

WESTERN WATER ASSESSMENT REPORT

Analysis of Documented Stakeholder Needs for Climate Information in the Missouri River Basin

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Prepared for:
Doug Kluck, NOAA Central Region Climate Services Director

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***left photo: Doug Kluck, NOAA National Climatic Data Center
center photo: Barnes Realty Co., Northwest Missouri
right photo: Doug Kluck, NOAA National Climatic Data Center***

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Executive Summary

In order to gain a better understanding of climate-related needs in the Missouri River Basin, this project entailed an analysis of needs stated in published documents. Through web-based searches and the querying of colleagues within the Basin, fifty-three documents were ultimately selected to be included in the analysis. Documents were chosen if they identified or expressed a climate-related need and had a geographic scope within the Missouri River Basin. Regionally and nationally focused documents were selected if they specifically mentioned stakeholders or decision-making within the Basin. Types of documents included workshop reports, white papers, conference presentations, meeting minutes, posters, journal articles and various other types of publications. Climate-related needs included drought, flooding, other extreme weather events, and longer-term climatic changes. (Tables 1 and 2 of the appendix display the documents by year of publication and sector.)

Once documents were selected for inclusion they were loaded into NVivo, a qualitative data analysis software. NVivo was used to code the individual needs within each document by various coding nodes, including sector and year. Coding allowed for analyses of the different types of needs, identifying which needs were more prevalent than others, and how needs differed between sectors. See Table 5 in the appendix for a list of the coding categories, as well as the number of needs identified per category.

While a variety of needs were identified across the multiple sectors and coding categories, some general themes emerged. Some of these commonly seen needs included:

- The need for additional plains snowpack monitoring, especially from the flood control sector.
- In regards to modeling, the output needs to be applicable to users and at a scale that is relevant to the intended recipients of decision-makers.
- A prominent research need finding across several sectors was a better understanding of potential climate change impacts for their respective sectors. It seemed that a lack of understanding these potential impacts translated into a barrier for decision-making in regards to adaptation.
- Almost all sectors called for better federal agency coordination, in addition to improved coordination with states, tribes, and local communities. For example, there were several specific mentions of the USACE being more inclusive.
- The messaging and communication of climate-related information needs to come from trustworthy sources, and from multiple media avenues (television, radio, social media, etc.).
- Many documents from the flood control sector expressed the need for improved public education on their particular flood risks.
- While not citing climate change directly, it was expressed that the USACE should give greater weight to recent variability and extreme events, in regards to reservoir planning and operations.

Introduction

Compared to river basins such as the Colorado River, the Missouri River Basin has received relatively minimal federal engagement in terms of the provision of climate services. In order to effectively begin a coordinated, multi-agency effort to meet the climate-related needs of stakeholders throughout the basin, it is critical to identify those needs, catalog research and service capacities, map needs to capacities, and use social network analysis to understand how climate information gets disseminated. This initial project is an attempt at the first step in that process by broadly cataloging and evaluating climate-related needs through the examination of previously published documents. Ideally this effort will help guide federal investments in climate services for the Basin by providing a blueprint for where services are needed the most.

This project was conducted in conjunction with Doug Kluck, Central Region Climate Services Director for the National Oceanic and Atmospheric Administration (NOAA). The findings below are intended to facilitate NOAA efforts to coordinate climate services in the Missouri Basin. By providing a baseline assessment of stated needs for climate information and services, this report and the accompanying database should provide a clearer picture of where future NOAA efforts may be most effective.

The reader should note, given that all of the findings contained in this report are based on published documents, that the needs described below should not be considered comprehensive. Other needs for climate information and services may not yet be articulated or captured in a report but could be equally important. Future work will attempt to capture those needs not available through published documentation.

