NOAA Western Region
Climate Service Providers Assessment

Phase II Final Report

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1. Introduction

Climate services provide scientifically-based information and products that support knowledge and understanding about the impacts of climate on decisions and actions[1]. They are created and shared by organizations and agencies that are known as climate service providers. Better understanding of who these climate service (CS) providers are, what types of services they provide, who they provide services to, and how they collaborate with others can support strategic improvements in the provision of climate services.

The NOAA Western Region Climate Service Providers Assessment is a two-phase project supported by the NOAA Western Regional Collaboration Team (NOAA West) to improve our understanding of CS providers in the western contiguous United States (Figure 1). In the first phase of this project, researchers from Climate Assessment for the Southwest (CLIMAS) and Western Water Assessment identified over 130 CS providers in the eleven Western States and generated the public, searchable Climate Service Providers Database[2] to share this information broadly. They also conducted an analysis of the providers, including their locations; funding sources; organization type; states, sectors (focal areas served, such as economics, human health, and agriculture), and stakeholders served; and services provided[1]. Results from this first phase highlighted gaps in our knowledge of how providers assess and respond to demand, as well as a lack of end-user perspectives on climate services.

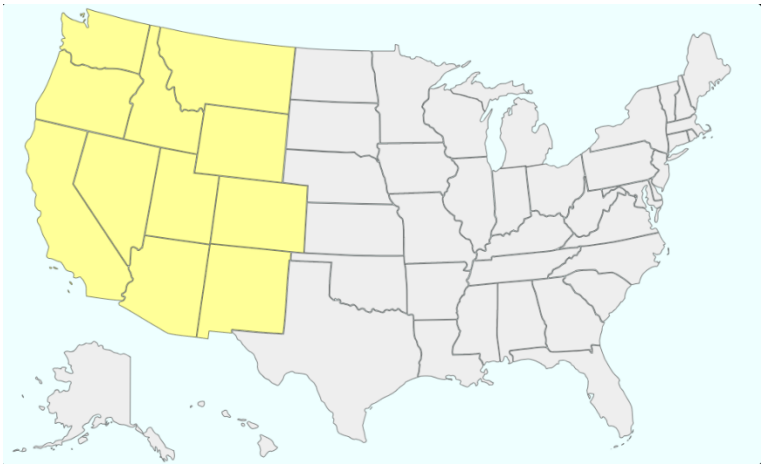

Figure 1. Map of states included in the NOAA Western Region Climate Service Providers Assessment (shaded in yellow). Figure from the Climate Service Providers Database: https://wrcc.dri.edu/ClimSvcProviders/.

This report details findings from the second phase of the NOAA Western Region Climate Service Providers Assessment, which prioritized filling these knowledge gaps with an emphasis on the perspective of CS providers. Specifically, this work utilized a web-based survey, phone interviews, and qualitative network analysis to help answer three key questions:

1. What climate services do stakeholders use and who do they collaborate with?
2. What climate services are most in demand?
3. What CS providers are most consulted?

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[1] Meadow et al, Meadow, A., E. McNie, J. Berggren, R. Norton, B. McMahan, G. Owen, and L. Rae (2016). NOAA Western Region: Climate Service Providers Database Development and Preliminary Analysis. Available online at http://wwa.colorado.edu/publications/reports/wrcs_database_report.pdf

[2] The Climate Service Providers Database is available online at https://wrcc.dri.edu/ClimSvcProviders/

2. Methods

The foundation of work in Phase 2 is an online survey of CS providers in the western contiguous United States. The Climate Service Provider Survey (Appendix B) was sent to the providers identified in the Climate Service Providers Database to better understand the stakeholder groups and other providers they work with, the sectors they work in, and the services they provide. Survey questions focused on identifying stakeholder groups, sectors, and services that a provider currently focuses on and gaps in stakeholder groups, sectors, and services that providers know need services but they do not currently provide. Questions also focused on how CS providers interact with each other (i.e., through data, collaboration, and referrals). With these questions, the survey allowed for deeper understanding of providers' existing climate service user networks, portfolios, and emergent demand while also supporting an analysis of the provider network in the eleven Western states. Of the 139 providers who received the Climate Service Provider Survey, 44 completed it, for an overall response rate of 31.65%. Of the respondents, 23 (52.3%) were from federal CS providers, 8 (18.2%) were from state CS providers, 9 (20.5%) were from university CS providers, and 4 (9%) were from NGOs.

TOTAL	44
Federal	23
State	8
University	9
NGO	4

Table 1. Breakdown of respondents to the Climate Service Provider Survey, by organization type.

In order to contextualize some of the responses, we conducted opportunistic follow-up interviews with 5 survey respondents that reflected the approximate respondent breakdown (2 federal respondents, 2 university respondents, and 1 from a state agency). Interview questions explored topics not easily included in a survey, including: why providers felt that some demand for climate services was going unmet, how external events can influence demand for climate services, if they have experienced shifts in demand for different categories of climate services, and how providers assess and evaluate emergent needs and the impacts that their services are having. The interview data provided deeper context into the perspectives of a subset of survey respondents, but we would reiterate that the interviews are not meant to be comprehensive or generalizable. This opportunistic sample gives us a sense of challenges, barriers, resources, and opinions within the larger population included in the survey. They are not designed or intended as a representative sample that would allow us to extrapolate and draw generalizable conclusions about climate service provision in the region.

3. Results

Through the online survey and phone interviews, CS providers in the eleven Western states shared their perspectives on existing stakeholders, services, and sectors served; gaps that they cannot or do not fill; and provided details on how they interact with each other.

Results of this work can be grouped into five key takeaways:

1. Stakeholder groups: CS providers already spend a large percentage of their time working with many of the stakeholder groups that most often have unmet demand for additional services. That is, some stakeholder groups request information or services that providers cannot meet, even though they are already spending a large portion of their time with those same stakeholder groups. Note that Phase 1 of this project identified

several additional stakeholder groups that are not well-covered by CS providers, including tribes and the private sector[1]. Providers did not identify these stakeholder groups as having as much unmet demand as others in the survey. This could reflect issues affecting these groups' access to services or connectivity to CS provider networks. It could also reflect limitations in providers' capacity and/or ability to build relationships with new user groups.

2. Climate Services: CS providers identified a difference between the top ranked services currently being provided and the top ranked services needed but not fully provided – that is, unmet needs. The types of services most often provided were identified as capacity building (e.g., workshops and coordination) and broad information dissemination (e.g., newsletters). The top ranked services needed but not currently provided were direct inputs into decision-making frameworks (e.g., data, decision support tools, and vulnerability assessments).
3. Sectors: CS providers identified several sectors with emergent or unmet demand for climate services, including economics, energy, human health, indigenous peoples, social vulnerability, and agriculture. Providers indicated that they most frequently provide services to water, climate and weather, and drought sectors.
4. Networks: The relationships between the different types of CS providers reflects institutional structure and hierarchy, especially with federal CS providers. At the same time, the real-world relationships between the providers reveals a more complex set of relationships between CS providers that involves multiple iterations of referral and provision of information across networks as data-focused climate services are translated and filter down to CS providers that work more directly with stakeholders. This highlights that many CS providers are also consumers of climate services. Although there is some redundancy in these networks, this provides multiple pathways for information to disseminate based on specifically identified needs and gaps that are often assessed by stakeholder focused CS providers that have assessment, evaluation, and stakeholder engagement as core elements of their mission.
5. General: Across all three focal areas of the survey (stakeholder groups, services, and sectors), CS providers indicated some overlap between the groups, services, and sectors that they currently work with and demand for additional information. That is, despite existing service provision, some stakeholder groups, services, and sectors have additional demand that is not currently being met.

3.1 Stakeholder Groups

CS providers work with a wide range of stakeholder groups that range from government agencies, resource managers, and tribes to researchers, educators, and the general public. The Climate Service Provider Survey provided an opportunity to better understand which stakeholder groups are already well-served by providers, and which groups have a need for additional climate services. Survey respondents were asked to indicate the percentage of time that their organization spends with a range of stakeholder groups (i.e., educators, government, researchers). Stakeholder groups listed in the survey are consistent with those evaluated in Phase 1 of this project[1]. Results from the survey indicate that respondents spend the majority of their time in ongoing interactions with government stakeholder groups (Figure 2).

