A yellow plane flying over a forest fire

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**2024 WRP REPORT**

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***Outcomes and Findings***

**ENHANCING RESILIENCE**

**TO AVOID**

**CASCADING DISASTER**

**Western Regional Partnership (WRP)**

**Reliable Outcomes for America's Defense, Energy, Environment,**

**and Infrastructure in the West**



WRP provides a proactive and collaborative framework for senior-policy level Federal, State and Tribal leadership to identify common goals and emerging issues in the states of Arizona, California, Colorado, Nevada, New Mexico and Utah and to develop solutions that support WRP Partners and protect natural and cultural resources, while promoting sustainability, homeland security and military readiness.



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**WRP Report Disclaimer**

The purpose of the report is to document the work of WRP conducted in support of the WRP Strategic Priority, “*Enhancing Resilience to Avoid Cascading Disaster.”* This includes mainly the outcomes and findings by the three WRP Deep-Dives conducted in support of the WRP Strategic Priority.

A large portion of this report is developed from the meeting minutes of the WRP Deep-Dive calls. We take great effort in capturing notes from meetings, carefully reviewing and organizing those notes, and then sending out any proposed notes to the attributed person to ensure accuracy. Therefore, this document is a collective and consensus effort thanks to the numerous participants but does not necessarily represent the official perspective of any particular agency. The report only includes publicly available information from WRP Partners and participants and is augmented by relevant agency news releases or publications to create greater awareness of current WRP Partner actions.

A special thank you to all who have taken the time to participate in the past WRP year and share your expertise.[[1]](#footnote-1) WRP functions effectively because of the collective partnership members who represent state, federal and tribal entities in the WRP Region and we thank you.

Table of Contents

[Introduction to WRP 5](#_Toc165300861)

[Executive Summary 8](#_Toc165300862)

[Summary of WRP Deep-Dive Efforts 20](#_Toc165300863)

[WRP Aviation/Airspace Needs Deep-Dive 21](#_Toc165300864)

[Water Security/Resilience 35](#_Toc165300865)

[Wildland Fire (Response/Prevention) 49](#_Toc165300866)

[Tribal Engagement Committee (TEC) 63](#_Toc165300867)

[WRP Sentinel Landscape Temporary Working Group 65](#_Toc165300868)

[WRP Acknowledgements 67](#_Toc165300869)

[WRP Steering Committee and WRP Committee Co-Chairs: Acknowledgements 68](#_Toc165300870)

[Airspace / Aviation: Acknowledgements 71](#_Toc165300871)

[Water Security/Resilience: Acknowledgements 76](#_Toc165300872)

[Wildland Fire: Acknowledgements 79](#_Toc165300873)

[Tribal Engagement Committee: Acknowledgements 83](#_Toc165300874)

[Sentinel Landscape Temporary Working Group: Acknowledgements 85](#_Toc165300875)

# **Introduction to WRP**

At each WRP Principals’ Meeting, Principals meet to share information, network, and formally adopt strategic priorities governing collaborative staff-level efforts for WRP action. This report addresses the priority approved by the WRP Principals at their December 2022 Principals’ Meeting, focused on *Enhancing Resilience to Avoid Cascading Disaster.* To explore the adopted priority more fully, a brief survey was conducted with WRP leadership[[2]](#footnote-2) after the 2022 WRP Principals’ Meeting, which identified three Deep-Dives in support of the WRP priority:

* Aviation/Airspace Needs
* Water Security/Resilience
* Wildland Fire (Response/Prevention)

To assist in this critical effort, subject matter experts for each deep-dive were identified and teams formed to address each topic. The Deep-Dive teams worked to explore tools and resources needed to build resilience to support the diverse missions of Federal, State, and Tribal entities in the WRP Region. This report summarizes WRP efforts since the December 2022 meeting and documents actions and recommendations.

**WRP History and Overview of the Region**

In 2007, representatives of Federal agencies and State and Tribal leadership in Arizona, California, Nevada, New Mexico and Utah partnered with the Department of Defense (DoD) to establish the Western Regional Partnership. Colorado was added in 2015.

WRP provides a proactive and collaborative framework for senior-policy level Federal, State and Tribal leadership to identify common goals and emerging issues in the states of Arizona, California, Colorado, Nevada, New Mexico and Utah and to develop solutions that support WRP Partners and protect natural and cultural resources, while promoting sustainability, homeland security and military readiness.

