The Colorado Basin River Forecast Center and the Decision Making Process

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Motivation for study

Consistent with WWA's mission to provide information that can assist decision makers, we wanted to learn:

- Who are CBRFC stakeholders, what do they feel are their current and future vulnerabilities, and how do they cope?

- How can the dust on snow and bark beetle research be useful to CBRFC stakeholders?

Methodology

- Reviewed literature on decision maker use of forecasts. While a variety of factors explain non-use of forecasts, generally a key determinant of forecast use is perception of risk based on previous experience. Forecast skill is generally not as critical to use.
- In consultation with CBRFC, developed a survey covering 3 areas:
  - background information about stakeholders
  - vulnerability (weather and climate events respondents have experienced or expect to experience) and coping mechanisms
  - how stakeholders use forecasts; knowledge of/concern about dust on snow and bark beetle
- Pretested survey with water managers
- Compiled list of current and potential CBRFC stakeholders including CBRFC stakeholder meeting attendees, managers of ~80 reservoirs monitored by CBRFC, NWS forecasters, Bureau of Reclamation roster of water users in the Upper Colorado Region, emergency managers
- Distributed survey to 141 stakeholders via Survey Monkey last summer; 70 stakeholders responded

I. Background information about stakeholders

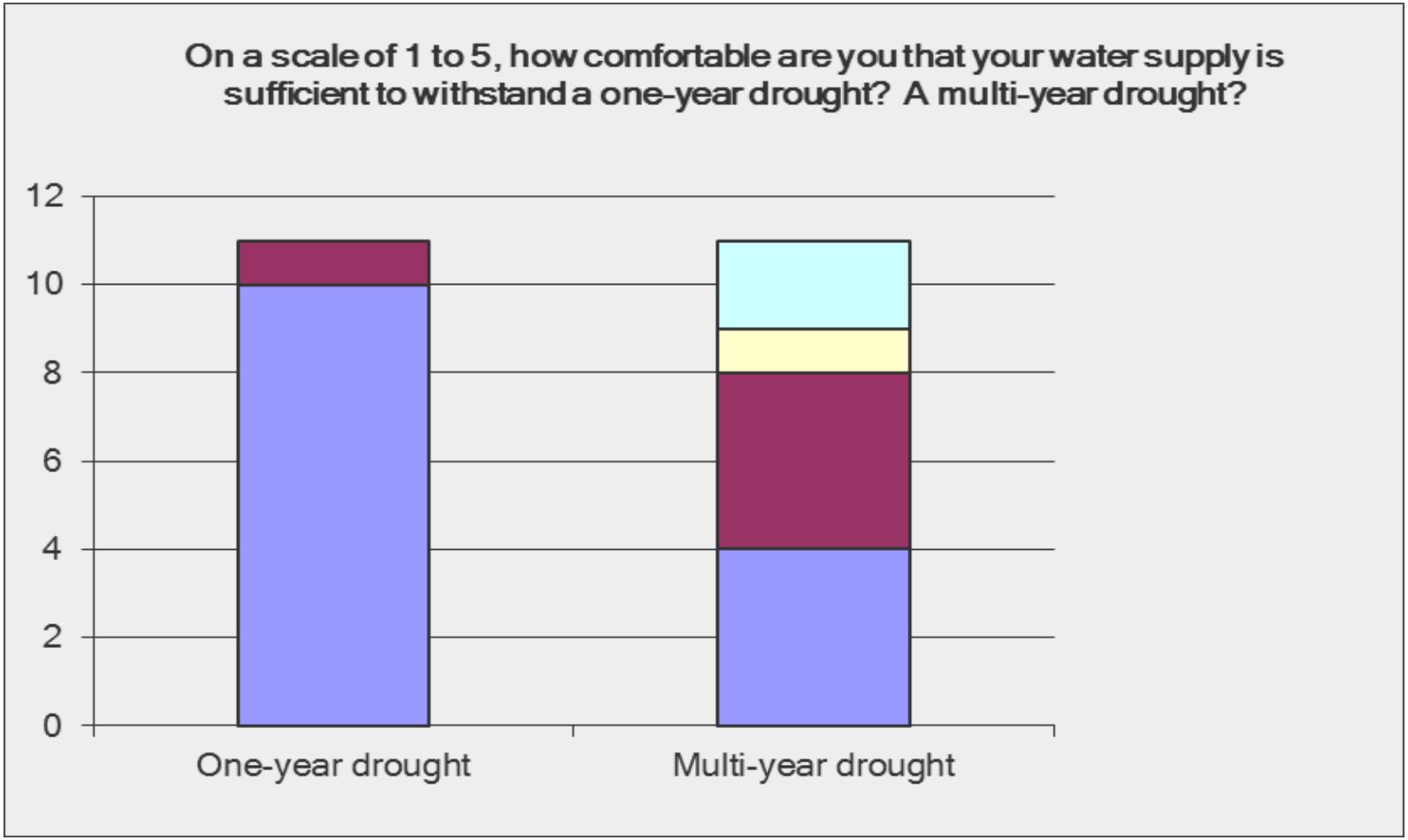
Survey respondents work for:

- federal agencies (23)
- water conservancy districts (11)
- regional water entities (9)
- municipal water utilities (8)
- flood control districts (3)
- organizations providing either research, consulting, or work on policy issues (3)
- state agencies (2)
- irrigation districts (2)
- electric power providers (2)

~half describe affiliation as water management, 14% govt forecasting, 8% emergency mgmt/flood control; the remainder scattered among ag, research, energy, water treatment, recreation, environmental, etc.

