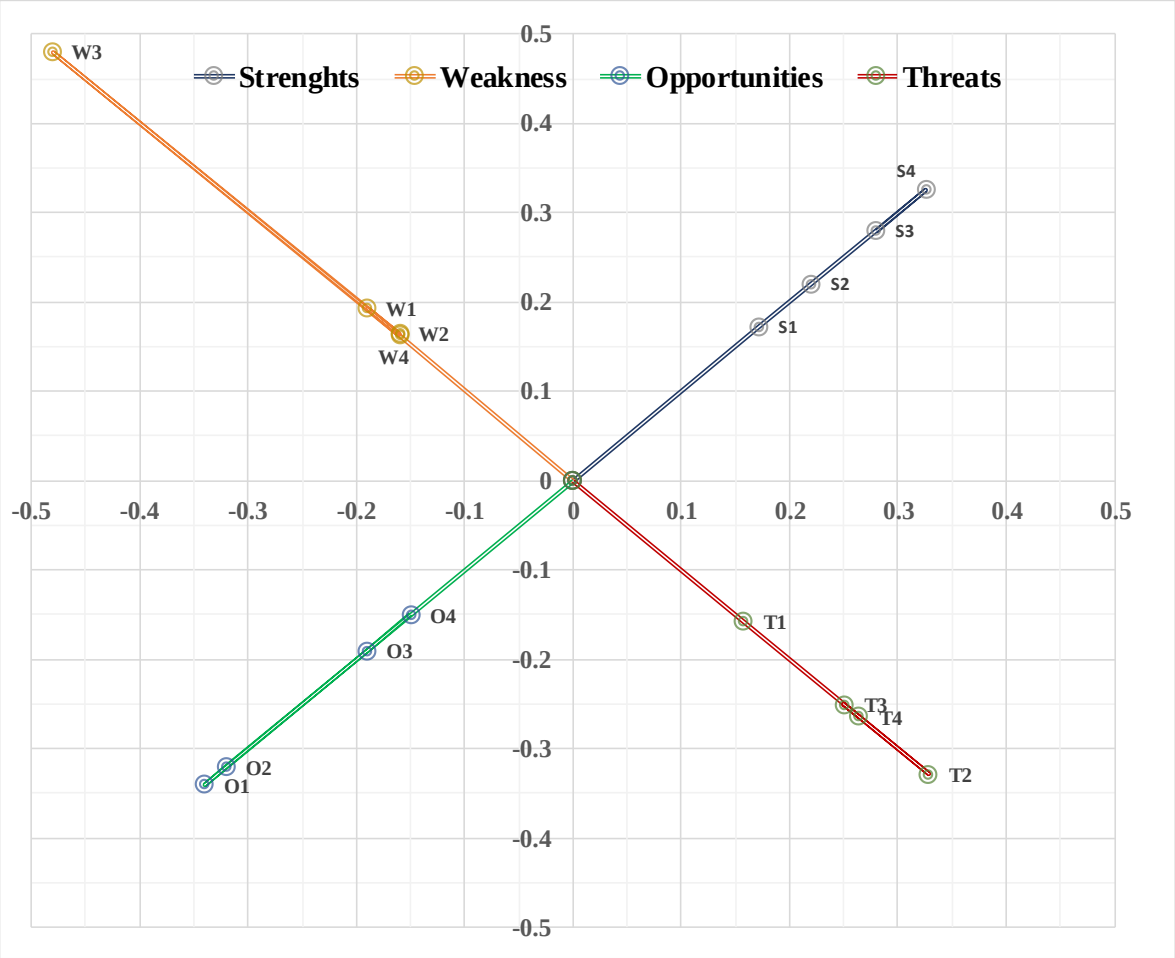
Results:

***Kharel et al.* submitted to Environmental Management**

Academia



Government



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Key findings:

- Respondents recognized **higher water management challenges** as compared to the available strengths and opportunities
  - Need of decision support systems/tools utilizing the available data
  - Need of social perception data
  - Preparedness for climate change/drought future conditions

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Leveraging the results

- Develop management scenarios focusing on identified and prioritized SWOT factors
  - E.g., water needs for irrigation, and oil and gas extraction
  - E.g., enforcement of water use; redcedar control
- Feed management scenarios into the integrated modeling platform- Envision

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