The WRP Region has 18% of the U.S. population, 19% of the U.S. land mass, considerable state, federal and tribal lands, and various land management processes. These factors and the fact that many land use issues are regional means that WRP Partners’ interests may lead to unintended land use conflicts.To work together more effectively across geopolitical boundaries, common and emerging issues in the WRP region must be identified, along with potential conflicts and solutions.

Within the six-state region, there are:

* Significant amounts of federally managed lands (federal land ownership in these states ranges from 34.1% - 84.9%)
* Extensive Training Ranges, Premier Testing Facilities, Unmatched Military Air Space
* Approximately 172 Federally recognized Tribes
* Significant State Trust Landholdings

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| State | % of Federal Land  (not including DoD managed lands) | % of DoD Managed Land | % of Indian Trust Land | Private Land | State Trust Land | Size of State in square miles and ranking by area |
| Arizona | 35.5% | 6.6% | 27.6% | 17.5% | 12.7% | 114,000; 6th largest state |
| California | 40.2% | 4.0% | .5% | 50.3% | 2.5% | 160,000; 3rd largest state |
| Colorado | 38.9% | 0.7% | 1.1% | 54.9% | 4.4% | 104,100; 8th largest state |
| Nevada | 78.8% | 6.1% | 1.42% | 13.03% | .15% | 110,561; 7th largest state |
| New Mexico | 29.7% | 4.4% | 10.2% | 43.9% | 11.6% | 121,593; 5th largest state |
| Utah | 63.6% | 3.4% | 4.5% | 21% | 7.5% | 84,904; 13th largest state |

The benefits of participating in WRP include:

* A forum to engage with high-level representatives of states, federal and tribal entities across WRP Region.
* Opportunities to enhance situational awareness of policy and emerging issues.
* Enable interagency dialogue for identifying, addressing, and avoiding these potential conflicts.
* Recommendations and innovative solutions in the gap between real time problems and long-term policy development.
* Access to tools and WRP Deliverables.

**WRP Structure**

WRP’s Charter delineates the mission, goals, and responsibilities for the Partnership. The Steering Committee (SC) is composed of senior staff members representing WRP Principals; it coordinates with the Co-Chairs of the four WRP Committees:

* Energy
* Military Readiness, Homeland Security, Disaster Preparedness and Aviation
* Natural Resources
* Tribal Engagement Committee

The Committees work to improve regional and interagency cooperation among federal agencies, tribal leadership, states, and non-governmental organizations on critical Western regional issues and provide a forum for information exchange, issue identification, problem solving, and recommendations. The Committees helped with the formation of the Deep-Dive Teams to best address the WRP Priority.

A GIS Support Group works with the WRP SC to assist all Committees.

The WRP Sentinel Landscape Temporary Working Group (SL WG) was created by the SC acting under the authorization of the Principals and has been meeting since 2023. SL WG

was created to explore opportunities to address western issues through the Sentinel Landscapes Partnership’s mission and their outcomes are summarized in this report.

# 

# **Executive Summary**

At the December 2022 WRP Principals’ Meeting, the Principals approved the WRP priority of *Enhancing Resilience to Avoid Cascading Disaster.* To explore the adopted priority more fully, a brief survey was conducted with WRP leadership[[3]](#footnote-3) after the 2022 WRP Principals’ Meeting, which identified three Deep-Dives in support of the WRP priority:

* Aviation/Airspace Needs
* Water Security/Resilience
* Wildland Fire (Response/Prevention)

Deep-Dive teams met frequently since the last WRP Principals’ Meeting, to discuss these matters in the framework of the overarching theme of “Enhancing Resilience to Avoid Cascading Disaster.” The teams considered cross-cutting issues that may cause cascading disaster with focus in areas affecting aviation, water security and wildland fire and associated issues.

The Deep-Dives teams investigated:

* Resilience issues that cause cascading disasters impacting Federal agencies, States, and Tribal missions.
* Tools and resources needed by WRP Partners to stop cascading disasters.
* Areas of commonality in which WRP Partners can leverage existing or develop new tools and resources needed to promote resilience to avoid cascading disasters in the west.
* Highlighted additional best practices and approaches to leverage existing tools and resources that promote resilience to avoid cascading disasters.

The report summarizes the activities of these teams and their recommendations for further work on these subjects. Although much was accomplished, the consensus reached by the participants is that further work needs to be done.