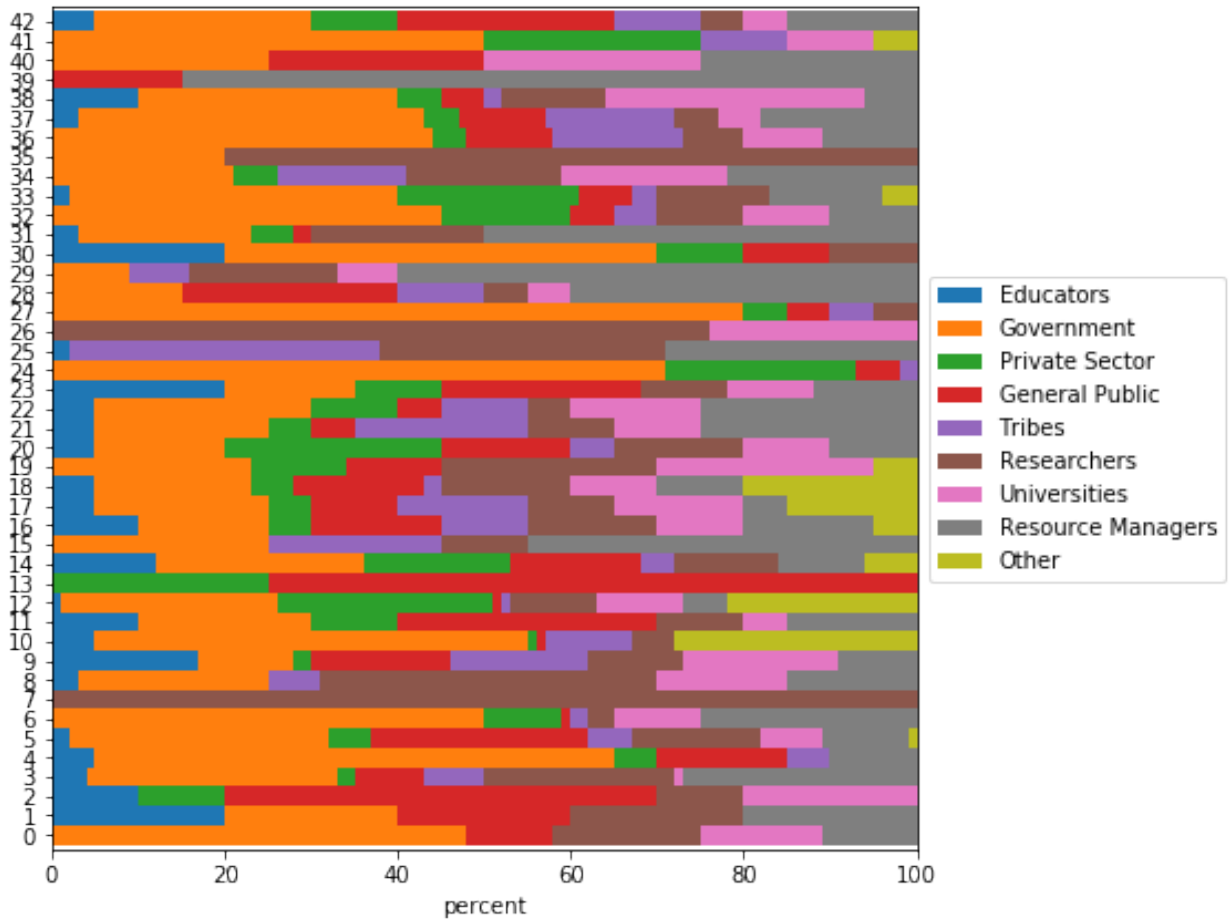

Figure 2: Percentage of each provider organization's time spent with stakeholder groups.

Respondents were also asked to indicate which stakeholder groups, of the groups they engage, request new services or information that their program or organization does not yet provide. Results show that the survey participants are most frequently unable to meet requests from government, resource managers, researchers, the general public, and the private sector (Figure 3).

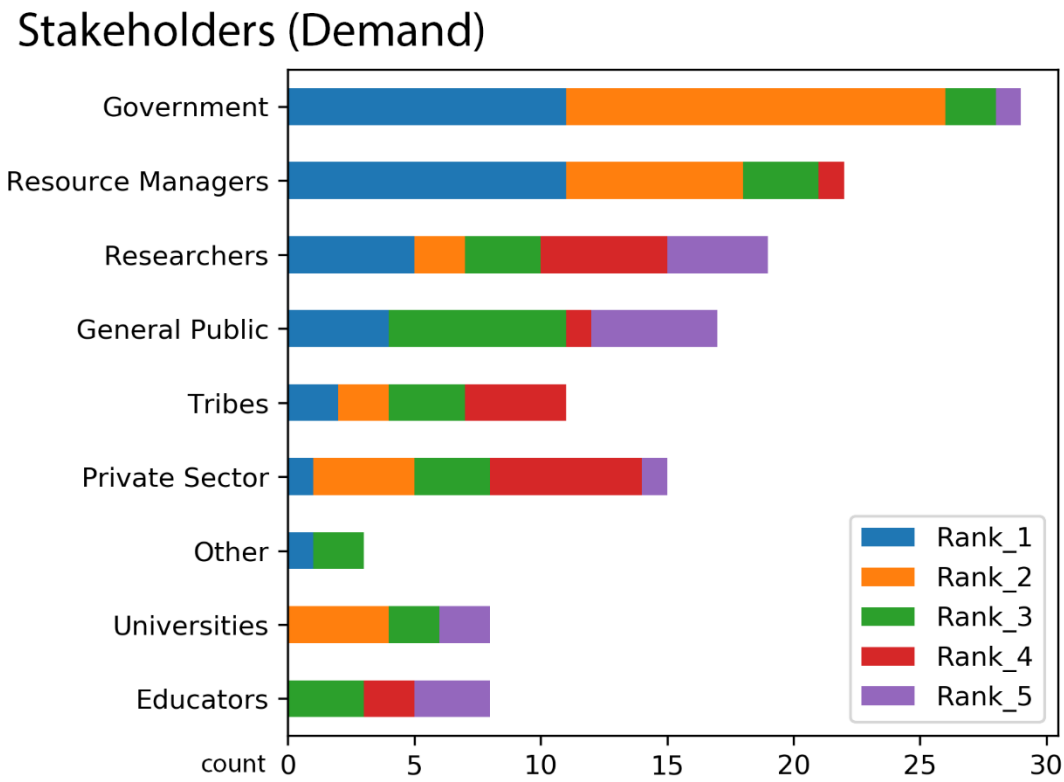

Figure 3: Stakeholder groups that request new services or information that Climate Service Provider Survey respondents' organizations do not yet provide, ranked from most-frequently requested (Rank_1) to least-frequently requested.

A closer look at these stakeholder group requests for new services parsed by broad provider categories (university located, state agency, federal agency) highlights some notable differences in which groups are requesting services and from whom. This includes some 'intuitive' relationships including like-for-like collaboration (university located CS providers receiving requests from other universities or federal government agencies responding to demand from other federal agencies). This also includes less obvious differences, such as the relative lack of private sector demand outside of federal agencies, and limited interaction between state agencies and universities or tribes. These differences may simply reflect areas where there are limited opportunities for interaction, but they may also reflect persistent gaps in the network where additional investments in stakeholder engagement and development of climate services partnerships would have a larger potential of increasing this collaborative overlap.

3.2 Climate Services

Climate services include a broad range of products, processes, and activities including information production like data and model development, decision support tools, and monitoring and evaluation; information sharing like newsletters, articles, and presentations;

and capacity building like coordination and workshops. Survey participants provided an assessment of how stakeholders use their existing climate services by indicating which of a list of climate services their program or organization provides to stakeholders, ranked in order of most-often provided to least-often provided. Note that these services are those most-frequently provided by CS providers, but they aren't necessarily the most in-demand services.

Services included in the survey were consistent with those evaluated in Phase 1 of this work[1]. The top-ranked existing services include data, decision support tools, presentations, coordination, and workshops (Figure A). Some of these can be considered capacity building and information dissemination (i.e., coordination, workshops, and presentations), while others provide more direct inputs into decision-making frameworks (i.e., data and decision support tools).

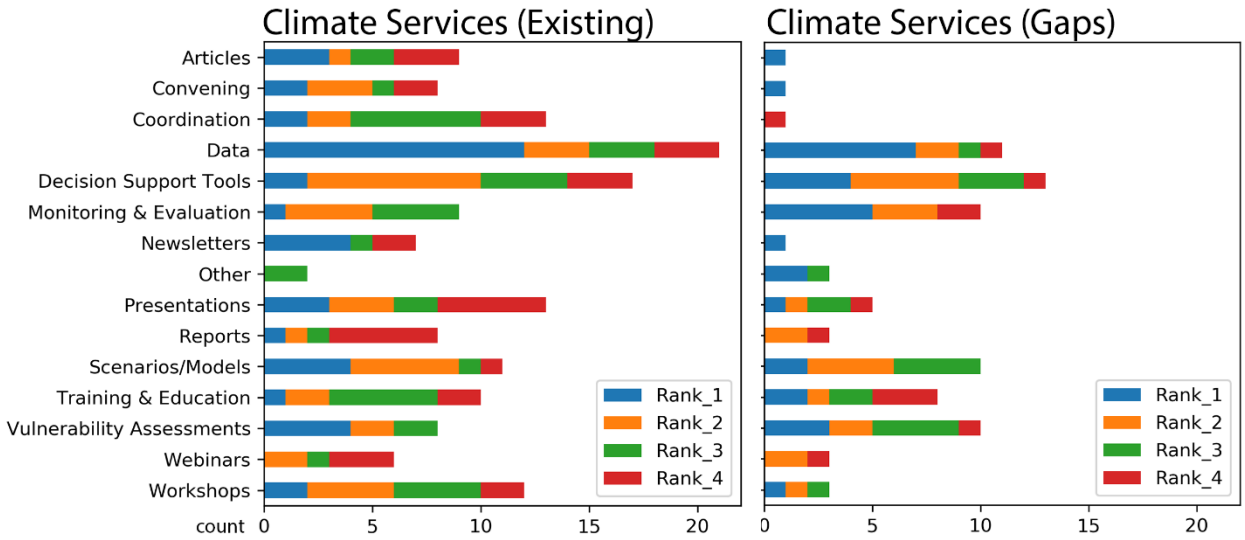

Figure 4A (left): Climate services that Climate Service Provider Survey respondents' organizations provide to stakeholders, ranked in order of most often provided (Rank_1) to least often provided. Only the top four services from each respondent is displayed.

Figure 4B (right): Climate services that stakeholders most frequently request of Climate Service Provider Survey respondents' organizations but that they do not provide, ranked in order of most-often requested (Rank_1) to least-often requested. The top four services from each respondent are shown.

As with stakeholder demand, a closer look at existing climate services parsed by organizational category (university, state, federal) provides some insight into the different ways that groups operate in climate services provision. This includes some types of climate services that are frequently provided across these categories (data, presentations, training/education, and workshops) as well as some types of services that are more commonly provided by a subset of the providers, including articles, decision support tools, reports and vulnerability assessments (university and federal), newsletters (university and state), and webinars (federal).

Survey respondents were also asked to indicate which types of new services are most in demand by their stakeholders by considering the same list of climate services in the context of

which services are most frequently requested of their program/organization that it does not already provide, ranked in order of most-requested to least-requested (Figure 4B). The most-requested services include decision support tools, data, monitoring and evaluation, scenarios/models, vulnerability assessments, and training and education. While some of the top-ranked gaps such as data and decision support tools are also among the most-provided services, many such as monitoring and evaluation, training and education, and vulnerability assessments are not as frequently provided. In addition, many of the top-ranked gaps reflect direct inputs into decision-making frameworks rather than capacity-building and information-sharing services. Overlap between the existing services provided and those most requested indicates that services like data and decision support tools are in high demand. Other top gaps offer topics of interest for development of climate services in the future.

