

The logo is circular with the text "RIO GRANDE-BRAVO CLIMATE OUTLOOK" around the perimeter. Inside the circle is a stylized black and white illustration of a river valley with mountains and a winding river.

RIO GRANDE-BRAVO CLIMATE OUTLOOK

**A Summary of
Survey Responses**

Rio Grande-Bravo Climate Outlook

A summary of survey responses

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Introduction

The Rio Grande/Bravo Basin (RGB) is subject to perhaps the widest variety of extremes in weather and climate in the continental United States; the region is exposed to tornadoes, severe storms, hurricanes, winter storms, wildfire, and drought. The drought in the RGB, that began in Fall 2010 and reached exceptional proportions in 2011, continues today throughout much of the basin. Cumulative drought impacts on the U.S. side of the border include wildfire damage, agricultural losses, urban and residential infrastructure damage, losses in energy production and interstate transmission, interstate lawsuits, and reductions in surface water supplies, with an estimated cost of more than \$13 billion in 2011 alone. The ongoing drought has impacted the Mexican states of Chihuahua, Coahuila, Nuevo Leon and Tamaulipas, known for agriculture, industry, manufacturing, mining, international trade, technology development, in the following ways: agricultural losses, rangeland impacts, extensive wildfires, and reductions in surface water supplies; Mexican agricultural losses from drought in 2011 exceeded \$1.3 billion.

The region faces additional challenges, due to the need to coordinate and understand information and climate variations throughout the 182,200 square mile watershed and the 1,896 mile length of the mainstem Rio Grande, originating in the mountains of Colorado, and its main tributaries, including the 348 mile-long Rio Conchos. While there have been increased efforts to communicate timely drought information, primarily in the U.S., resource managers, and the national weather services of the U.S. and Mexico, have noted that coordinated efforts to communicate across the transborder region will benefit decision making, cooperative emergency management and fire management efforts, and help reduce the costs of disaster relief, saving lives, property, economic values and maintaining quality of life.

To address this need, the Climate Assessment for the Southwest (CLIMAS), in partnership with the Southern Climate Impacts Planning Program (SCIPP), developed a prototype binational, bilingual online quarterly climate outlook, for the Rio Grande/Bravo River Basin, in coordination with the North American Climate Services Partnership (NACSP). In 2002, CLIMAS pioneered the production of NOAA RISA climate outlooks, which synthesize climate, hydrological, and drought impact information from multiple sources; CLIMAS monthly and quarterly products, the *Southwest Climate Outlook*, and the *Transborder Climate* newsletter, help inform stakeholders on medium-term decision-making needs (Guido et al., 2013), and have served as invaluable tools for communicating the linkages between observed conditions, weather and climate causal factors, and predicted climate and drought conditions. *Transborder Climate*, and its experimental predecessor, the *Border Climate Summary*, which cover the border region from California to New Mexico, are the only regularly occurring bilingual climate information products in North America; Mexican research institutions, such as CICESE, UNAM, CIBNOR, and government agencies, such as Servicio Meteorológico Nacional (SMN), have been regular contributors to these products, in addition to U.S. contributors from federal agencies, NGOs, and universities. In 2011, SCIPP developed

perhaps the most effective and immediate drought outlook tool, *Managing Drought in the Southern Plains*, a series of webinars to address immediate information needs and provide immediate feedback (Shafer and Riley, 2012). These RISA teams have demonstrated capability and capacity to develop an effective prototype RGB Outlook, in order to integrate climate knowledge and decision-making concerns across nations and throughout the RGB, from headwaters to mouth.