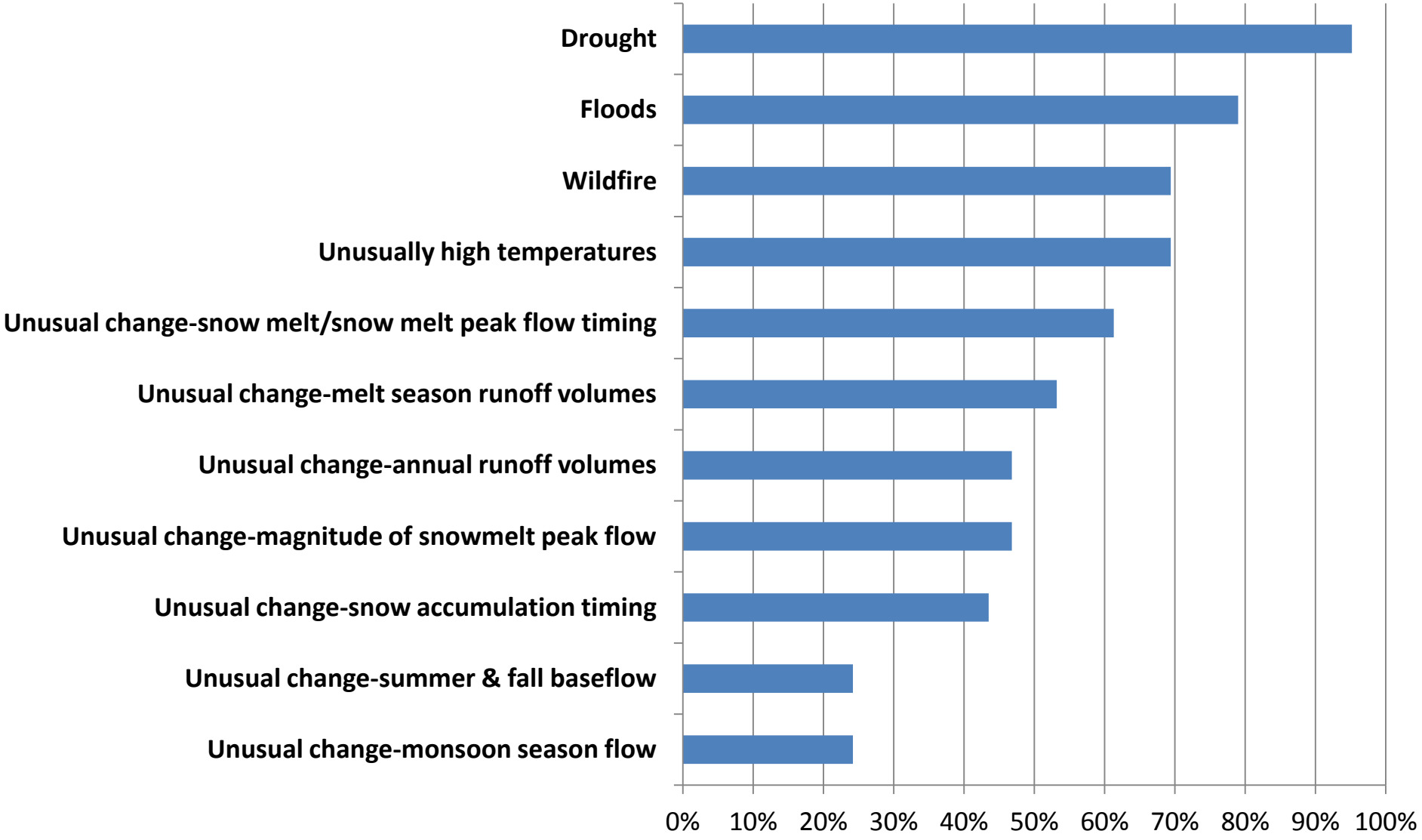
Service area (select all that apply)	
Colorado, including municipalities and counties within the state	34%
Colorado River Basin	31%
Utah, including municipalities and counties within the state	23%
Other (please specify)	21%
Arizona, including municipalities and counties within the state	18%
Southwest region (Arizona, New Mexico, Colorado, Utah)	13%
Western U.S.	13%
New Mexico, including municipalities and counties within the state	8%
Wyoming, including municipalities and counties within the state	8%
National	3%
U.S.-Mexico border	3%
Global	2%