Parsing the climate services gaps by organizational category highlights different "top" gaps. For university groups the top gaps are Data, Decision Support Tools and Monitoring and Evaluation despite data and decision support tools being identified as some of their most provided services. This would indicate that some of this groups highest demand is asking for more of what they already provide – and escalation of their work would enhance climate services in the region. For state groups, the top gaps are decision support tools, scenarios/models and vulnerability assessments. These are three areas where these groups have limited services of these types in their portfolios and would suggest that resources to develop new services are much needed. For federal groups, the top three gaps are Data, Decision Support Tools and Vulnerability Assessments, all of which are well represented in their existing portfolios, and again suggesting additional resources to enhance their work or amplify their reach would help these services reach more groups, or allow those groups to do more with that information.

3.3 Sectors

Climate services can also be described in terms of the sectors – or topic areas – on which they focus. Sectors can include topic areas like agriculture, water, transportation, and climate and weather. In the Climate Service Provider Survey, respondents were asked to indicate which sectors most use existing climate services by ranking the sectors from those where services are most used to those where they are least used (Figure 5A & B). Sectors listed in the survey were consistent with those evaluated in Phase 1 of this work[1]. Results show that the providers who participated in the survey most frequently provide climate services for water, climate and weather, and drought sectors. Agriculture, ecosystems, and extreme events are also relatively frequently served by providers who participated in the survey.

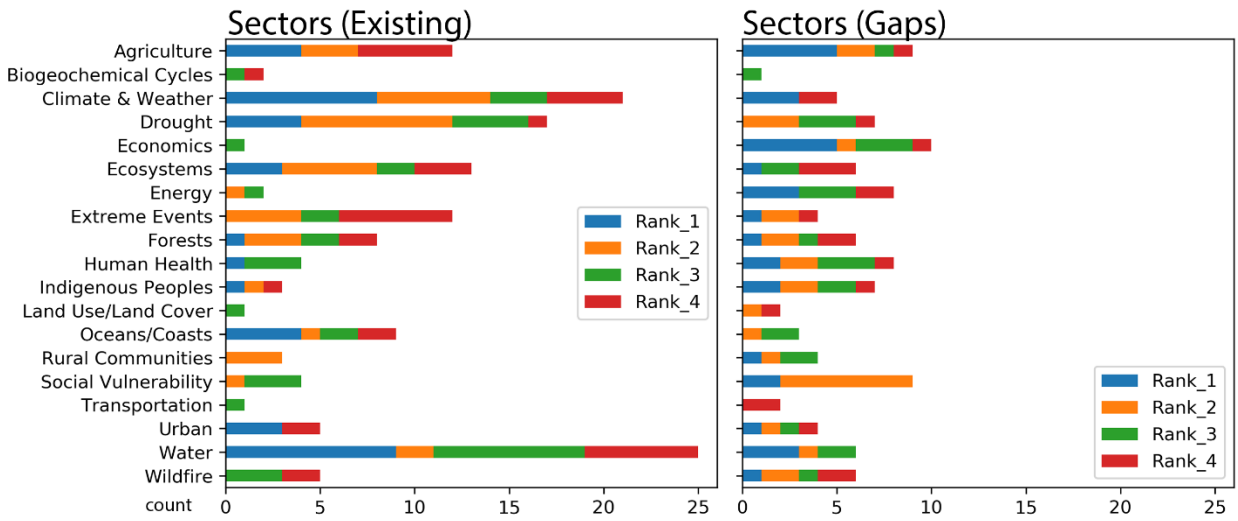

Figure 5A (left): Sectors that Climate Service Provider Survey respondents serve, ranked in order from most served (Rank_1) to least served. The top four sectors from each respondent are shown.

Figure 5B (right): Sectors that request services from Climate Service Provider Survey respondents, but that they cannot or do not provide, ranked in order from the sector most in need to the sector least in need. The top four sectors from each respondent are shown.

Parsing the sectors that are currently being served by the organizational category of the providers that serve them is less informative than previous comparisons, owing to the large number of categories of sectors. This comparison does reveal that the forests and oceans and coasts sectors are not served as often by providers in the state government category.

Respondents also indicated which sectors request information from their organization that they cannot or do not provide, ranked in order from the sector with greatest need for climate services to the least in need (Figure 5B5B). This allowed respondents to provide an assessment of sectors where new services are most in-demand by stakeholders, and where new services that cover those sectors would be most beneficial to these stakeholders. Results suggest that there are gaps in services provided to a number of sectors, including agriculture, economics, energy, human health, indigenous peoples, and social vulnerability.

Parsing the gaps in sectors, reveals that for the areas with suggested gaps in services, there is some clustering based on the organizational category: agriculture, energy, and social vulnerability (university, state, and federal), economics (state and federal), human health, and indigenous peoples (university and federal).

3.4 Geographic Scale of Services

The Climate Service Provider Survey also asked respondents to indicate the geographic scales at which their organization most frequently provides services, ranked from most frequent interactions to least frequent and omitting any scales that are not relevant to their organizations (Figure 6A & B). The scales listed in the survey were consistent with those evaluated in Phase 1 of this work[1]. Results indicate that survey respondents most frequently provide climate services at state, regional, and national scales. They also provide services at county, municipal, and tribal scales, though less frequently than at other scales. Respondents provide climate services at international scale less frequently than at all other scales.

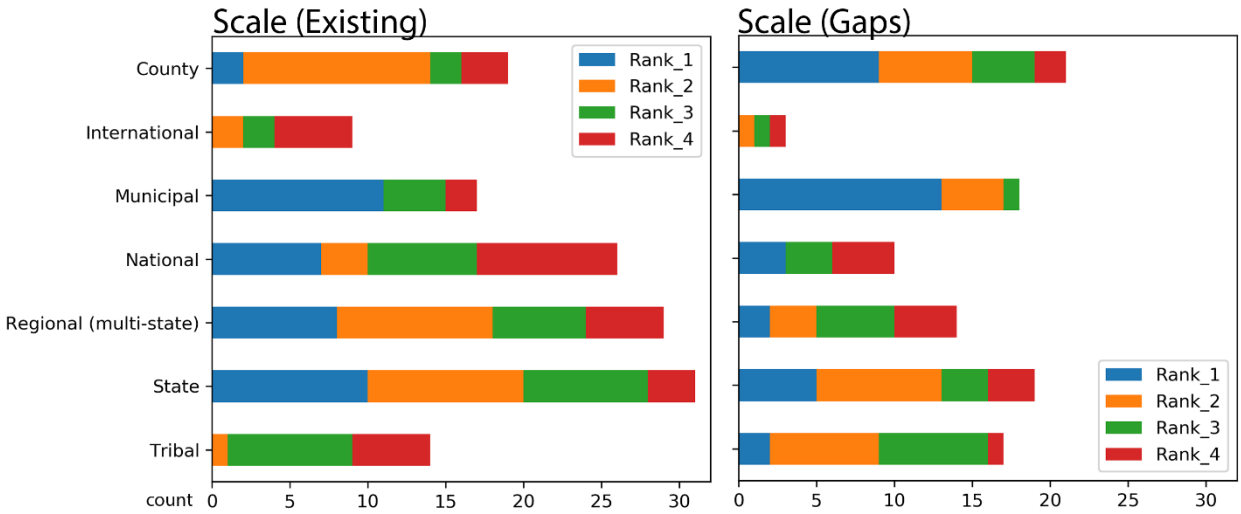

Figure 6A (left): The scales at which Climate Service Provider Survey respondents' organizations provide climate services, ranked from most- (Rank_1) to least-frequently requested scales. The top four scales from each respondent are shown.

Figure 6B (right): The scale at which Climate Service Provider Survey respondents' organizations most frequently receive requests for new climate services, ranked from most- (Rank_1) to least-frequently requested scales. The top four scales from each respondent are shown.

Organizational categories for existing services highlight relatively increased provision of state, regional, national, and tribal scale services from federal providers, while university providers cover municipal, county, state and regional (with less emphasis on national and tribal).

Respondents also shared the scale at which they see the greatest demand for new climate services, ranked from most frequently requested to least frequently requested (Figures 6A & B). Results suggest that the greatest demand for new services from respondents exists at county, municipal, state, and tribal scales, while there is much less demand for information at international scales. While there were no clear gaps between the scale of unmet demand and the scale of existing met demand, the unmet demand rankings for county, municipal, and tribal scales are slightly higher than their corresponding rankings for existing scales covered. This indicates that there is some potential for growth at these scales and that there may be a desire for more local-scale climate services. This represents a possible growth area for additional collaborative research development.

The gaps in the geographic scale of services provided highlight the extent to which municipal and county level information is in high demand, across the organizational categories, while larger scale data remains in high demand from the federal (and to a lesser extent the university based) CS providers.

3.5 Provider Network

To better understand the way in which the CS providers engage with both end users and each other, we devised a relatively simple network survey that allowed for a comprehensive assessment of an organization's connection to other CS providers, and established a framework for a comprehensive end-user survey, if resources were ever made available for such an effort. For each organization in the database, survey respondents were asked to check any of 3 applicable boxes about their network connection:

1. **Research and Collaboration** with the Organization
2. Used **Data and information** from the Organization
3. **Referred Stakeholders** to the Organization

By grouping the individual programs together within their clustering organization we can use the responses to this network portion of the survey to identify some patterns and differences in the way that organizations share information with end-users, collaborate with each other, and refer stakeholders and end-users to other organizations. The three categories of interaction from the network survey parse these relationships into three forms: bi-directional (information and engagement shared in both directions: "research and collaboration"); unidirectional from the organization to the end-user ("data and information"), and unidirectional as the organizational representative refers end-users to other organizations ("stakeholder referral").

This network framework also highlights the fact that very few CS providers serve as the sole intermediary between climate/environmental data and end-users/stakeholders. Some curate raw data into outreach and dissemination products that are used by other CS providers (who are themselves "stakeholders" in the CS provider chain). Others are more directly involved with stakeholders, helping to guide data and information products into the hands of their stakeholders and partners, and some move around on this continuum. The chain of dissemination/referral framework (Figure 7) is a rough approximation of this continuum. While in reality there may be more connections and a much messier set of interactions, the chain captures the approximate framework. It divides the activities of CS providers into 3 approximate roles – 1) processing and organizing climate and environmental data, 2) serving as a bridge that connects data and information with other end-users (including other CS Providers) and 3) facilitating connection-to and data/information-use-by those more traditionally defined as stakeholders (i.e. those who would not likely also be classified as a CS provider).