Methods

The idea of relying on a document analysis methodology to identify needs stems from an attempt to avoid duplicating existing similar assessment efforts—in other words, to establish a baseline of relevant knowledge before engaging in other assessment activities. Using this methodology also helps avoid fatigue among decision makers and other stakeholders who are often faced with repeated requests for information about climate information needs. Reviewing previously published documents also allows for a broad understanding of the baseline needs over an extended period of time and across multiple sectors. A documented needs analysis is generally considered a precursor to more in-depth surveys or interviews. Among other recent efforts, this methodology has already been used in a study of needs across Colorado, Wyoming, and Utah (Berggren and Dilling, in prep).

For this project the examination of stakeholder needs was conducted by systematically developing a list of documents in which stakeholders within the Missouri River Basin had expressed or identified climate-related needs. Documents were identified through web-based searches and the querying of colleagues within the Missouri River Basin. Types of documents included were:

- Workshop reports
- White papers
- Conference presentations

- Meeting minutes
- Posters
- Journal articles
- Various other types of publications.

Documents were ultimately selected if they identified or expressed a climate related need and had a geographic scope within the Missouri River Basin. Regionally and nationally focused documents were selected if they specifically mentioned stakeholders or decision-making within the Basin. Climate related needs included drought, flooding, extreme weather events, and longer-term climatic changes. In the end, fifty-three documents were selected, and included stakeholders in the following sectors:

- Agriculture
- Flood control
- Land management
- Fish and wildlife
- Water management
- Tribes
- Drought planning
- Multiple (this generic sector was used when the document included several sectors without a dominant primary sector).

Three documents only focused on two sectors, and were included in each individual sector. Tables 1 and 2 summarize the documents by sector and year of publication:

Year of Publication	
2001	1
2002	0
2003	0
2004	0
2005	3
2006	1
2007	3
2008	3
2009	7
2010	4
2011	21
2012	10
Total	53

Sectors	
Agriculture	8
Drought Planning	7
Fish and Wildlife	4
Flood Control	13
Land Management	3
Multiple	10
Tribes	3
Water Management	8
Total	56

Tables 1 and 2. The number of documents broken down by year of publication and sector. Three documents were coded as two separate sectors, thus the difference in totals. Documents that discussed more than two sectors were coded as 'multiple'.

Once documents were selected for inclusion, they were loaded into NVivo, a qualitative data analysis software that is capable of searching for key words across large numbers of documents. NVivo was used to code the individual needs within each document by various coding categories, including sector and year. Coding allows for analyses of the different types of needs, identifying which needs were more prevalent than others, and how needs differed between sectors. Needs were coded into the following categories and subcategories:

- Monitoring and Data Collection
 - Snowpack
 - Biological
 - Climate or Weather
 - Frost Depth Gauges
 - Soil Moisture
 - Streamflow
 - Water Quality
 - Water Resources in General
- Research Topics
 - Modeling or Forecasting
 - Funding
 - Specific Types of Data or Analysis
- Coordination, Collaboration and Communication
 - Coordination and Partnerships
 - Dissemination of Information
 - Public Education
 - Communication
- Policies, Programs and Law
 - Law
 - Programs and Management
 - Governance
 - Climate Change Related
- Social Issues
 - Greater Inclusion

Results

The text below describes the major findings from each of the main coding categories. For a full list of all documents reviewed and needs identified, consult the accompanying database. (Refer to the 'DATABASE GUIDE' tab for an explanation of the database tabs).

The other great weakness in the nation's drought impact assessment skills is in the area of ecosystem services. Beyond water supply and agricultural yields, little effort is made

to assess the short- and long-term ecological effects of drought, and how those effects translate into socio-economic impacts. This is true of all natural hazards, but the pervasive and cumulative effects of drought suggest that it is the hazard most under-measured by the few indicators currently available.