**WRP Aviation/Airspace Needs Deep-Dive**

Airspace in the WRP region is complex and busy, with numerous governmental and general public users having various interests in maintaining their ability to function within it. The Deep-Dive team met ten times since the previous Principals’ Meeting to explore three essential topics more fully:

Congested Electromagnetic Spectrum (EMS) as it Relates to Airspace

Aviation depends on access to Radio Frequency (RF) EMS. RF supports many functions, including aviation communication, navigation, surveillance, traffic control, collision avoidance, and firefighting support. The Department of Defense (DOD) is the largest user of EMS, making the management of EMS a critical support for national security. The Federal Aviation Administration (FAA) manages frequency bands related to airspace.

Part of this support includes mitigating Radio Frequency Interference (RFI), unwanted signals disrupting desired communication service. RFI may be caused by aging electronic equipment that was not designed to protect against current sources in the electromagnetic environment (e.g. 5G signals), illegal radio stations, or natural sources, such as solar flares or atmospheric conditions. Occasionally, RFI is intentional, such as frequency jammers and spoofing.

The availability of RF is also impacted by repurposing initiatives and auctions, large usage volume, dynamic sharing activities, and compaction. Optimization of spectrum across these increasing demands is difficult. The Interagency Spectrum Advisory Council has been established to promote efficiency in spectrum use by federal agencies and other users.

Spectrum repurposing and loss impacts mission capabilities, navigation, communication, and safety, both within and outside government. Loss of spectrum has the potential to adversely impact DOD mission performance.

Findings regarding EMS Aviation/Airspace Needs:

* The importance of redundancy and standardization for new technology to ensure a resilient airspace.
* Future technology implementation should continue to leverage the distributed nature of commercial wireless/cellular-based technologies.
* Technology must be used to address resource issues.
* Proper EMS management improves safety for crewed missions.

Dynamically Managed Airspace

Dynamically managed airspace allows for optimizing use of airspace through improved air traffic control and systems. The Deep-Dive team explored the need for enhanced collaboration among all users, both new entrants and existing users. Among the findings in this regard are:

* Enhancing FAA infrastructure to include uncrewed traffic management, advanced air mobility and Counter-UAS capabilities.
* Accelerating upgrades to airspace systems.
* Providing real-time status of special use airspace.
* Providing timely data to improve intelligent use of airspace.
* Employing the three C’s: communicate, collaborate, and coordinate.

Space operations

As space launches and recoveries become much more common and frequently private in nature, the need to integrate these operations into the airspace becomes more critical. This was recently recognized by the Secretary of Defense’s release of a “Commercial Space Integration Strategy.”

Space operations use considerable airspace, and impact general aviation and DOD activities whether the operation goes off as scheduled or is cancelled. Launches frequently require windows of several days. Among the findings in this area are:

* The need for better, more timely awareness by all users.
* The need for consistency and coordination among users.
* Consideration of encroachment by spaceports on airports and airspace.
* Concerns with impacts on military training and civil aviation.
* New technologies enabling future growth of space operations.

Potential New Technologies/Entrants

Among the new technologies are Uncrewed Aircraft Systems (UAS). This enables flights previously impossible or unfeasible, changing the aviation system in a way not seen since the advent of commercial jet aircraft. Additionally, sustainable aviation fuel or battery operated, and hybrid aircraft are changing air mobility. Among the specific findings:

* New technologies and accompanying regulatory response should not compromise safety, reduce availability or increase costs of stakeholders.
* New and quieter aircraft could adjust flight operations and flight paths, possibly relieving congestion.
* There is a need to test new technologies in the airspace.
* Supportive systems and technologies for new platforms are needed.

**WRP Aviation/Airspace Needs Deep-Dive Recommendations for Future WRP Action include:**

* Continue to be an effective forum and inform/set the stage for decisionmakers, noting conflicts and priorities that need to be addressed. Keep aware of new technologies/entrants.
* Identify outcomes from relevant studies (ASSURE, NASA, etc.) that could help ensure sufficient access to spectrum for aviation operations.
* Stay informed of efforts on Dynamically Managed Airspace.
* Invite FAA and other appropriate subject matter experts to highlight growth of current and new Space operations and locations (Space Launches (Ports), Rocket Launches, High Altitude Balloons) and opportunities to deconflict mission impacts.
* Continue to be aware of DOD Airspace Needs.

**Water Security/Resilience Deep-Dive**

Water resource planning in the WRP Region is complicated by unpredictable climate and weather, water rights, infrastructure needs, regulation changes and population and economic growth. The Deep-Dive team met eight times since the previous Principals’ Meeting to explore resource planning and management amidst extreme events. The Deep-Dive team organized its work under several risk categories:

Risk Category: Complexity of Regulatory Laws and Water Resource Management.