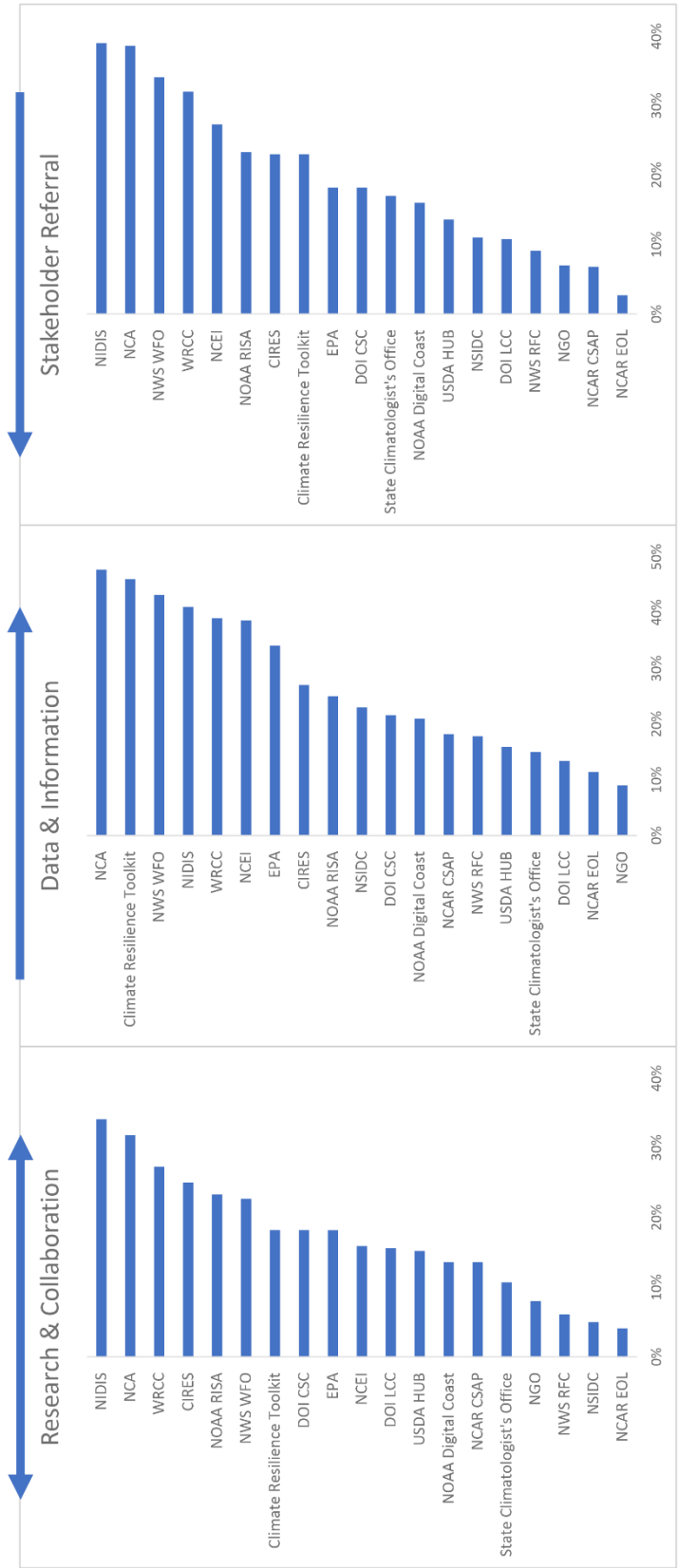

Figure 7: Chain of dissemination of information for different climate service providers, indicating how they engage with stakeholders.

3.6 Interviews and Thematic Summary

The surveys captured broad trends across the climate service providers who participated, but they were unable to capture the depth of experience of any individual climate service provider. To supplement the surveys, the research team conducted 5 semi-structured interviews with a sample of survey respondents who reported they would be willing to participate in a follow up interview. These key informant interviews were focused on a deeper look into a number of key areas, including: 1) their perspective on emergent areas of interest, including gaps in climate services provision and how they might prioritize the needs of their stakeholders; 2) methods of assessment and evaluation, and specifically whether their organization was involved in a systematic way of identifying or responding to these needs and gaps; 3) their perspective on the primary drivers of demand, and how they prioritize, balance, and sustain climate services provider activities beyond the initial needs of a stakeholder; and 4) how they assess specific needs and demands vs. general needs and gaps they might identify – i.e. choices and challenges in choosing between tailored climate services and more general decision support tools. These key informant interviews were outside the initial scope of the project as proposed. As such, they provide interesting albeit limited insight into what future in-depth assessments of climate service provider networks might reveal when used in conjunction with larger samples and more quantitative instruments.

A short overview of six key themes that emerged from the key informant interviews is provided below. The first three themes are focused broadly on stakeholder experience, the relationship between climate service providers and end-users, and opportunities to expand and enrich these relationships. The second three themes cluster around the network dynamics of climate service provider relationships, including between CS providers within the provider network, and outside of that network as it extends to stakeholders and end users.

A1) Providing climate services frequently includes facilitation by the climate services provider as they work with stakeholders to demonstrate the application and utility of new (or existing) climate services. This requires both subject matter expertise and technical capacity regarding data analysis and visualization, in order to engage with stakeholders on their needs for climate services. One respondent summarized it as "[climate] services are sometimes not *what* data is available, but *how to use the data"* (emphasis theirs). Within the context of a stakeholder needs assessment, this means that identifying gaps and needs and designing climate services products to meet those needs may be insufficient if the stakeholder doesn't know how to integrate these products into their decision-making.

A2) There are persistent concerns about end user access to data and climate services, including how they find and integrate these data and services into their workflow. Interview responses focused on issues as one respondent termed "user experience and 'discoverability' and access". This includes how data are presented and, more specifically, how data can be sorted, filtered, or queried. This respondent noted that sometimes the tool or visualization is unnecessarily complicated. A less complicated web tool or climate services interface might simplify the data and analysis and also increase usage. This is a crucial point when considering how climate service providers might train new stakeholders and end-users, starting with more

general applications and then allowing the end-user to reach out if they have more complicated questions or need more detailed analyses.

A3) There is demand for descriptive information that explains the importance or relevance of climate services and environmental data. Interview participants noted that end users increasingly seek contextual information regarding the data and climate services being provided. One participant noted that stories or anecdotes can help them make sense of the data. The climate resilience toolkit is an excellent example of a systematic approach to this, and could serve as a model for how regional climate service providers can include context – that is, background information, including examples of use-cases. along with their tools and services. Telling the story of why and how an organization developed a particular tool or service could also help to inform evaluation efforts by connecting a stakeholder expressed need (demand) to the development and delivery of a particular service or tool. Conversely if no such context or background exists, it might highlight that a particular service was designed without a particular end user in mind.

B1) There is overlap across the network of climate service providers (federal, university, state/local, etc.) in terms of both stakeholder engagement and the development and delivery of climate services. Although this overlap could be perceived as redundant, particularly under budget constraints, it does not equate to duplicative effort. For example, one participant characterized this overlap as complementary, and described the important coordination work that necessarily occurs within and across these networks as a strength rather than a liability. Overlap across the network can strengthen connections, facilitate lessons learned, promote innovation, grow the base of end-users, and better meet emerging demands.

B2) Many climate service providers are also climate service consumers. One participant highlighted that new climate services are often produced with a mix of in-house data, information and technical expertise and various resources from other climate service providers. In addition, this participant highlighted the value of network referrals that connect end-users to climate services providers that may better meet needs. These chains of service referral are a key part of the CS provider network, and highlight a strength of some of the 'redundancy' noted in B1.

Summary Discussion

The Climate Service Provider Survey and accompanying phone interviews and qualitative network analysis provide insight into the landscape of climate service provision and highlight opportunities for improved, strategic climate service development in the western contiguous US. Survey results indicate that providers are unable to fully meet demand for climate services like data, decision support, monitoring and evaluation, scenarios/models, training and education, and vulnerability assessments. Respondents also highlighted gaps in providing services in the topical areas of agricultural, economics, energy, human health, indigenous peoples, and social vulnerability. Survey results indicate no clear gaps in the geographic scale of services needed, though data indicate the potential demand for tailored services at county, municipal, and tribal community scales.

Climate Services Accessibility and Facilitation: Many of the climate services that various providers have developed require some degree of facilitation or curation on the part of the provider. In the absence of some additional information or instructions, end-users may not have the requisite analytical expertise or contextual understanding to integrate these services into their decision-making framework. Many CS providers surveyed seem to recognize this, and either look to other groups to help them connect their services to stakeholders, or have explicitly included stakeholder/end-user engagement in the development of climate services to ensure a more meaningful connection between data/information and decision-making. There are numerous options forward to improve this connection, including a better understanding of stakeholder needs before developing services. This includes involving stakeholders throughout the project life cycle to ensure requirements for climate information are included as part of the development process, and more regular connections between CS providers and end-users to demonstrate and evaluate the utility of the services, refine services and provide ongoing support/expertise. This emphasizes that an underdeveloped aspect of CS provision is not always the gaps in available data, but gaps in understanding of operational contexts, how information is used, and ways in which data and information can be integrated into existing or novel decision frameworks.

User Experience: Interviews also highlighted end-user experience, and the challenge of how data is presented, sorted, filtered, and queried. With the wide range of available services, the discovery and integration of data from similar or overlapping sources can be overwhelming for end-users. CS providers are consequently challenged by the need to develop web/service interfaces that simplify data access and increase usage and also retain the rigor and defensibility of these data and information. Although this is an ongoing challenge, it leaves CS providers with opportunities to develop innovative visualization tools that help tell the story of the data, while retaining rigor/defensibility required for academic uses and management decision-making.

Overlapping Boundaries between CS Providers: One aspect that was already clear but was re-emphasized with both the survey and network data was the extent to which there are overlapping service boundaries at multiple scales. This presents a challenge as overlapping or competing CS products can cause confusion among end-users who are unsure of which service to use or why there are similar products. This can also lead to concerns about redundancy and resource allocation across agencies, particularly if there are no obvious differences between the services provided. These are valid concerns, but these overlapping boundaries also present an opportunity for improved collaboration and coordination. Strategic thinking and improved coordination and collaboration across networks can help different CS providers ensure they are reaching out and engaging different end-users, delivering unique services, and are aware of and understand where overlap in services is necessary for stakeholder driven CS provision. This last point emphasizes that many CS providers have limited capacity to address increasing demand for climate data and information. The issue therefore, is not one of too many CS providers, but of making sure the network of CS providers has the capacity to ensure continuity of relevant data and information for existing users and the ability to engage new stakeholders to identify

emergent needs for CS information. Overlap within the network can be leveraged as a strength to meet the existing needs and increasing demand for climate services.