Climate and Other Challenges in the Rio Grande/Bravo

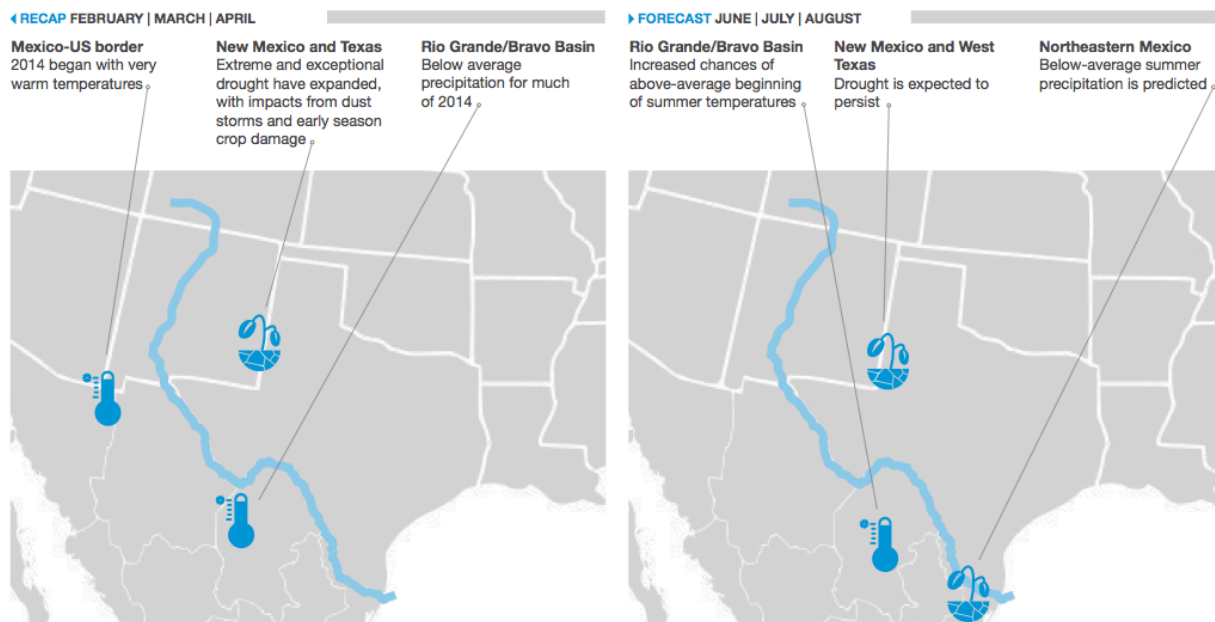
To prepare for future change in the Rio Grande/Río Bravo Basin region, the NACSP convened a workshop, in September 2014, to examine regional challenges at the intersection between climate, water resources, ecosystems, and water use. Climatologists, water managers, and ecosystem managers from the region identified key concerns that included: increasing temperatures, the depletion of surface water and groundwater resources, increasing frequency and intensity of weather and climate extremes, shifts in the timing and geographic location of summer precipitation, flashier flood events, more severe drought episodes, changes in the integrity of habitat for threatened and endangered species, and the introduction of new invasive vegetation, insect, and animal species. These concerns, in concert with non-climatic stressors, such as population growth, economic changes, impacts of energy exploration, legal and regulatory issues, and changes in agricultural yields, viability and practices, highlight the need for timely and reliable climate information, data, and knowledge products, like the *Rio Grande-Bravo Climate Impacts & Outlook*. The aforementioned concerns echo key findings of recent climate assessments, such as the IPCC Fifth Assessment Report, the National Climate Assessment, Reclamation's Upper Rio Grande Basin Risk Assessment, and its Lower Rio Grande Basin Study. These documents prominently mention the following:

- A region already stressed by non-climatic factors, faced with decreased future water supplies (Llewellyn and Vaddey, 2013; Reclamation 2013; Romero-Lankao et al. 2014)
- Projected increases in temperature and decreases in soil moisture (Romero-Lankao et al. 2014; Shafer et al. 2014)
- Possible decreases in the yields of key crops, such as corn and wheat (Porter et al. 2014)
- Regional barriers to planning and management (Romero-Lankao et al. 2014), and
- Increased stress on communities that are already highly vulnerable to weather and climate extremes (Reclamation 2013; Romero-Lankao et al. 2014; Shafer et al. 2014)

Description of the Outlook

The *Rio Grande/Bravo Climate Impacts & Outlook* (hereafter *RGB Outlook*) is produced in English and translated into Spanish. It is designed to be produced quarterly. Prototypes were created and distributed in December 2013 and June 2014. The *RGB Outlook* is created jointly by CLIMAS and SCIPP and is posted on the NIDIS Drought Portal, <http://www.drought.gov/>.

Each issue contains a summary of significant events, a discussion of drought conditions, seasonal outlooks, fire forecasts, and news. Each outlook has been six pages long. The summary page includes graphical depictions of significant events in the preceding several months and highlighted forecast and impacts in the coming months (Figure 1).