Administration of water in the West is largely governed by the states, but the federal government plays an important role as well, including issues surrounding federal lands and tribal water rights. Water rights regulation varies among the states; although the western states take a broadly similar approach that differs from that of the eastern states, there remain variances even within that western paradigm. Given the significant federal land in the west, federal agencies must often participate in state processes including basin-wide adjudications of water rights.

The major issue identified revolves around the challenges to plan, fund, permit and implement projects across political boundaries. Population growth must be accounted for as well, suggesting a holistic approach to the issue. To help with water rights considerations and climate conditions, many data and science resources have been developed. In the WRP Region, the Colorado River basin is a key element, and the U.S. Geological Survey has developed an important platform to provide discoverable information.

Among findings on this issue:

* Data is available, but needs to be reliable, continuous, accessible and sufficient.
* Good data from multiple sources are necessary for long-term planning.
* Data collection agencies require staff and resource.
* Difficult technical and policy decisions will need to be addressed, such as on land use, growth and development.
* Planners must engage with utilities, municipalities and the general public, taking water supply into consideration.
* Different jurisdictions and agency perspectives must be considered.
* Policies supporting growth must also consider climate and wildfire.
* Flood management and stormwater capture must be included in planning documents.
* There must be coordination among all levels of government.
* Secondary and tertiary project benefits should be identified to maximize funding sources and environmental benefits.
* WRP meeting help foster needed dialogue and conversations.

Risk Category: Weather and Climate

Extreme events can lead to cascading impacts and require complex management paradigms. Water policies are often based on historical hydrology and do not account for changes in climate and extreme events, creating challenges for water management. Drought, wildfire and debris flow events can lead to compounding flooding; run-off after wildfires can be especially concerning. Whether a multi-year drought is a new normal is difficult to discern.

Among the findings on this topic:

* Implement policies and projects to alleviate future disasters, such as expediting ground water recharge during wet years.
* Communicating risks is challenging.
* Changing climate may be addressed differently than short term events.
* The federal government should continue working with stakeholders on a watershed basis.
* Water managers must continue to evolve their decision-making processes as technology improves and weather and climate knowledge grows.
* Infrastructure is needed to capture and store stormwater.
* Develop a holistic approach to major floods and droughts.
* Aligning planning documents and coordination among all agencies may assist in funding projects.
* There is a need to address tribal water rights.
* Contaminants from wildfires are detrimental to the water and ecosystem.
* Unlined canals act as groundwater recharge basins.

Risk Category: Infrastructure

Water infrastructure includes built and natural features that move and treat water, including drinking water, wastewater and stormwater. Issues in this area include loss of infrastructure, maintenance and rehabilitation, aging infrastructure, affect of changes in climate and hydrology assumptions since the infrastructure was built, affect of wildland fire on infrastructure, and the overall need for clean drinking water, especially in tribal and underserved communities.

Among the findings on this topic:

* The importance of using natural infrastructure.
* Aquifer storage and recovery as a valuable tool to capture water underground, reduce subsidence and provide water supply.
* The need for diverse infrastructure owners to manage interconnectedness of their assets.
* A systems approach for operations and maintenance may help planning and funding.
* Loss of infrastructure has a cascading impact on the community.
* Recognize the importance of indigenous knowledge.

Risk Category: Water Quality

Issues identified with respect to water quality include the need to treat contaminants that may not have been considered in the original design of facilities, the need for different types of treatment for different water needs, and the complexities of reuse.

Among the findings on this topic:

* + Prioritizing opportunities that offer multiple benefits.
  + Performing watershed assessments and maintenance to reduce fuels benefits water quality and quantity.
  + Water recycling may improve water quality and quantity.
  + Water quality and quantity requires management to build resilience to impacts from hazards, develop long-term infrastructure solutions, improve precipitation, and weather forecasts.
  + Well-maintained forests and natural areas may reduce wildfire risk and improve water quality.

The Water Security Deep-Dive team also identified a Best Practice: State agencies collaborating with federal agencies to address water security. States have discovered the importance of working with FEMA on hazard mitigation planning. State mitigation plans can help unlock funding opportunities through Hazard Mitigation Assistance Grant programs that cover a wide range of activities such as technical assistance, training, building codes, planned development, and large-scale infrastructure projects. Specific examples from WRP states were reviewed by the team.