Gaps and Opportunities: A related aspect to CS provider redundancy is that gaps in understanding and meeting demand across sectors may revealed as structural barriers within and across networks and help to identify potential relationships that could be developed. Understanding gaps in the context of structural barriers is a first step in addressing barriers that are limiting growth in the development, delivery and use of new climate services. Expanding beyond existing end user groups and service delivery pathways to grow new markets for climate services will require a deliberate investment of time and resources in order to better understand these areas of emergent demand, and how to bridge those gaps.

Network Chains: Many CS providers are also climate service consumers which suggests collaboration rather than competition between providers in CS provision. This system of nested relationships is optimal when the various organizations have the capacity and knowledge to engage in patterns of referral and CS use – i.e. they are able to identify whether they are the ideal provider for a given stakeholder or if not, point them towards more suitable CS providers. The reality of the system is more complex and messy, as some of the chains of service referral are embedded within CS development, as in situations when one CS provider curates data from another CS provider. The reality is that most CS providers do not have the capacity to spend additional time connecting end-users to different CS providers. This is one area where the CS providers database can provide a critical service, provided regularly scheduled updates to the database are maintained to keep the tool useful and relevant over the long term.

The Importance of Context: A related aspect that emerged from the interview data was the concern among some CS providers that end-users might lack the background knowledge or context to effectively apply the delivered data and information for specific operational environments and purposes. This relates to how end-users understand and integrate climate services, and flags a growth area for CS development and provision, especially among agencies or organizations that have the capacity to have this contextualized education and training component as an area of expertise that is included in their CS portfolio. An example might be a partnership with an end-user to ensure they understand and effectively integrate climate data and information, or a series of case studies that provide analogs for how other organizations have used climate services in the past. Overall this process could help contextualize and lend meaning to data and information that is otherwise abstract, or give examples for prospective end-users to demonstrate how CS providers might connect to their own needs.

Institutional Dynamics and Political Context: Climate service provision is embedded within institutional dynamics that affect how year over year plans are made. This includes shifting strategies within institutions or agencies, evolving priorities for funding new efforts, and the costs to maintain existing efforts. In some cases, developing a new tool or interface may have more political will than maintaining an existing service. This tension is not a unique challenge and presents opportunities to share other experiences and lessons learned to better understand how this challenge has been successfully managed to enable continuity of existing

services and also create space for innovation and the development of new services over long periods of fluctuating demand. In addition to institutional or agency dynamics, most CS providers must be able to navigate and help shape the national dialog on climate issues and resultant shifts in national politics and policy priorities. How issues are framed and discussed must be sensitive to current social and political contexts if they are to be heard. Framing climate services as consumer driven constituent services that measurably improve decision-making has met with some success. Although challenging in practice, well-developed relationships between constituent groups and CS providers can result in coherent messages about the needs for – and benefits of – climate services, and serve to positively influence national dialog and policy.

Future Opportunities

There is a broad range of opportunities for leveraging this Climate Service Providers Assessment work, contingent on available resources. Following are three different strategies that reflect varying levels of additional and ongoing investment (Figure 8):

- Option 1 considers the work described in this report as the middle phase in a three-phase project. Phase 1, which was completed in 2017, focused on identifying CS providers in the western contiguous United States and compiling those providers in the searchable, publicly available Climate Service Providers Database. Phase 2 (this work) provided an assessment of CS demand grounded in CS provider perspectives. A potential Phase 3 would be focused on an intensive survey of end-users to better define and characterize their demand for various services, to identify who they are seeking services from and what services they are seeking, and to conduct a more comprehensive assessment of the gaps and needs they identify that are not yet being met. The database created in Phase 1 provides an ideal framework for this kind of network survey as it defines the network of CS providers in the region, and the CS provider survey created in Phase 2 can provide a foundation for surveying end-users. The social network focus of this option is time and resource intensive.
- Option 2 represents a 'leveraged' framework for advancing this work. It would involve a scaled back version of the network survey by soliciting key members of the CS provider network to engage in a similar network survey within their own stakeholder networks. This would allow for a more well-defined assessment of subsets of the overall CS provider network, but which would not require the resources to do a comprehensive survey of the entire network. This option also helps to avoid the challenges of a social network analysis of such a large and fluid network by focusing on the relationships within regional/topical subsets. Option 2 would require fewer resources than Option 1.
- Option 3 treats the survey and report as the end-product for this work, while publicizing the existence of the Climate Service Provider Database, and focusing limited available resources on maintaining and updating the CS Provider database on an annual basis. This is the least resource-intensive option.

Option	Who	Considerations
Limited updates & maintenance of CS DB	(likely) WRRC/DRI	–Database "done" & polished – ready to promote but could become static over time –Low cost option to keep this relevant but little room for additional growth beyond current DB capacity
End-user demand & network analysis using leveraged resources	NOAA-West, project team + collaborating organization(s)	–CS project priorities map onto widespread desire for better info on CS Services – finding leveraged partner would stretch resources –Partners may be willing but remains a challenging time re: federal resources
End-user demand & network analysis as stand-alone project	NOAA-West project team	–Continues momentum and looks to a crucial (and difficult) question – how CS can evolve to meet emergent end-user need –Higher cost option but most control over process, easier to centralize

Figure 8: Opportunities for leveraging the Climate Service Providers Assessment work.

Appendix A: Supplemental Figures

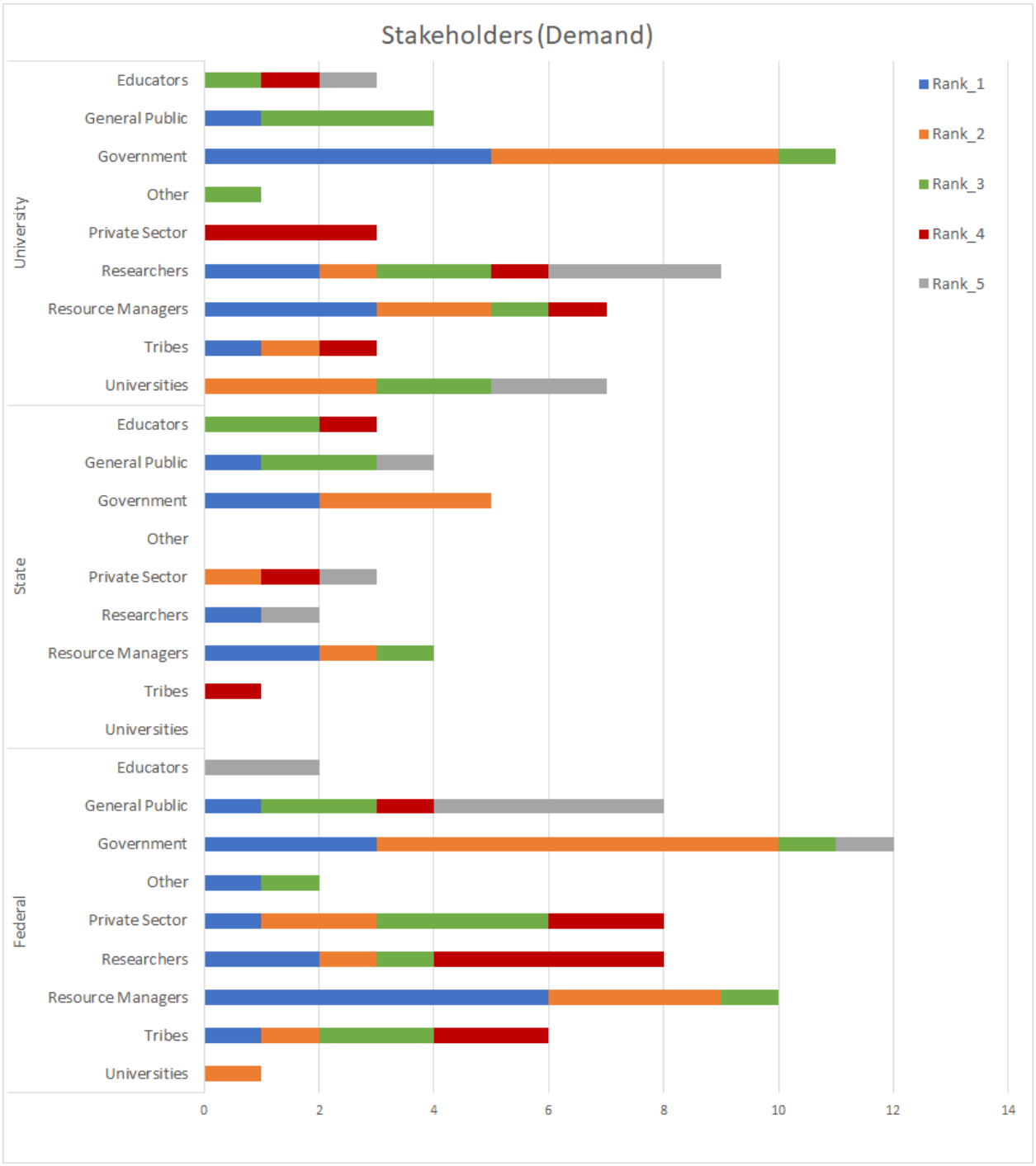

Figure A1: Sectors that utilize services from university, state, and federal providers in the Climate Service Providers Database,