Monitoring and Data Collection

The majority of needs regarding monitoring and data collection were from the flood control sector. This included better monitoring regarding snowpack, frost depth gauges, soil moisture, water quality, and water resources in general. In regards to snowpack monitoring, it was specifically mentioned that additional plains snowpack monitoring was needed. For example, one document called for "...[the] establishment of additional permanent plains snow measurement stations (using already established snow measurement standards)." In reference to soil moisture monitoring, one document suggested, "... we need better coordinated, accurate and timely data on the topics of soil moisture and channel conveyance." Additional needs from the flood control sector included "improved data infrastructure and incorporation of scientific modeling tools for determining the amount of runoff".

Documents from several other sectors called for additional monitoring with regards to climate or weather related variables. Several agricultural sector needs included additional rural data and finer resolution of evapotranspiration data, while drought planning sector needs included expanded drought networks and validating model results with observable local conditions. In the 'multiple' sector, needs related to better streamlining and coordinating of monitoring activity, and to ensure "...that monitoring networks are expanded and well maintained and that funding for new climate change adaptation efforts does not come at the expense of existing federal programs that provide critical basic data." A document from the water sector expressed the need to "...integrate data from intensive research areas, gradient networks, national and regional surveys, and from existing data inventories and remote-sensing programs."

Research Topics

Modeling or Forecasting: Documents from the agriculture sector expressed the need for both better long and short-term climate forecasts. For example, one document noted that because farmers make long-term decisions, they "require multi-year and/or decadal climate predictions." Conversely, however, another document noted that a farmer doesn't need to know gradual trends throughout the century, but rather "...when it will be 200% of normal within the current year - which is relevant to him now." With regards to all forecasts, several documents noted the need for higher temporal and spatial resolution, and qualified probabilities and uncertainties. In the drought planning sector, a couple needs were related to incorporating localized factors (e.g. diversity of crops grown or irrigation type) into modeling efforts. Another document in the drought sector mentioned the need for "...detailed humidity forecasts, drought updates and forecasts, current conditions and forecasts of the water table, and detailed wind forecasts."

Fewer modeling and forecasting needs came from the fish and wildlife sector. Those that were mentioned included "...predictive models of species responses to climate change" and "...better regional climate models." In the flood control sector, several needs included additional probabilistic river forecasts and retrospective forecast information. An interesting note in

regards to the US Army Corps of Engineers (USACE) Missouri River Mainstem System Annual Operating Plan was “...the fact that recent decades have experienced more extreme events should be considered, rather than view the entire historical record as having equally likely chances of occurrence.”

Documents from the ‘multiple’ sector expressed the need for more accurate long-term precipitation and temperature predictions, in addition to models that are at the regional and local scale so they can be applicable and linkable to other types of models. An interesting difference seen in the water management sector was not only a need for more accurate forecasts, but support in how to “...make decisions given the uncertainties introduced by considering climate projection information.” This also included identifying various strengths and weaknesses of downscaled climate models.

Funding: Only documents from the flood control and ‘multiple’ sectors expressed funding related needs. In the flood control sector, this included the full funding of the Missouri River Recovery Program, Missouri River Ecosystem Restoration Plan, and Missouri River Authorized Purposes Study. Other funding needs related to preventative mitigation planning and infrastructure repair. In the ‘multiple’ sector, it was mentioned that funding is needed to “...enhance wildlife habitat and management and restore public and private lands.” Several other documents expressed the need for additional funding to better understand climate related impacts.

Specific Types of Data or Analysis: Several documents in the agriculture sector suggested the use and development of climate scenarios or scenario planning. This included not only creating “...future climate scenarios at fine spatial and temporal scales” but also scenario-planning exercises that involve user communities and climate scientists. Other prominent needs included research into climate change specific impacts on the agriculture sector, local scale information, and producing information that can actually be applied to decision-making in the agricultural sector. Needs in the drought planning sector also included research into regional and local scale impacts, such as “...in other areas for a better understanding of regional drought variations.”