**WRP Water Security Team recommended they continue efforts work through the water security risks identified**. Invite additional subject matter experts to share information on best practices, and challenges associated with risks to water supplies, with focus on the following areas:

* Complexity of regulatory laws and water resource management
* Weather
* Infrastructure; and
* Water quality

Based on the above risk categories, explore multi-sector mitigation opportunities in water management through the lens of extreme events (such as drought, flooding, wildfire, etc.) and identify science and data gaps for informed decision making.

**Wildland Fire (Response/Prevention) Deep-Dive**

As the number and severity of wildfires in the west increases, wildfire mitigation poses a complex and growing challenge. Fire seasons have transitioned into “fire years” due to factors such as fire suppression, increasing fuel in forests and rangelands, and changing climate.

The federal government is the largest land manager in many WRP states, but states, tribes and non-governmental organizations also have important roles in planning, preparation, mitigation, response, and recovery systems around wildland fire. Land ownership and the numerous agencies involved complicate the issues surrounding wildland fire, but there are many collaborative efforts as well.

The Deep-Dive team held 12 calls since the last Principals’ Meeting. As this team was new, there was a greater amount of brainstorming about the issue and its ramifications. The team identified five main issues:

Preparedness Before the Disaster

The team described the issue as identifying gaps and solution sets to more effectively coordinate integrated and collaborative wildfire planning and activities proactively across jurisdictional boundaries. Mitigation funding can save resources over the long term. As wildfires do not respect jurisdictional boundaries, it is necessary to have a collaborative, cross-jurisdictional approach. Some of the tools available include prescribed fires, managing beneficial fires, and mechanical treatments.

The team identified Best Practices of implementing a cohesive strategy across jurisdictions, recognizing the Wildland Fire Mitigation and Management Commission’s approach emphasizing pre-fire mitigation and post-fire recovery, and using available tools such as California’s Statewide Wildland Urban Interface Fuels Treatment (SWFT) and Good Neighbor Authority (GNA) to address wildfire risk on public lands.

Findings on this topic include:

* Plan, prevent, respond, and recover as if there is not a division between the lands.
* Enhance long-term resiliency, such as using fire-resistant construction and addressing invasive species.
* Identify ways to streamline federal agencies’ fire response/post-disaster assistance.
* Improve contracting tools, build out contractor capacity in both the public and private sectors, and develop statewide tools to accomplish the work more quickly.
* The land management mix necessitates robust partnerships with multiple agencies.
* It is important for federal agencies to work with nearby and adjacent landowners, particularly tribes, to ensure there are egress and ingress routes in case of emergency.
* There is a need for an interagency disaster organization at the regional level.
* Integrate post-fire and disaster programs based on the holistic needs, risks, and prioritize resources to timing.
* Conduct a hazard risk analysis – pre- and post-fire analysis to get ahead of debris flows. This will help with resource allocation.
* WRP should learn more about the U.S. Forest Service’s proposal to amend land management plans regarding Old-Growth Forest Conditions Across the National Forest System.

Mitigation

The issue is to identify additional steps to achieve fuels management coordination, planning and treatments for landscape resiliency and post-fire impact mitigation. Many resources and best practices have been developed to encourage collaboration, such as the Tactical Fire Remote Sensing Advisory Committee that focuses on remote sensing support to wildland fire operations, acting as a forum to share ideas and build awareness of activities in the wildfire and R&D communities.

Findings on the topic of mitigation include:

* Conditions have deteriorated as climate change and fire suppression have contributed to overstocked forest landscapes, and as invasive species have been encouraged by catastrophic fires.
* It is important to pull in regulatory agencies early in the consultation process.
* It would help if agencies formalized their processes on consistently integrating fuel management into their plans.
* Pre-planning in areas of high-risk fire to address control and deforestation.
* Consider the use of natural resources to assist with fire suppression.

Aerial Response/Drones

The issue was identified as the need for coordination regarding wildland fire, NAS, fire response and integration of UAS into wildland fire operations. Wildfire response often requires immediate, emergency access to airspace. UAS intruders can significantly hamper fire response. Counter UAS may be a solution.

Findings on this topic include:

* + Importance of establishing Temporary Flight Restriction (TFR) to reduce commercial drone incursions.
  + There is an increase in requests for aircraft to participate in the wildland fire hazard relief.
  + Persistent, dynamic communication systems are desired.
  + Importance of having sufficient spectrum for communications without interference and for safe navigation.
  + There is a need for real-time data collection and dissemination for coordinated UAS operations in the wildland fire environment.
  + Sense-and-avoid technologies that synchronize for harmonious coordination over the wildland and RX environment.
  + UAS technologies should be commensurate with application software solutions that advance situational awareness and planning capabilities for airspace management and integration within the wildland fire environment.
  + Opportunities to work together can increase situational awareness, facilitate proper training opportunities and promote preservation of protected areas.
  + Firefighting, Search and Rescue, Law Enforcement, Utility or other Critical Infrastructure Restoration, Damage Assessments Supporting Disaster Recovery Related Insurance Claims, and Media should be thoroughly familiar with the process by which they may apply for waivers from TFRs.