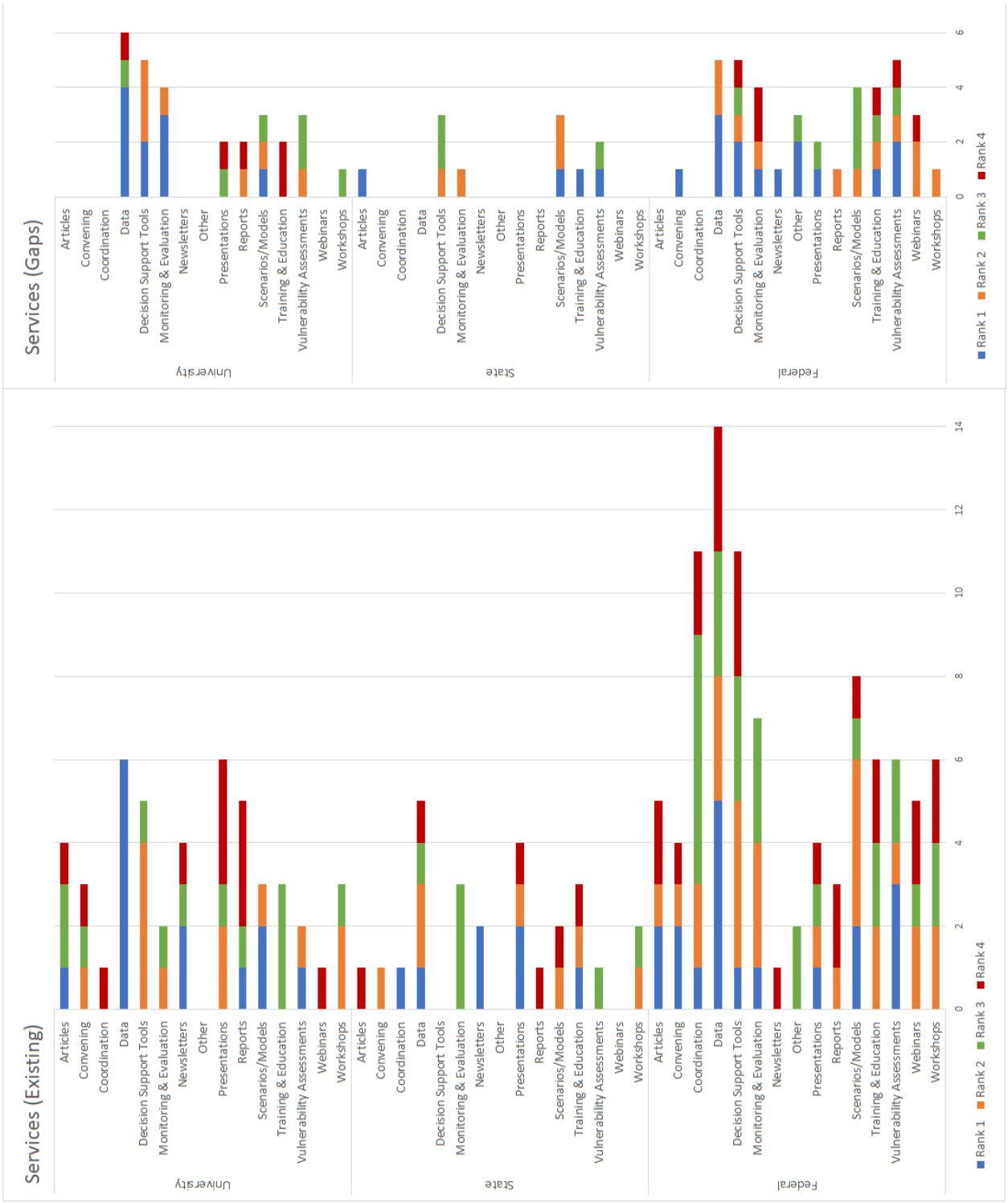

Figure A2: (Top) Services that stakeholders request, but that providers in the Climate Service Providers Database do not provide; and (Bottom) Services that providers in the Climate Service Providers Database provide to stakeholders. Shading indicates how frequently these services were ranked as the top four services by survey respondents.

Figure A4: (Left) Sectors with which university, state, and federal climate service providers most frequently engage; (Right) Sectors with which university, state, and federal climate service providers do not engage, but identify as having climate service needs. Shading indicates how many times each sector was ranked as a top four sector by survey respondents.

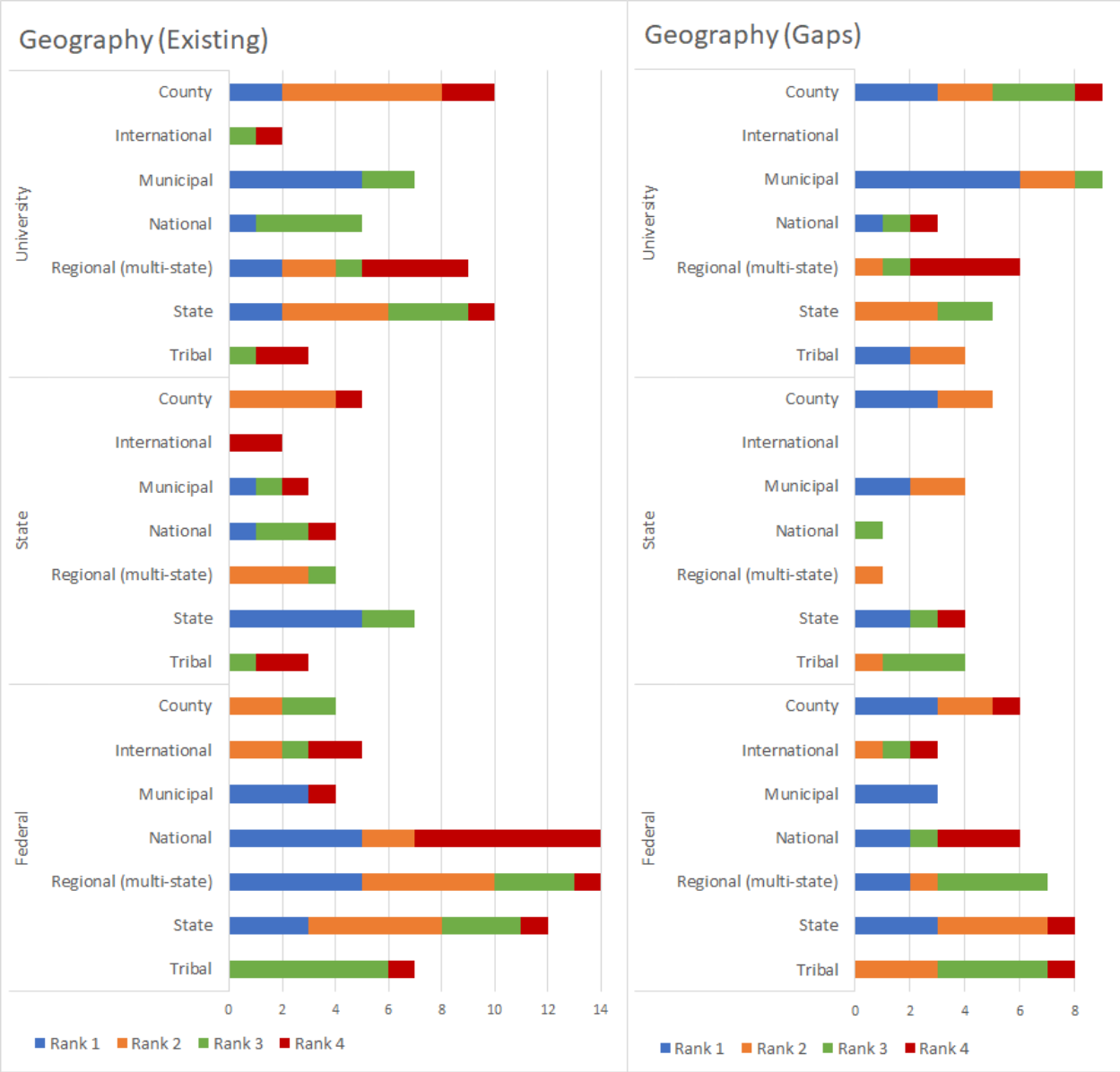

Figure A5: (Left) The scale at which university, state, and federal providers engage; (Right) The scale at which university, state, and federal providers see a need for engagement, but do not have the capacity or other ability to engage. Shading indicates how many times each scale was ranked as a top four scale by survey respondents.

Appendix B: Climate Service Provider Online Survey
NOAA-West CS Provider Survey

Q1.1
This survey was developed by CLIMAS and Western Water Assessment to learn more about the climate service provision in the western US. This survey is the second phase of the NOAA Western Region Climate Service Providers Landscape Assessment. The first phase identified Climate Service Providers in the eleven Western States and generated a searchable directory of climate service providers in the west. Support for this survey was provided by the NOAA Western Regional Collaboration Team (NOAA West).

For the purposes of this survey: ***Climate services*** refer to scientifically based information and products that enhance users' knowledge and understanding about the impacts of climate on their decisions and actions (see Meadow et al., 2016); ***Stakeholders*** refers to users of the climate information you provide; and ***Climate service providers*** are organizations that help create, translate, and disseminate potentially useful climate information (see Meadow et al., 2016).

The first half of the survey will help us learn more about key stakeholders, the main climate services provided to them, and their information needs. Questions in the second half of the survey focus on the interactions your organization has with other climate service providers.

This survey should take approximately 15-25 minutes to complete. We ask that each organization submit only one response on behalf of your organization, program, or agency.

Q1.2 Please enter your name, email, and the program/organization for which you are responding. *Note: researchers on the project team will have access to survey responses for analysis and report writing, but specific/identifiable responses will not be attributed to programs/organizations in any reports or follow up work.*

- Name (1) _____
- Email (3) _____
- Program/Organization (2) _____

Q2.1
In Section 1, we would like more information about the climate services you provide and sectors you cover, and in particular the services and sectors most used by your stakeholders, as well as any gaps in services or sectors-covered, where additional services or sectoral coverage would benefit your stakeholders.

Note: The categories used in this section - *stakeholders*, *services*, *sectors*, and *scale* - are derived from the NOAA West Climate Service Providers Database - information about these categories can be found in the project final report (Meadow et. al. 2016).

Q2.2 **STAKEHOLDERS** (current): Of your ongoing interactions providing services to existing stakeholders, what is the approximate percentage of your organization's time spent with each stakeholder group? (must total to 100%)

_____ Educators (1)
_____ Government (2)
_____ Private Sector (3)
_____ General Public (4)
_____ Tribes (5)
_____ Researchers (6)
_____ Universities (7)
_____ Resource Managers (8)
_____ Other (9)

Q2.3 **STAKEHOLDERS** (demand): Please indicate which of the listed stakeholders request new services or information from your program/organization that you do not yet provide. Rank in order of groups that **most-frequently** request to least-frequently request new services/information.