II. Vulnerability and Coping Mechanisms



Most comfortable	
Least comfortable	

Events experienced in past 10 years



Problems caused by events

	Lost revenue	Unanticipated expenses	Difficulty assuring system reliability
Drought	52%	52%	**61%**
Floods	29%	**71%**	49%
Wildfire	32%	**86%**	32%
Unusual change in **snow melt or snow melt peak flow timing**	13%	33%	**83%**
Unusual change in **annual runoff volumes**	33%	29%	**79%**
Unusual change in **magnitude of snow melt peak flow**	9%	41%	**68%**
Unusual change in **melt season runoff volumes**	33%	29%	**81%**
Unusually **high temps**	21%	53%	53%
Unusual change in **snow accumulation timing**	16%	21%	**79%**
Unusual change in **summer and fall baseflow**	27%	20%	**80%**
Unusual change in **monsoon season flow**	0%	44%	**67%**

Perception of likelihood of future events

	Likely	50/50 chance	Unlikely	Don't know
Drought	**88%**	11%	0%	2%
Unusually **high temperatures**	72%	17%	0%	11%
Wildfire	62%	17%	8%	13%
Unusual change in **snow melt or snow melt peak flow timing**	55%	33%	0%	12%
Unusual change in **annual runoff volumes**	54%	22%	4%	20%
Floods	53%	32%	8%	8%
Unusual change in **melt season runoff volumes**	53%	24%	4%	18%
Unusual change in **magnitude of snow melt peak flow**	47%	28%	4%	21%
Unusual change in **snow accumulation timing**	44%	24%	11%	20%
Unusual change in **summer and fall baseflow**	33%	38%	7%	22%
Unusual change in **monsoon season flow**	**30%**	26%	7%	**37%**

Past use and effectiveness of coping mechanisms

	Has used	Very effective	Somewhat effective	Not at all effective
Increased use of **CBRFC forecasts**	**75%**	44%	56%	0%
Increased use of **other weather or climate forecasts***	71%	29%	69%	2%
Instituted **water conservation** program	50%	52%	48%	0%
Developed **drought plan**	45%	36%	59%	5%
Trained personnel	43%	48%	52%	0%
Developed **emergency management plan**	34%	27%	60%	13%
Increased **storage**	32%	**67%**	33%	0%
Transbasin diversion	25%	**67%**	33%	0%
Purchased **water rights or shares**	25%	54%	31%	15%
Financial incentives (rates, surcharges, budgets)	25%	33%	67%	0%
Instituted **outdoor water restrictions**	21%	**73%**	27%	0%
Changed **staffing** level	21%	40%	60%	0%

*Other products used by at least half of respondents: U.S. Drought Monitor, U.S. Seasonal Drought Outlook, Climate Prediction Center Precipitation and Temperature Products, CBRFC Forecast Briefings, NRCS State Basin Outlook Reports

Likelihood of using coping mechanisms in future

	Highly likely	50/50 chance	Highly unlikely
Increased use of **CBRFC forecasts**	75%	20%	6%
Increased use of **other forecasts**	73%	23%	4%
Train personnel	66%	17%	17%
Develop **drought plan**	65%	13%	23%
Institute **water conservation** program	63%	8%	29%
Develop **emergency management** plan	45%	18%	37%
Purchase **water rights or shares**	37%	14%	49%
Transbasin diversion	35%	9%	56%
Financial incentives (rates, surcharges, budgets)	34%	16%	50%
Increase **storage**	32%	21%	47%
Lease alternative water source/use water bank	31%	20%	49%
Institute **outdoor water restric**tions	31%	6%	63%
Conjunctive use of groundwater and surface water	27%	12%	61%
Institute **warning system**	27%	14%	59%
Change **staffing** level	23%	51%	26%

Top short- and long-term concerns

Short-term

- Climate variability/change incl extreme events and drought
- Water supply/demand balance
- Budget issues
- Wildfire

Long-term

- Climate variability/change incl extreme events and drought
- Water supply/demand balance
- Colorado River Compact issues
- Population growth

III. Use of forecasts and decision making

Decision for which CBRFC forecasts are useful

- Reservoir operations such as timing and volume of releases (15)
- Flooding (7)
- Issuing warnings (6)
- Drought response (4)
- Environmental issues (3)
- Power (2)
- Irrigation, maintenance, treatment plant, purchases, field work (1 each)

Factors that limit use of CBRFC forecasts

Difficulty determining quality of CBRFC forecasts	41%
Other (please specify)	27%
Difficulty knowing which CBRFC forecasts are useful	22%
Inaccuracy of CBRFC forecasts	22%
Lack of familiarity with CBRFC forecasts	22%
My organization's operating procedures	19%
Conflict between CBRFC forecasts and other forecasts I use	19%
Difficulty interpreting CBRFC forecasts	16%
Conflict between CBRFC forecasts & non-forecast factors	8%
Conflict between CBRFC forecasts & our organization's internal tools	5%
Legal constraints	3%

Next steps

One-on-one interviews of ~10-15 survey respondents. Possible areas of inquiry:

- Short and long-term organizational concerns
- Coping mechanisms – past and future
- How CBRFC forecasts and other information are used in decision making; how much weight is given to this information
- What information about the dust on snow and bark beetle research would be useful to decision makers; what form should the information take

For questions about CBRFC stakeholder survey:

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For more information and contacts for all of the projects mentioned and many more:

Western Water Assessment website: http://wwa.colorado.edu/