Post-Fire Landscape Resilience and Recovery

The issue was described as addressing post-fire recovery and what is missing to prevent cascading effects. Many agencies are involved in post-fire response, including USFS, USGS, NRCS and FEMA, and DOD has its own capabilities. The team identified as a Best Practice emphasizing post-fire management. The USFS has identified the 4R’s of post-fire response as Repair, Emergency Response, Rehabilitation and Recovery. The team also noted many successful post-fire landscape response and recovery examples in WRP states.

Among the findings on this topic:

* Many of these issues also apply to water security.
* Flooding has risks of immediate cascading effects and long-term effects.
* Contaminants can enter the water supply.
* There is a need for post-fire management to be part of the fire management cycle.
* Have strong collaboration with the many levels of government to determine whether any areas are at risk of flooding.
* Importance of gray infrastructure solutions to complement nature-based solutions.
* Importance of native grass bank supply in nursery stock for reforestation.
* Recommend a strong, coordinated outreach and risk analysis by the many federal agencies to assist with post-fire response.
* Post-fire flooding and debris flow analyses necessitate interagency coordination to ensure the delivery of consistent and unified risk assessments to communities, facilitating response and recovery efforts effectively.
* Need to develop a comprehensive package of tools and resources to assist communities in the recovery phase.
* Work with USFS new National Post-Disaster Recovery Team on areas of mutual collaboration.
* Review the Wildland Fire Mitigation and Management Commission Reports and recommendations.
* Identify opportunities to leverage efforts more fully.

Science, Data and Technology

The team described the issue as identifying science, data and technology needs to understand wildfires, their impacts and how to mitigate them, and support informed, risk-based decisions. Although there is a need for science-driven tools to help address wildfire issues, a Best Practice was identified of utilizing current tools, such as the Burn Intensity and Debris Flow Probability maps, the National Water Dashboard, and the AirNow and Fire Information for Resource Management System.

Findings on this topic include:

* Coupling the predictive model with meteorological models can determine where the risks lie.
* Hazards are easier to figure out. Risk is based on probabilities. Probabilities are where risk is measured and where you put your values. Risk is the probability of impacts to values. Agencies differ on the weights placed on different values.
* It is necessary to understand the potential geologic response (post-fire landslide, etc.), both from looking at debris flow and rockfall.
* The use of additional technology might provide additional fire predictive tools.
* Data challenge is that no one agency or bureau has all the data.
* Implement the Cohesive Strategy: The Wildland Fire Leadership Council is convening science, data, and technology experts in June 2024 to address a broad scope of issues in this space and how to proceed in developing solutions based on current, in-depth research and how to ensure that results make it to the field for use in decision-making.

The team also recommended that the Wildland Fire Deep-Dive Team to continue to work through the five identified issue areas (Preparedness Before The Disaster, Mitigation, Aerial Response/Drones, Post-Fire Landscape Resilience and Recovery, and Science, Data and Technology) through inviting additional subject matter experts to share best practices and challenges.

**Tribal Engagement Committee (TEC)**

The TEC became a permanent committee at the previous Principals’ Meeting. It held regular calls to facilitate information-sharing among tribal members and state and federal agencies in the WRP Region, seek tribal input on WRP efforts, and receive updates on timely and important issues. Tribal members are still encouraged to participate in all WRP Committees.

The TEC established an outreach subcommittee to develop a communication/outreach plan to encourage additional tribal participation in WRP; this work is ongoing. The TEC also acknowledged the numerous agencies for the presentations, information sharing and collaborative efforts, including topics such as natural resources, disaster, energy, better planning, funding opportunities, Tribal-State/Federal relations and addressing Tribal infrastructure.

**WRP Sentinel Landscape Temporary Working Group**

At the previous Principals’ Meeting, the WRP Sentinel Landscape Temporary Working Group was created. It has proven to be an effective forum to assist Sentinel Landscape designations within the WRP Region: four proposals were submitted for final consideration for the 2024 designation cycle: Great Salt Lake (UT); Mojave Desert (CA); San Diego (CA); and Eastern New Mexico.