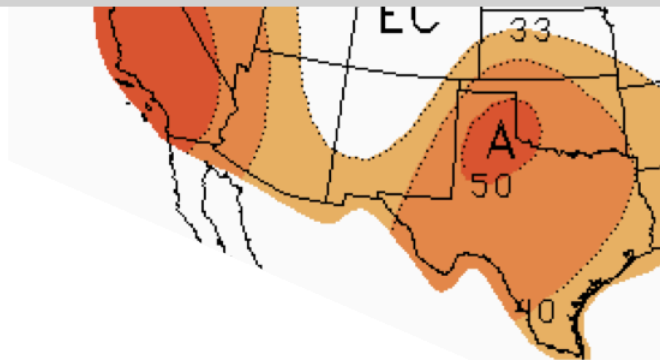
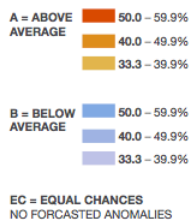


Current drought depiction uses the North American Drought Monitor (NADM) for the most recent month. NADM was chosen because it captures trans-border drought depictions, although it is not updated as frequently as the U.S. Drought Monitor and does not include as much local input. A brief paragraph highlighting drought conditions within the basin is included.

Seasonal forecasts for temperature and precipitation are provided by the NOAA Climate Prediction Center (CPC) for U.S. regions and by the Servicio Meteorológico Nacional (SMN) for Mexican states (Figure 2). One challenge in producing a unified product is that the CPC seasonal outlooks are statements of likelihood (probability) of above, below, or near-normal conditions while the SMN outlooks are actual forecasted values (departure from normal temperature or normal total precipitation). In addition, CPC outlooks are provided for 3-month periods while SMN products are provided monthly.

UNITED STATES
FORECAST MADE MAY 15, 2014

The NOAA Climate Prediction Center indicates increased chances for above-average temperature for the entire US-Mexico border region during June through August. The areas of predicted above-average temperatures in the western and southwestern United States are due to the expected persistence of a western ridge of high pressure that has been present for much of the year, thus far. High pressure favors warm, dry conditions.

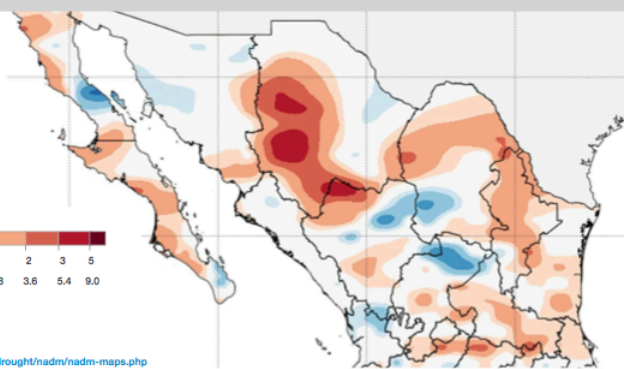
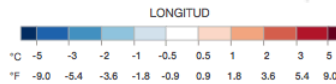


http://www.climas.arizona.edu/sites/default/files/SWClimateOutlook_jul11.pdf

MÉXICO
FORECAST MADE JUNE 2014

The Servicio Meteorológico Nacional (Mexican National Weather Service) predicts above-average maximum temperatures for June 2014, across northern Mexico.

JUNE PRECIPITATION AMOUNTS



<https://www.ncdc.noaa.gov/temp-and-precip/drought/nadm/nadm-maps.php>

Seasonal fire outlooks are produced by the U.S. National Interagency Coordination Center's Predictive Services Program. Unfortunately, similar outlooks are not produced for Mexico. Consequently, fire conditions are only depicted for the U.S. side of the border.

The news section includes a brief article on a topic relevant to the region and links to several other stories of interest.

Survey Results

A survey was distributed on August 19, 2014 to 161 people who were identified through various interactions by the two RISA Teams, State Climatologists, and NOAA partners. The distribution list included 20 individuals from agencies in Mexico and the remainder from agencies in New Mexico or Texas. The survey and recruitment notice were provided in both English and Spanish. Nine individuals responded to the initial request for the English version of the survey and one individual for the Spanish version. A reminder email was sent on September 4, 2014, generating an additional twelve respondents to the English survey.