Stakeholders requesting new services/info
_____ Educators (1)
_____ Government (2)
_____ Private Sector (3)
_____ General Public (4)
_____ Tribes (5)
_____ Researchers (6)
_____ Universities (7)
_____ Resource Managers (8)
_____ Other (9)

Q2.4 **SERVICES (Use)**: Please indicate which of the listed climate services (on the left) your program/organization **provides** to stakeholders by dragging into the box on the right. Rank in order of **most-often provided** to **least-often provided**. This is your organization's assessment of use-of *existing* SERVICES by your stakeholders.

Climate services most used
_____ Convening (1)
_____ Workshops (2)
_____ Training & Education (3)
_____ Scenarios/Models (4)
_____ Data (5)
_____ Articles (6)
_____ Webinars (7)
_____ Monitoring & Evaluation (8)
_____ Reports (9)
_____ Newsletters (10)
_____ Decision Support Tools (11)
_____ Coordination (12)
_____ Presentations (13)
_____ Vulnerability Assessments (14)
_____ Other (15)

Q2.5 **SERVICES (Gaps):** Please indicate which of the listed climate services (on the left) stakeholders **request** of your program/organization but that you do not provide. Rank in order of **most-requested** to **least-requested.** This is your organization's assessment of demand-for *new* SERVICES by your stakeholders.

Gaps: Climate services with largest need/gap.
_____ Convening (1)
_____ Workshops (2)
_____ Training & Education (3)
_____ Scenarios/Models (4)
_____ Data (5)
_____ Articles (6)
_____ Webinars (7)

_____ Monitoring & Evaluation (8)

_____ Reports (9)

_____ Newsletters (10)

_____ Decision Support Tools (11)

_____ Coordination (12)

_____ Presentations (13)

_____ Vulnerability Assessments (14)

_____ Other (15)

Q2.6 **SECTORS (Use):** Please rank as many SECTORS as are relevant to your organization, from the sectors where services are most used, to sectors where they are least used (drag the sector topics from the list on the left into the box on the right). This is your assessment of SECTORS where *existing services* are most used by stakeholders.

Sectors most used

_____ Agriculture (1)

_____ Climate & Weather (2)

_____ Drought (3)

_____ Economics (4)

_____ Ecosystems (5)

_____ Forests (6)

_____ Oceans/Coasts (7)

_____ Land Use/Land Cover (8)

_____ Energy (9)

_____ Urban (10)

_____ Extreme Events (11)

_____ Indigenous Peoples (12)

_____ Human Health (13)

_____ Rural Communities (14)

_____ Water (15)

_____ Wildfire (16)

_____ Transportation (17)

_____ Social Vulnerability (18)

_____ Biogeochemical Cycles (19)

Q2.7 **SECTORS (Gaps):** Please rank any SECTORS that request information from your organization that you cannot or do not provide, from the sector with the largest gap or most needed climate services area to smallest gap or need (drag the sector topics from the list on the left into the box on the right). This is your assessment of SECTORS where new services are most in-demand (by stakeholders), and where new services that cover these SECTORS would be most beneficial to these stakeholders.

Gaps: Sectors with largest need/gap for additional climate services.

_____ Agriculture (1)

_____ Climate & Weather (2)

_____ Drought (3)

_____ Economics (4)

_____ Ecosystems (5)

_____ Forests (6)

_____ Oceans/Coasts (7)

_____ Land Use/Land Cover (8)

_____ Energy (9)

_____ Urban (10)

_____ Extreme Events (11)

_____ Indigenous Peoples (12)

_____ Human Health (13)

_____ Rural Communities (14)

_____ Water (15)

_____ Wildfire (16)

_____ Transportation (17)

_____ Social Vulnerability (18)

_____ Biogeochemical Cycles (19)

Q2.8 **Scale/Level of Existing Services (Use):** Please rank frequency of existing/ongoing interaction you have with different scales/levels of stakeholders (i.e. through existing climate services), from most frequent interaction to least frequent, omitting any scales that are not relevant to your organization.

Rank: Scale/Level of existing CS Use
_____ Municipal (1)
_____ County (2)
_____ State (3)
_____ Tribal (4)
_____ Regional (multi-state) (5)
_____ National (6)
_____ International (7)

Q2.9 **Scale/Level for new Services (Demand):** Please rank demand for new climate services by scale/level - from the most frequently requested level/scale of services to least frequent, omitting any scales that are not relevant to your organization.

Rank: Scale/Level of new CS demand
_____ Municipal (1)
_____ County (2)
_____ State (3)
_____ Tribal (4)
_____ Regional (multi-state) (5)
_____ National (6)
_____ International (7)

Q3.1 **Section 2:** On the next four pages, you will see providers from the NOAA Western Region Climate Service Providers Database organized by type (Federal, University, State, & NGO). Please check the box or boxes that corresponds with how your organization (PIs, research staff, collaborators) interacts with them, using the following categories.

(1) Research and collaboration with the organization
(2) Used data and information from the organization
(3) Referred stakeholders to the organization

The default answer (N/A) can be left in place if you have no substantive interaction.
Note: Only the organizations that are part of the NOAA West Climate Service Providers Database are listed here. If you want to refer to a group not found here, use the section at the

end of each page. If you want to suggest an organization be added to the database - refer to this form.

This **FIRST** page focuses on **FEDERAL CLIMATE SERVICE PROVIDERS**

Q3.2 NOAA Regional Integrated Sciences and Assessment (RISA)

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
California Nevada Climate Applications Program (CNAP) (1)	☐	☐	☐	☐
Climate Assessment for the Southwest (CLIMAS) (2)	☐	☐	☐	☐
Climate Impacts Research Consortium (CIRC) (3)	☐	☐	☐	☐
Western Water Assessment (WWA) (4)	☐	☐	☐	☐

Q3.3 National Weather Service (NWS)

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
Arkansas-Red Basin River Forecast Center (ABRFC) (1)	☐	☐	☐	☐
California Nevada River Forecast Center (CNRFC) (2)	☐	☐	☐	☐
Colorado Basin River Forecast Center (3)	☐	☐	☐	☐
Missouri Basin River Forecast Center (4)	☐	☐	☐	☐
Northwest River Forecast Center (5)	☐	☐	☐	☐
West Gulf River Forecast Center (6)	☐	☐	☐	☐
Your Local NWS Weather Forecast Office (NWS WFO) (7)	☐	☐	☐	☐

Q3.4 Department of the Interior - Climate Science Centers (CSC)

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
North Central Climate Science Center (NC CSC) (1)	☐	☐	☐	☐
Northwest Climate Science Center (NW CSC) (2)	☐	☐	☐	☐
South Central Climate Science Center (SC CSC) (3)	☐	☐	☐	☐
Southwest Climate Science Center (SW CSC) (4)	☐	☐	☐	☐

Q3.5 Department of the Interior - Landscape Conservation Cooperative (LCC)

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
California Landscape Conservation Cooperative (CALCC) (1)	☐	☐	☐	☐
Desert Landscape Conservation Cooperative (DLCC) (2)	☐	☐	☐	☐
Great Basin Landscape Conservation Cooperative (GBLCC) (3)	☐	☐	☐	☐
Great Northern Landscape Conservation Cooperative (GNLCC) (4)	☐	☐	☐	☐
Great Plains Landscape Conservation Cooperative (GPLCC) (5)	☐	☐	☐	☐
Southern Rockies Landscape Conservation Cooperative (LCC) (6)	☐	☐	☐	☐
North Pacific Landscape Conservation Cooperative (NPLCC) (7)	☐	☐	☐	☐
Plains and Prairie Potholes (LCC) (8)	☐	☐	☐	☐

Q3.6 Department of the Interior - Other

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
Colorado Water Institute (1)	☐	☐	☐	☐
Continental Divide Research Learning Center (CDRLC) (2)	☐	☐	☐	☐
Geosciences and Environmental Change Science Center (GECSC) (3)	☐	☐	☐	☐
Aldo Leopold Wilderness Research Institute (4)	☐	☐	☐	☐

Q3.7 United States Department of Agriculture (USDA)

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
USDA Northern Plains Climate Hub (1)	☐	☐	☐	☐
USDA Northwest Regional Climate Hub (2)	☐	☐	☐	☐
USDA Southwest Climate Hub (3)	☐	☐	☐	☐

Q3.8 National Center for Atmospheric Research (NCAR)

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
NCAR: Climate & Global Dynamics Laboratory (CGD) (1)	☐	☐	☐	☐
NCAR: Engineering for Climate Extremes Partnership (2)	☐	☐	☐	☐
NCAR: Climate Science and Applications Program (CSAP) (3)	☐	☐	☐	☐
NCAR: Computational and Information Systems Lab (CISL) (4)	☐	☐	☐	☐
NCAR: Earth Observing Laboratory (EOL) (5)	☐	☐	☐	☐

Q3.9 Other Federal Providers

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
CDC: Climate and Health Program (1)	☐	☐	☐	☐
Central and Northern California Coastal Ocean Observing System (2)	☐	☐	☐	☐
EPA: Creating Resilient Water Utilities (3)	☐	☐	☐	☐
Environmental Protection Agency (EPA) (4)	☐	☐	☐	☐
National Centers for Environmental Information (NCEI) (5)	☐	☐	☐	☐
National Climate Assessment (NCA) (6)	☐	☐	☐	☐
National Ecological Observatory Network (NEON) (7)	☐	☐	☐	☐
National Estuarine Research Reserve System (8)	☐	☐	☐	☐
National Integrated Drought Information System (NIDIS) (9)	☐	☐	☐	☐
National Ocean Service (10)	☐	☐	☐	☐

U.S. Climate Resilience Toolkit (11)	☐	☐	☐	☐
Western Regional Climate Center (WRCC) (12)	☐	☐	☐	☐
National Fish, Wildlife, and Plants Climate Adaptation Strategy (13)	☐	☐	☐	☐
NOAA CoastWatch West Cost Regional Node (14)	☐	☐	☐	☐
NOAA Digital Coast (15)	☐	☐	☐	☐
NOAA U.S. Integrated Ocean Observing System (IOOS) (16)	☐	☐	☐	☐
US Forest Service (USFS) Climate Change Resource Center (17)	☐	☐	☐	☐

Q3.10 Other Federal Providers - Not Listed Above

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
Other (1)	☐	☐	☐	☐
Other (2)	☐	☐	☐	☐
Other (3)	☐	☐	☐	☐
Other (4)	☐	☐	☐	☐
Other (5)	☐	☐	☐	☐

Q4.1

This **SECOND** page focuses on interactions with **UNIVERSITY CLIMATE SERVICE PROVIDERS** identified in the NOAA West Climate Service Providers Database.