Given this record of success it is recommended that the WRP Sentinel Landscape Temporary Working Group continue for another WRP year and provide an update at the 2025 WRP Principals’ Meeting.

Update:

* After the 2024 WRP Principals’ Meeting, on May 15, 2024, new Sentinel Landscapes were [announced](https://www.defense.gov/News/News-Stories/Article/Article/3776193/dod-interagency-partners-designate-5-new-sentinel-landscapes/). Three of the four Sentinel Landscape proposals submitted within the WRP Region were chosen to become a Sentinel Landscape. The 2024 Sentinel Landscapes designates include the Great Salt Lake (UT), Mojave Desert (CA) and Eastern New Mexico.

**Recommended WRP 2024-2025 Strategic Priority**

The priority of “*Enhancing resilience to avoid cascading disaster”* is incredibly substantial and critical. The West has both significant resources and critical needs. Agencies are facing great challenges and success will depend on greater collaboration among state, federal and tribal entities. Continued focus in this area will enable WRP to more fully analyze, develop recommendations and support WRP Partners.

In 2024-2025, WRP review the best practices and solution sets identified in the 2024 Report on *Enhancing Resilience to Avoid Cascading Disaster* and determine if there are any further gaps and then work collaboratively to implement recommendations.

It is recommended that one more WRP year is dedicated to this priority to enable more in-depth effort and action.

**Enhancing Resilience to Avoid Cascading Disaster**



# **Summary of WRP Deep-Dive Efforts**

## **WRP Aviation/Airspace Needs Deep-Dive**

**Background**

The WRP Region arguably has the most complex and busiest airspace in the nation. This area has four of the ten largest airports, four of the eleven MetroPlex projects[[4]](#footnote-4), and four space ports[[5]](#footnote-5), while accounting for 19 percent of the country’s landmass and 75 percent of the Department of Defense’s (DoD) Special Activity Airspace (SAA).[[6]](#footnote-6) Significant changes continue to occur within the region’s airspace such as: exponential increase in the use of uncrewed aircraft (drones);[[7]](#footnote-7) implementation of new technology; introduction of military aircraft such as the F-35; and increasingly congested airspace. Improving access to the National Airspace System (NAS) is critically important for continued economic growth in the west.

“Resilient airspace” in the WRP Region is critical. It includes the following elements:

* A safe flying environment with the needed flexibility for users to complete their missions with the greatest harmony possible among users.
* All users having reliable communication, navigation, and surveillance.[[8]](#footnote-8)
* All users having a common set of public data that can be shared to enhance situational awareness.
* An opportunity for users to collaborate, share mission needs and concerns, and address them with regulating authorities in an efficient manner.
  + The ability to share real-time status to create an ‘info-centric’ NAS with improved flexibility and airspace access for all users.
  + Adapting to new technologies.

Issues of aviation and airspace sustainability have been important to WRP since its formation. For example, in 2015, WRP released a report titled “[Airspace Sustainability Overview](https://wrpinfo.org/media/1464/wrp_airspace_sustainability_overview_august-2015.pdf),” which highlights aviation encroachment/sustainability concerns and provides information on aviation coordination best practices and aviation resources. Accompanying this report was a fact sheet on [Meteorological Evaluation Towers](https://wrpinfo.org/media/1048/met-tower-fact-sheet-july-2016.pdf) (MET) and their impacts. Many of these issues, such as certain land-based development, continue to impact aviation. Many structures are built under 200 feet to avoid the FAA rule requiring coordination of any structure 200 feet or taller.[[9]](#footnote-9), [[10]](#footnote-10)

**Addressing Aviation/Airspace Needs to Enhance Resilience to Avoid Cascading Disaster**

Airspace is a finite resource and competition for its use is increasing. Having a resilient NAS is critical to the WRP Region. Preserving the safety of flight is crucial – this is a big issue across the NAS and more than just the NAS. It is critical to have dedicated airspace, which allows the freedom to maneuver, and the necessary spectrum to conduct the mission. The WRP Aviation/Airspace Needs Deep-Dive teamidentified three focus areas in the WRP Region to explore:

* Congested Electromagnetic Spectrum (EMS) as it Relates to Airspace
* Dynamically Managed Airspace
* Potential New Technologies/Entrants

The team met ten times since the last WRP Principals’ Meeting to fully explore these topics. This Chapter aims to highlight the importance of these issues and how they are interrelated, relevant information for policy makers, findings, and recommendations for the next WRP work year.