The survey consisted of four parts: demographic information that described the characteristics of the population served by the respondent's organization; use of climate

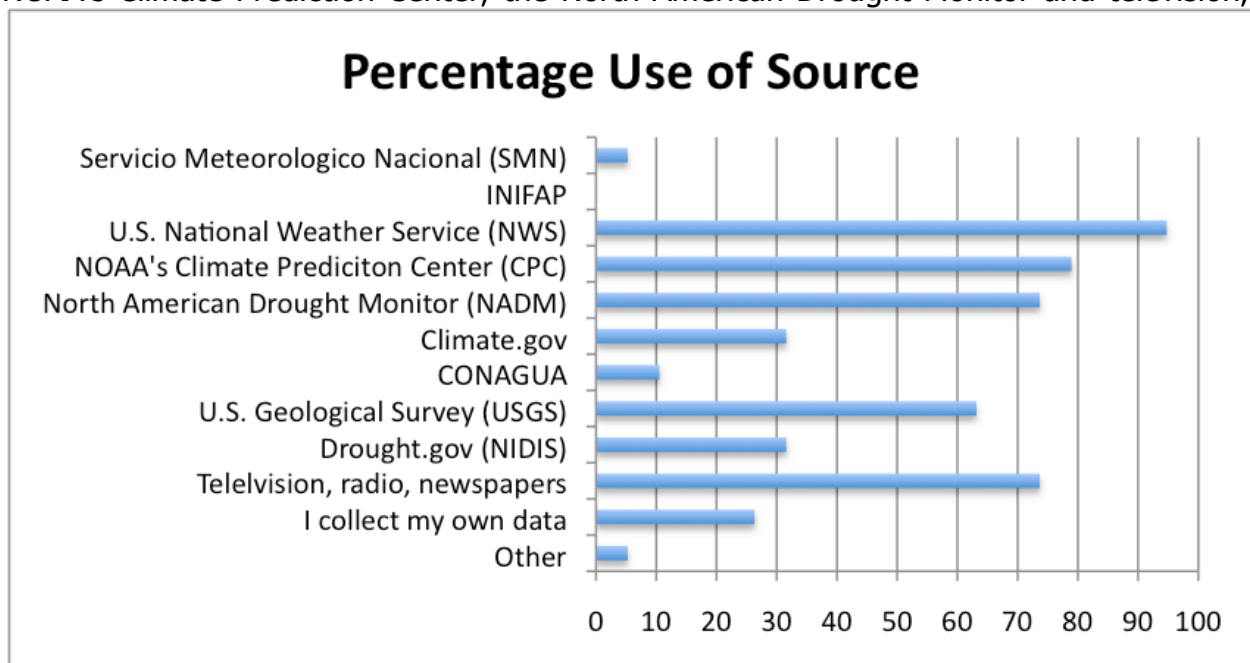
information; document layout; and preferred formats for distribution. Respondents were also given an opportunity to sign up for notices when future editions of the Outlook are released or if they were willing to be contacted for follow-up surveys or interviews.

Of the 22 total respondents, 14 were from Texas, seven from New Mexico and one from Chihuahua. Sixteen respondents were from state organizations, two were from tribal or indigenous communities, two were from cities, and one each were from county and national park. Eighteen respondents indicated that their organization served a population of 100,000 or greater; fourteen of these were over one million.

As for type of organization, respondents were fairly evenly divided between federal agencies (7), water management (5), university or extension (4), and ecosystem management (3). Two respondents indicated that they were elected or appointed government officials (one respondent did not indicate affiliation). Respondents were roughly equally interested in information related to Texas (10 respondents), New Mexico (8) and the Mexico-U.S. Border region (12). Of the Mexican states, Tamaulipas had the most interest (4) and some interest was expressed in Coahuila and Chihuahua (2 respondents each) and Nueva Leon (1 respondent). Multiple selections were allowed.

Use of Climate Information

Respondents use a variety of information sources (Figure 3). The U.S. National Weather Service was the most frequently-cited source, with 95% of respondents indicating that they use the source on at least a monthly basis (84% on at least a weekly basis). NOAA's Climate Prediction Center, the North American Drought Monitor and television,



radio or newspapers were all frequently used with at least 70% consulting these sources on a monthly or more frequent basis.

Mexican sources were infrequently used among the respondent sample, with only 11% citing CONAGUA and 5% citing Servicio Meteorologico Nacional (SMN) on at least a monthly basis. This is not surprising given the low response rate from Mexico; however it does indicate that agencies on the northern side of the border do not frequently consult Mexican sources of climate information.

Respondents were given an opportunity to include other sources that they consult. The National Climatic Data Center (NCDC) and the U.S. Natural Resources Conservation Service (NRCS) were mentioned as sources.