(1) Research and collaboration with the organization

(2) Used data and information from the organization

(3) Referred stakeholders to the organization

The default answer (N/A) can be left in place if you have no substantive interaction.

Note: Only the organizations that are part of the NOAA West Climate Service Providers Database are listed here. If you want to refer to a group not found here, use the section at the end of each page. If you want to suggest an organization be added to the database - refer to this form.

Q4.2
University Providers in Arizona

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
ASU: Central Arizona-Phoenix Long-Term Ecological Research (CAP LTER) (1)	☐	☐	☐	☐
ASU: Decision Center for a Desert City (DCDC) (2)	☐	☐	☐	☐
NAU: Merriam-Powell Center for Environmental Research (MPCER) (3)	☐	☐	☐	☐
UA: Center for Climate Adaptation Science and Solutions (4)	☐	☐	☐	☐
UA: Native Nations Climate Adaptation Program (NNCAP) (5)	☐	☐	☐	☐
UA: Udall Center for Studies in Public Policy (6)	☐	☐	☐	☐

Q4.3 University Providers in California

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
UC Merced: Center for Climate Communication (CCC) (1)	☐	☐	☐	☐
UC Davis: Agricultural Sustainability Institute (2)	☐	☐	☐	☐
UCLA: Coastal Center (3)	☐	☐	☐	☐
UCLA: Center for Climate Science (4)	☐	☐	☐	☐
UCLA: Water Resources Working Group (5)	☐	☐	☐	☐
USC: Sea Grant (6)	☐	☐	☐	☐
UCLA: White Mountain Research Center (7)	☐	☐	☐	☐
Stanford: Center for Ocean Solutions (8)	☐	☐	☐	☐

Q4.4 University Providers in Colorado

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
CU: Institute of Arctic and Alpine Research (1)	☐	☐	☐	☐
CU: National Snow and Ice Data Center (NSIDC) (2)	☐	☐	☐	☐
CU: Natural Hazards Center (3)	☐	☐	☐	☐
CU: Cooperative Institute for Research in Environmental Sciences (CIRES) (4)	☐	☐	☐	☐
CSU: Western Forest Fire Research Center (5)	☐	☐	☐	☐

Q4.5 University Providers in Idaho / Montana / Nevada / Utah

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
UI: Idaho Water Resources Research Institute (1)	☐	☐	☐	☐
UI: Interactive Numeric and Spatial Information Data Engine (INSIDE) Idaho (2)	☐	☐	☐	☐
UM: Montana University System Institute on Ecosystems (3)	☐	☐	☐	☐
MSU: Montana Water Center (4)	☐	☐	☐	☐
Nevada Climate Change Portal (5)	☐	☐	☐	☐
USU: Utah Center for Water Resources Research (6)	☐	☐	☐	☐
USU: Wasatch Dendroclimatology Research (WaDR) Group (7)	☐	☐	☐	☐

Q4.6 University Providers in Oregon

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
OSU: Climate Impacts Research Consortium (CIRC) (1)	☐	☐	☐	☐
OU: Institute for a Sustainable Environment (2)	☐	☐	☐	☐
OSU: Institute for Natural Resources (Oregon Explorer) (3)	☐	☐	☐	☐
OSU: Institute for Water and Watersheds (4)	☐	☐	☐	☐
OSU: Oregon Climate Change Research Institute (5)	☐	☐	☐	☐
OSU: PRISM Climate Group (6)	☐	☐	☐	☐

Q4.7 University Providers in Washington

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
UW: Climate Impacts Group (1)	☐	☐	☐	☐
UW: Joint Institute for the Study of the Atmosphere and Ocean (JISAO) (2)	☐	☐	☐	☐
UW: Landscape Ecology and Conservation Lab (3)	☐	☐	☐	☐
UW: Washington Sea Grant (4)	☐	☐	☐	☐

Q4.8 Other University Providers - Not Listed Above

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
Other (1)	☐	☐	☐	☐
Other (2)	☐	☐	☐	☐
Other (3)	☐	☐	☐	☐
Other (4)	☐	☐	☐	☐
Other (5)	☐	☐	☐	☐

Q5.1 The **THIRD page** focuses on interactions with **STATE-LEVEL CLIMATE SERVICE PROVIDERS** identified in the NOAA West Climate Service Providers Database.

(1) Research and collaboration with the organization
(2) Used data and information from the organization
(3) Referred stakeholders to the organization

The default answer (N/A) can be left in place if you have no substantive interaction.

Note: Only the organizations that are part of the NOAA West Climate Service Providers Database are listed here. If you want to refer to a group not found here, use the section at the end of each page. If you want to suggest an organization be added to the database - refer to this form.

Q5.2 State Climate Offices

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
Arizona State Climate Office (1)	☐	☐	☐	☐
California Department of Water Resources (2)	☐	☐	☐	☐
Colorado Climate Center (3)	☐	☐	☐	☐
Montana Climate Office (4)	☐	☐	☐	☐
Nevada State Climate Office (5)	☐	☐	☐	☐
Office of the New Mexico State Climatologist (6)	☐	☐	☐	☐
Office of the Washington State Climatologist (7)	☐	☐	☐	☐
Oregon Climate Service (8)	☐	☐	☐	☐
Utah Climate Center (9)	☐	☐	☐	☐
Water Resources Data System & Wyoming State Climate Office (10)	☐	☐	☐	☐

Q5.3 Arizona

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
Arizona Drought Task Force Technical Monitoring Committee (1)	☐	☐	☐	☐

Q5.4 California

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
California Air Resources Board (1)	☐	☐	☐	☐
California Climate Change Extension (2)	☐	☐	☐	☐
California Climate Change Portal (3)	☐	☐	☐	☐
California Climate Science Program (4)	☐	☐	☐	☐
California Data Exchange Center (5)	☐	☐	☐	☐
California Institute for Water Resources (6)	☐	☐	☐	☐
California Natural Resources Agency (7)	☐	☐	☐	☐
California Ocean Protection Council (8)	☐	☐	☐	☐
California Ocean Science Trust (9)	☐	☐	☐	☐
Southern California Coastal Ocean Observing System (SCCOOS) (10)	☐	☐	☐	☐

Q5.5 Colorado

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
Colorado Water Conservation Board (1)	☐	☐	☐	☐
Colorado Water Conservation Board (2)	☐	☐	☐	☐

Q5.6 Idaho

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
Idaho Department of Water Resources (IDWR) (1)	☐	☐	☐	☐

Q5.7 New Mexico

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
New Mexico Water Resources Research Institute (1)	☐	☐	☐	☐

Q5.8 Nevada

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
Nevada Integrated Climate and Evapotranspiration Network (NICE Net) (1)	☐	☐	☐	☐
Nevada Water Resources Research Institute (2)	☐	☐	☐	☐

Q5.9 Oregon

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
Oregon Coastal Management Program (1)	☐	☐	☐	☐
Oregon Department of Environmental Quality (2)	☐	☐	☐	☐

Q5.10 Washington

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
State of Washington Water Research Center (1)	☐	☐	☐	☐
Washington Department of Fish and Wildlife (2)	☐	☐	☐	☐
King County (3)	☐	☐	☐	☐
Northwest Association of Networked Ocean Observing Systems (4)	☐	☐	☐	☐

Q5.11 Wyoming

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
Wyoming State Climate Office/Water Resources Data System (1)	☐	☐	☐	☐
Wyoming Water Research Program (2)	☐	☐	☐	☐

Q5.12 Other State Providers - Not Listed Above

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
Other (1)	☐	☐	☐	☐
Other (2)	☐	☐	☐	☐
Other (3)	☐	☐	☐	☐
Other (4)	☐	☐	☐	☐
Other (5)	☐	☐	☐	☐

Q6.1 The **FOURTH and FINAL page** focuses on interactions with **NGO CLIMATE SERVICE PROVIDERS** identified in the NOAA West Climate Service Providers Database.

1) Research and collaboration with the organization
2) Used data and information from the organization
3) Referred stakeholders to the organization

The default answer (N/A) can be left in place if you have no substantive interaction.

Note: Only the organizations that are part of the NOAA West Climate Service Providers Database are listed here. If you want to refer to a group not found here, use the section at the end of each page. If you want to suggest an organization be added to the database - refer to this form.

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
Aspen Global Change Institute (7)	☐	☐	☐	☐
Association of Fish and Wildlife Agencies (10)	☐	☐	☐	☐
California Ocean Science Trust (31)	☐	☐	☐	☐
Carpe Diem West (3)	☐	☐	☐	☐
Climate Accountability Institute (8)	☐	☐	☐	☐
Coastal Ecosystems Institute of Northern California (CEINC) (4)	☐	☐	☐	☐
Coastal Resilience (18)	☐	☐	☐	☐
EcoAdapt (14)	☐	☐	☐	☐
Geos Institute (12)	☐	☐	☐	☐
King County (15)	☐	☐	☐	☐
Nature Serve (9)	☐	☐	☐	☐

Physicians for Social Responbility (PSR), Arizona Chapter (1)	☐	☐	☐	☐
Skagit Climate Science Consortium (SC2) (17)	☐	☐	☐	☐
Sonoran Institute (2)	☐	☐	☐	☐
The Nature Conservancy (13)	☐	☐	☐	☐
Urban Water Institute, Inc (6)	☐	☐	☐	☐
Wildlife Conservation Society (WCS) (11)	☐	☐	☐	☐

Q6.2 Other NGO Providers - Not Listed Above

	Research / Collaboration (1)	Data/Information Source (2)	Stakeholders Referred (3)	N/A (4)
Other (1)	☐	☐	☐	☐
Other (2)	☐	☐	☐	☐
Other (3)	☐	☐	☐	☐
Other (4)	☐	☐	☐	☐
Other (5)	☐	☐	☐	☐

Q7.1
We will be reaching out to climate service providers to ask short follow up questions regarding climate services demand/use. Would you be willing to participate in a short conversation or email exchange sometime in next few weeks?

- ○ Yes (1)
- ○ No (2)

Q7.2 Would you be interested in receiving updates and/or project reports as they are completed?

- ○ Yes (1)
- ○ No (2)