Research needs in the fish and wildlife sector called for a better understanding of the potential climate change impacts to “wildlife corridors and crucial habitat.” Documents from the flood control sector expressed a variety of research needs, but some prominent ones included additional floodplain mapping, the development of decision support tools, and the development of paleo reconstructions and analyses. Another research need seen in ‘multiple’ sector documents was how to include new information into planning and decision-making. For example, one document noted the need for “hydrologic studies to update the design flood with new probabilities.”

The most common research need in the land management sector was for additional vulnerability assessments. For example, “[e]ssential to the adaptation effort is identifying and, when possible, quantifying the comparative vulnerabilities of important ecological resources...” Several documents in the ‘multiple’ sector also suggested the importance of additional vulnerability assessments. In addition, a somewhat unique research need seen in the ‘multiple’ sector was for economic analyses relating to climate change impacts. One particular document noted, “[m]ore details are needed to determine how insurance companies may change their rates based on an increase in floods, tornadoes, fires or other weather-related risks.” A majority of

research needs expressed from the water sector had to do with a better understanding of how climate change might impact water resources. This included impacts on evapotranspiration, sediment yield, ice-event potential, and ecosystems.

Coordination, Collaboration and Communication

Coordination and Partnerships: In the agriculture sector, the need for better coordination between federal agencies such as USDA, USGS, NOAA, and DOI was expressed by several documents. In addition, documents mentioned that partnerships need to be developed between researchers and the actual users of the resulting information. For example, “[t]here is also an acute need for communities of climate scientists and stakeholders to educate one another, first by developing a mutual understanding of the idiom that each group uses.” Similarly in the drought planning sector, documents suggested partnering among researchers and users to foster “...individual and collaborative drought planning.” NIDIS was mentioned as a potential avenue for improving coordination between agencies, both state and federal.

The few needs mentioned in the fish and wildlife sector related to better coordination between not only federal agencies such as USACE and USFWS, but also tribes and states. A majority of the needs from the flood control sector included better coordination by the USACE. Some documents suggested the Corps should work with other agencies producing forecasts, while others suggested soliciting the general public’s input “...in order to effectively and efficiently design and implement recovery and flood risk management strategies.” Similarly to other sectors, documents from flood control called for general improved coordination among multiple federal agencies. For example, “[i]mprove future cooperation and collaboration with the National Weather Service (NWS), and its already-established forecast systems as well as with the U.S. Geological Survey.”

The common need seen in the land management sector had to do with better coordinating research activities, such as the “...need to effectively coordinate research activities across the landscape to address region wide priorities to ensure that funding is effectively used to answer landscape scale issues.” A need that was seen across several documents in the ‘multiple’ sector was the importance of including the users of information in the research and development of specific information. One document noted that it is “important for those of us involved in production agriculture that research be done with us as opposed to being done on us.” Numerous ‘multiple’ sector documents echoed other sectors in the need for the Corps to coordinate and collaborate with additional stakeholders.

Only one tribal document mentioned coordination needs, and those suggested more partnerships with the USGS and EPA for environmental monitoring. The prominent theme from the water sector was the need for local communities, states, and federal agencies to work together in not only the research, but also how to include the results into comprehensive water management plans.

Dissemination of Information: The most common needs mentioned in the agriculture sector regarding the dissemination of information were the need for the information to be relevant, timely, understandable by users, delivered through a variety of media, and from trustworthy sources. Not only does climate information need to be delivered through multiple sources, but also those sources must be easy to access for the intended audience. Similarly in the drought planning sector, documents suggested that products and information should be “... ”

geared toward providing existing information in forums that are more easily accessible such as over the radio, television, and the newspaper.”

In the flood control sector, documents stressed the importance of delivering information during an event, not just prior or after. Pathways of information during an event include “... neighborhood association captains, television media, radio media, flyers, internet, Extension Services, reverse 911, emergency response personnel, and others.” With regards to flood information getting to tribes, one document noted, “Messages need to be taken to the tribes, to their meetings, in person.”