Nearly every respondent (18 of 19) indicated an interest in short articles about websites or decision-support tools. Respondents were given an opportunity to provide up to three topics for which they would like to see articles in future editions. The responses were free-choice; there was no list of topics provided.

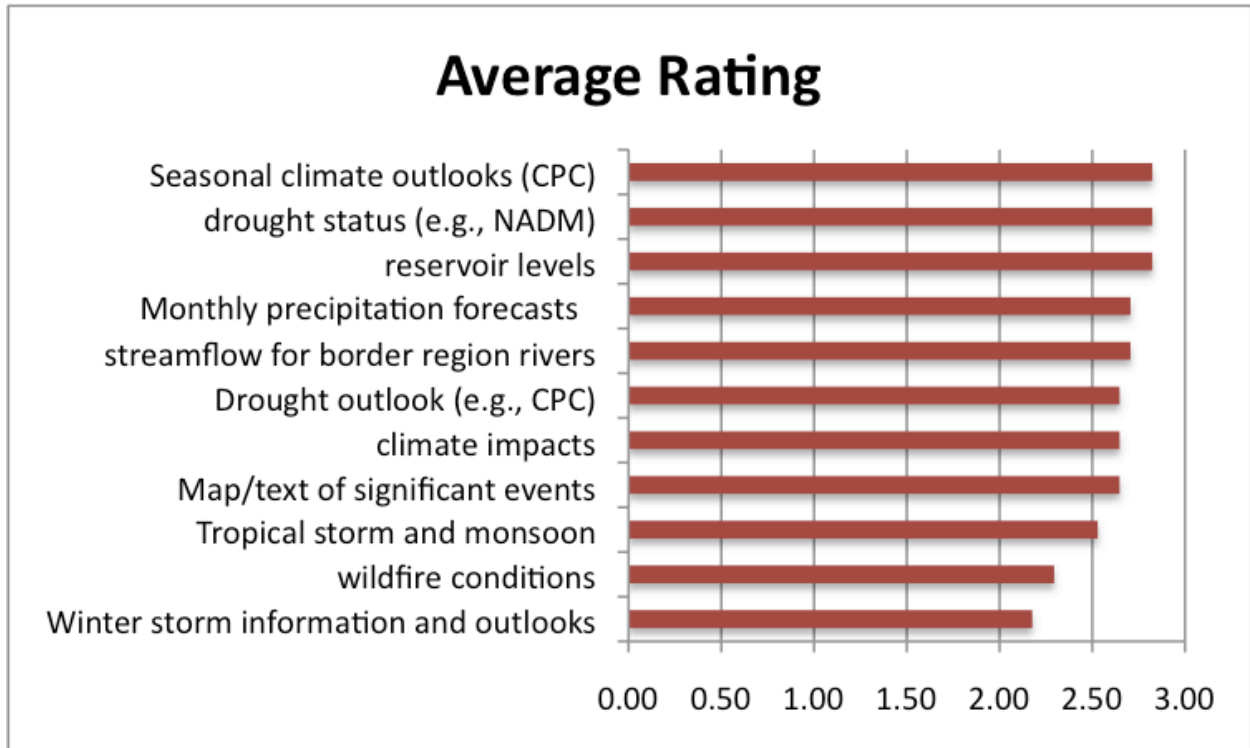
Responses could be grouped into five topics: drought, water supply, climate change, forecasts, and ecological or environmental. Drought forecasts, updates or impacts were most frequently mentioned, with six respondents indicating that (or close variations) as their first choice and three others as their second or third choice. Other drought-related topics mentioned included land use and impacts, drought mitigation programs, soil moisture estimates, drying stages, mega-drought forecasting, and weather modification.

Water supply was the second most-frequently mentioned topic. Topics related to water supply included snowpack and runoff predictions, projections of the water budget components (precipitation, stream flow, evapotranspiration), water management strategies, and cross-border drought and hydro-climate coordination.

Climate projections and effects of climate change on seasonal variability were mentioned by nine respondents, with two as their first choice. Forecasting-related topics included monthly and seasonal rainfall, the North American Monsoon, El Nino outlooks, tropical storm information, and fire forecasts. Ecological and environmental topics included long-term habitat shifts, projected environmental impacts, and how to apply climate forecasts to natural resource management and tools for doing this. One respondent wrote "surprise me" for a topic suggestion.