Similar themes were seen in the ‘multiple’ sector, where documents emphasized that information be easily accessible and from multiple sources. A somewhat unique need to the ‘multiple’ sector was for an internet based clearinghouse of information. This clearinghouse could provide “...case studies that illustrate and explain the use of information and tools” or “... improved capabilities for real-time, in-season deferred irrigation management.”

Public Education: Only a few public education needs were mentioned in the agricultural sector, and they included an “...overall education program of climate science.” Another document noted, “[a]ll Nebraskans need to realize that drought, including multiple-year drought, is a normal part of the state’s diverse climate.” Similarly, in the drought sector, several needs called for better education on the history of drought to “...give perspective as to the extremes in our climate.”

Overall, the majority of public education needs came from the flood control sector, and these needs predominately included better public knowledge of flood risks. The prominent message was that communities need to better understand their particular risk, and steps they can take to reduce that risk. One document suggested that, “[f]looding needs an icon like Smoky the Bear – ‘Randy the River Rat.’” Needs in the ‘multiple’ sector included greater public education regarding potential climate change impacts and what decision makers are doing to mitigate those impacts.

Communication: The prominent need in the agriculture sector was a better way to effectively communicate climate projections and potential impacts, including any uncertainties. For example, “[i]t is critical for these groups to communicate to their constituents what exactly are the changes caused by climate in order to continue to have their support in efforts to develop adaptive strategies.” One of the main findings in the flood control sector was the need for improved inter-agency communication. One document suggested that just because communication was occurring between high-level agency representatives, does not necessarily mean that information is funneling down to lower levels. The other main finding was regarding improved communication during flood events. A unique need to the ‘multiple’ sector was that communication needs to improve between the science community and decision makers, as it “... is essential to help set priorities for scientific investment in information that informs decision makers, and also for maximizing the usability of knowledge created by the science community.”

Policies, Programs and Law

Law: Not many needs related to legal issues were expressed, but an interesting legal need did come from the water management sector. The document suggested that climate change impacts highlight “...the critical need for understanding the overarching legal and institutional

structures governing water and other natural resources within the Greater Platte.”

Programs and Management: A common need seen in the agriculture sector had to do with drought planning and management. This included revising and updating drought plans, as well as incorporating the full range of possible climatic scenarios into planning. In the actual drought planning sector, several documents discussed the need for programs to deal with drought impacts. This included adequate markets for differing crops, and rental agreements between landlords and tenants. Another theme was the need for drought resiliency planning, either through new crop varieties or best management practices.

The main need seen in the fish and wildlife sector was for the development of plans that can protect ecosystems and allow for fish and wildlife to adapt to changing conditions. Management needs in the flood control sector predominately involved the Corps and how flooding could be better managed. One document noted “...the Corps needs to be given the flexibility to manage to changing, wetter conditions but also needs to be removed from reproach, if, after successive wet years, the following year turns out dry.” Other needs suggest the Corps should incorporate climate change related studies into future reservoir operating plans. Other flood management needs included better protection for farmland in the floodplain, reviewing system storage allocations, and incorporating the impacts of erosion and high groundwater in planning.

A variety of needs were identified in the ‘multiple’ sector, many of which called for programs that help stakeholders adapt to a changing climate. This included soil and water quality, transportation, agricultural productivity, and improved water and irrigation efficiencies. In addition, stable institutional mechanisms and research-based risk management tools were identified as supportive in climate change adaptation. In the water management sector, several documents expressed the need for national support in adaptation. This included “...a comprehensive national policy that promotes a coordinated and integrated approach to future drought...” and the development of a “...national climate service that would incorporate and coordinate existing climate and water data collection and analysis programs and services.”

Governance: The main theme regarding governance needs had to do with political support for climate related research and programs. For example, “states should work with federal agencies and Congress to secure support for state climate adaptation planning and implementation.” In addition, “[g]overnors support a comprehensive national policy that promotes a coordinated and integrated approach to future drought.” One document in the drought sector did note a unique need that called for further research “...assessing the effects of specific farm and food policies on farmers’ drought-adaptive capacity is required.”

Climate Change Related: Numerous different needs were identified across all sectors that were climate change specific in regards to policies and programs. One need in the drought sector suggested the “...development of regional climate early warning information systems should be a central activity around which federal, state, and local entities can coordinate to support adaptation strategies.” Another need in the flood control sector noted “...consideration should be given to allowing the Corps to move beyond the rigid structure of the historical record, along with providing the Corps greater flexibility to incorporate emerging climate information and conditions into system management.” Finally, a document in the ‘multiple’ sector expressed the need for the National Park Service to “...develop area-specific and resource-specific plans to protect the particular resources and values most at risk from climate change and other stresses.”

Social Issues

A couple different needs were identified in regards to social issues and greater inclusion for different stakeholders. In the fish and wildlife sector, one document expressed the “...need to consider the social, cultural, economic, and historic context of human activities associated with the Missouri River.” Another document discussed how tribes have limited access to information, and information/meetings need to be brought to the tribes themselves. In regards to how the Corps manages the system, one document suggested that the Corps move away from a “...perceived ‘command and control’ approach to one that informs and engages the public and the Tribes more effectively. We frequently heard comments about the need for inclusivity.”

Conclusions

Being the longest river in the United States, the Missouri River has an incredibly diverse set of stakeholders and decision-makers. As this analysis has shown, this diversity translates into a variety of climate-related needs across a multitude of sectors. While a range of differing needs was identified, some common themes emerged including: additional plains snowpack monitoring, the need for a better understanding of potential climate change impacts, improved coordination among federal, state, tribal and local agencies, and the need for the messaging/communication of climate related information to come from multiple and trustworthy sources. The most needs came from the agriculture, flood control, and ‘multiple’ sectors, and the most common types of needs related to researching specific types of data or analysis, how the information is disseminated, and issues in programs or management.

While climate change itself was not often directly cited in these needs, stakeholders did express interest in additional climate modeling/forecasting and monitoring, as well as incorporating recent climate variability into decision-making. A possible barrier to including climate change into planning might be a simple lack of understanding of specific climate change impacts, as evident by the number of needs relating to additional research regarding potential impacts. Because about eighty percent of the documents were published in the last four years, a similar analysis conducted on an annual basis, or in five or ten years, might illuminate a temporal change in these needs and whether or not these needs are being met. This analysis, however, does provide a baseline or “snapshot” of documented needs and where climate services are needed the most, which will hopefully help guide federal investments in climate services for the Missouri River Basin.

As mentioned before, the findings in this report are not comprehensive in identifying all stakeholder needs for climate-related information. In order to capture the needs missed by this analysis, additional efforts such as surveys and interviews might fill in the gaps to help create a more robust understanding of stakeholder needs. For example, engaging directly with tribal stakeholders might be a fruitful approach to identify needs that could be missed by only analyzing previously published documents. Nonetheless, this project is hopefully one of several first steps in the larger process of beginning a coordinated, multi-agency effort to meet the climate-related needs of stakeholders through out the Missouri River Basin.

Appendix

Year of Publication	
2001	1
2002	0
2003	0
2004	0
2005	3
2006	1
2007	3
2008	3
2009	7
2010	4
2011	21
2012	10
Total	53

Sectors	
Agriculture	8
Drought Planning	7
Fish and Wildlife	4
Flood Control	13
Land Management	3
Multiple	10
Tribes	3
Water Management	8
Total	56

Tables 1 and 2. The number of documents broken down by year of publication and sector. Three documents were coded as two separate sectors, thus the difference in totals. Documents that discussed more than two sectors were coded as 'multiple'.