Respondents were asked what types of information are most important for inclusion in the publications (Figure 4). Respondents were provided a list of options and asked to rank each as essential (3 points), very useful (2 points), somewhat useful (1 point), or not interested (0 points). This produced an aggregate score for each option, based on the number of respondents in each of the four categories. A score of 3.00 would

indicate all respondents indicated the topic as essential and a score of 0.00 would indicate no respondents were interested in the topic.



Consistent with the responses on the types of articles respondents would like to see, drought and water-related topics rated highest. Seasonal climate outlooks and monthly precipitation forecasts also were rated highly. All topics recorded an average of very useful (2.00) or higher.

Preferred layouts and distribution

The next series of questions related to preferences for the length, format, and method of distribution for the *Outlook*. The majority of respondents indicated “as long as necessary” for the length of publication. Of 19 who responded to the question, nine chose “as long as necessary” while three indicated a short summary of 1-2 pages was preferable and four preferred a 3-4 page summary. One respondent indicated 5-6 pages and two respondents indicated no preference for the length.

Bullet points were slightly more favored for text format with seven respondents choosing bullet points and four choosing paragraphs, although eight respondents chose “no preference.” Thus, it seems like a mix of bullet points and paragraphs could be useful; where summary information such as drought status is highlighted by bullet points while more in-depth topics could be written as paragraphs.

Tutorials or explanations of products were seen as very helpful (9 respondents) or somewhat helpful (5 respondents). Two respondents did not feel that tutorials or explanations were necessary and three others indicated no preference. Responses were split evenly between video format (4 respondents) and text (6 respondents), with nine respondents indicating no preference. Interestingly, the two respondents who did not favor tutorials or explanations also indicated a preference for “as long as necessary” for length. Thus, the preference for less explanation was not due to a preference for shorter documents.

Nearly all respondents indicated that the Spring 2014 *RGB Outlook* had a good amount of graphics (14 respondents). Four respondents indicated no preference while one marked needs more and none marked needs fewer graphics. Nearly all (13 respondents) indicated that the graphics were a good size. Two respondents expressed that the graphics should be smaller and four indicated no preference. None indicated that the graphics should be larger.

Likewise, the majority of respondents felt that there was an appropriate amount of text (11 respondents). Three respondents said that there is not enough text and five indicated no preference. None felt that there was too much text. Of the three who indicated the need for more text, two preferred paragraph style while one did not indicate a preference between paragraphs and bullets. All three indicated “as long as necessary” for the document length.

Most respondents (11) preferred to receive the *RGB Outlook* as a PDF file while five preferred a series of web pages. Three indicated no preference. For the layout of the PDF, a plurality chose portrait (7) over landscape (3), while most (9) chose no preference.

Future Plans

To address the challenges identified in the NACSP workshop, National Climate Assessment, and other studies, the NACSP plans to move forward in the Rio Grande-Rio Bravo region with climate service initiatives to: improve the quality and coordination of seasonal climate forecasts, strengthen collaboration on drought monitoring and early warning, and enhance the identification, reporting, and analysis of environmental and economic impacts of regional drought. Engagement with regional natural resource managers, including public and private sector decision makers and concerned parties, is an essential part of the strategies developed by NACSP and its partners. To improve communication and coordination, the NACSP will develop partnerships with key stakeholders (e.g., Jacobs et al. 2005) and build trust through iterative engagement (Brooks 2003), engage in two-way dialogues—such as the September 2014 workshop—develop awareness of climate information products and build capacity for the use of climate information in decision making, through products like the *Rio Grande-Bravo*

Climate Impacts & Outlook, and continue to fully utilize existing resources, such as the NIDIS website (<http://www.drought.gov>) and the websites of NACSP partners (<http://www.smn.cna.gob.mx>).

With regards to the *RGB Outlook*, the results of this survey will be used to refine the content and format of the publication to serve as a sustained climate information resource for the region. To this end, near-term plans include enhancing the role of Mexican partners in the *Outlook's* production, including expanding Mexico-specific content, broadening the distribution audience, and building on lessons learned from the survey results. In addition, the identification of resourcing opportunities for the *Outlook* remains a priority, both in continued production of the document and for enhanced information delivery mechanisms such as web-based dashboards. Further future plans include continuing coordination efforts, such as site visits and workshops, between U.S., Mexican, and Canadian partners under the NACSP umbrella in the area of regional-scale applications of seasonal-scale forecasts (e.g., new experimental 3-4 week outlooks, wildland fire outlooks), from which useful regional information can be distilled into the *RGB Outlook*.

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