Sector	Total Needs
Agriculture	114
Drought Planning	47
Fish and Wildlife	17
Flood Control	152
Land Management	10
Multiple	137
Tribes	5
Water Management	68

Table 3. The total number of needs identified by sector.

Sector	Top Three Need Subcategories	Total Needs
Agriculture	Modeling or Forecasting	21
	Specific Types of Data or Analysis	29
	Dissemination of Information	29
Drought Planning	Modeling or Forecasting	6
	Specific Types of Data or Analysis	10
	Coordination and Partnerships	6
	Programs and Management	9
Fish and Wildlife	Modeling or Forecasting	3
	Specific Types of Data or Analysis	4
	Coordination and Partnerships	3
	Programs and Management	3
Flood Control	Specific Types of Data or Analysis	28
	Coordination and Partnerships	20
	Programs and Management	20
Land Management	Modeling or Forecasting	2
	Specific Types of Data or Analysis	4
	Coordination and Partnerships	2
Multiple	Coordination and Partnerships	18
	Dissemination of Information	20
	Programs and Management	24
Water Management	Specific Types of Data or Analysis	18
	Coordination and Partnerships	9
	Modeling or Forecasting	14

Table 4. The top three subcategories within each sector, in terms of the number of needs identified.

Sector	Subcategory	Sector	Number of Needs
Monitoring and Data Collection			37
	Snowpack	Drought Planning	1
		Flood Control	5
	Biological	Multiple	5
	Climate or Weather	Agriculture	4
		Drought Planning	2
		Multiple	2
		Water Management	3
	Frost Depth Gauges	Flood Control	1
	Soil Moisture	Flood Control	3
	Streamflow	Drought Planning	1
	Water Quality	Flood Control	1
	Water Resources in General	Flood Control	5
		Multiple	1
		Tribes	1
		Water Management	2
Research Topics			193
	Modeling or Forecasting	Agriculture	21
		Drought Planning	6
		Fish and Wildlife	3
		Flood Control	13
		Land Management	2
		Multiple	15
		Water Management	14
	Funding	Flood Control	4
		Multiple	4
	Specific Types of Data or Analysis	Agriculture	29
		Drought Planning	10
		Fish and Wildlife	4
		Flood Control	28
		Land Management	4
		Multiple	17
		Tribes	1
		Water Management	18

Sector	Subcategory	Sector	Number of Needs
Coordination, Collaboration and Communication			210
	Coordination and Partnerships	Agriculture	11
		Drought Planning	6
		Fish and Wildlife	3
		Flood Control	20
		Land Management	2
		Multiple	18
		Tribes	1
		Water Management	9
			70
	Dissemination of Information	Agriculture	29
		Drought Planning	3
		Fish and Wildlife	1
		Flood Control	17
		Land Management	1
		Multiple	20
		Water Management	7
			78
	Public Education	Agriculture	3
		Drought Planning	4
		Flood Control	14
		Multiple	11
		Water Management	1
		33	
	Communication	Agriculture	9
		Drought Planning	2
		Flood Control	14
		Multiple	3
		Water Management	1
		29	
Policies, Programs and Law			110
	Law	Agriculture	1
		Water Management	1
		2	

Sector	Subcategory	Sector	Number of Needs	
	Programs and Management	Agriculture	72	6
		Drought Planning		9
		Fish and Wildlife		3
		Flood Control		20
		Land Management		1
		Multiple		24
		Tribes		1
		Water Management		8
	Governance	Agriculture	15	1
		Drought Planning		2
		Fish and Wildlife		1
		Flood Control		1
		Multiple		8
		Water Management		2
	Climate Change Related	Drought Planning	16	1
		Fish and Wildlife		1
		Flood Control		4
		Multiple		8
		Water Management		2
Social Issues				5
	Greater Inclusion	Fish and Wildlife	5	1
		Flood Control		2
		Multiple		1
		Tribes		1

Table 5. The number of needs identified, separated by sector, subcategory, and main category.