**CONGESTED ELECTROMAGNECTIC SPECTRUM (EMS) AS IT RELATES TO AIRSPACE**

**Issue:** Aviation operations depend on adequate and predictable access to EMS for communication, navigation, and air traffic management operations. EMS is a finite resource that is in increasingly high demand as new generations of networks are created to enable faster speeds and support more sophisticated devices. It is critical to ensure reliable/resilient communications/navigation systems for NAS users including DOD’s needs for spectrum operations.

Aviation relies on Radio Frequency (RF) spectrum. Civil aviation requires robust, reliable Communications-Navigation (COMNAV) capabilities to navigate in the NAS, and the military depends on access for its needs. The FAA secures, manages and protects aviation frequencies.[[11]](#footnote-11) By charter through the National Telecommunication and Information Administration (NTIA), FAA assigns, engineers and properly removes RFI from the environment for over 30,000 frequencies. The FAA is the second-largest consumer of RF spectrum (with DOD being first). Engineering RF spectrum is critical not only as it supports aviation functions such as communication, navigation, and surveillance but also heavily impacts international and domestic policy regarding radio-dependent aircraft systems. Segregated frequency bands assist in traffic control, navigation and surveillance. RF provides for collision avoidance and communication to maintain safe separation between aircraft and exchanging real-time data. Reserved frequencies assist swift response and coordination in emergencies, such as firefighting. The NTIA is responsible for federal users, including those using aviation frequencies, while ensuring minimal interference to federal bands.[[12]](#footnote-12)

FAA supports national security in many ways. Despite the ongoing evolution of Mode 5 technology and its integration into aviation systems, legacy systems continue to coexist alongside newer technologies. The FAA coordinates approximately 1,100 frequency assignments for DOD radar systems, about one-third of their work. Approximately 500 of those assignments are for electromagnetic capabilities, and an additional 600 for Identify Friend or Foe (IFF) radar systems. The FAA supports approximately 40 DOD multiplatform military exercise/event requirements annually. They are working with DOD CIO on a $16 Million effort that will maximize multiagency use of the 1030-1090 MHz range (including Mode 5 and Mode S). [[13]](#footnote-13) 5G C-Band (3.7 to 3.98 GHz) deployment raised concerns of potential interference with radio altimeters. The FAA worked with regulators and wireless providers to find an acceptable power level for 5G to operate near and around greater altimeters; this power level is included in agreements with wireless providers until 2028. They are working with the FCC to adopt the current power levels in 2028 and continuing conversations with FCC and AVS (safety flight standard subgroup). In the interim, the FAA participates in a 242 workgroup to prevent issues that occurred in the 5G deployment.[[14]](#footnote-14)

Radio Frequency Interference (RFI) is any unwanted signal disrupting a desired communication service. Common causes of RFI include faulty electronic equipment, such as noncompliant LED bulbs, illegal radio stations, arcing power equipment, poorly designed equipment, and natural sources, such as solar flares and atmospheric conditions. Roughly 220 RFI incidents are experienced monthly. RFI is usually unintentional, but occasionally the FAA is the victim of targeted attacks, including intentional frequency jammers and spoofing. Allocation of spectrum faces obstacles, with broadband commercial services encroaching into critical aviation bands like the 2.7 GHz and Air Surveillance Radar (ASR) bands. The proliferation of Wi-Fi technologies introduces interference issues that necessitate radar system filters. RFI incidents concentrate around congested areas, particularly airports, where 89% of issues arise due to the dense coexistence of wireless systems. Spectrum congestion intensifies with rapid technological advancements. In general, lower frequencies (ELF and VLF) are harder to jam due to their long wavelengths. Digital signals use digital modulation and can be spread across a range of frequencies, making it harder to pinpoint and jam a specific frequency. It is worth noting that many digital signal systems use newer adaptive techniques, such as frequency hopping, which also help to make jamming more difficult. HF systems are a bit easier to jam.[[15]](#footnote-15)

Aviation is also impacted by spectrum losses through spectrum repurposing[[16]](#footnote-16)/relocations. Spectrum congestion results not only from reduced access to spectrum, but also from usage volume and compaction as well as increasing data and data rate requirements from DOD platforms. Particular frequencies are allocated for certain uses, and their repurposing or sharing can have unintended consequences.

In November 2023, President Biden recognized the importance of RF spectrum, issuing a “[Memorandum on Modernizing United States Spectrum Policy and Establishing a National Spectrum Strategy](https://www.whitehouse.gov/briefing-room/presidential-actions/2023/11/13/memorandum-on-modernizing-united-states-spectrum-policy-and-establishing-a-national-spectrum-strategy/).”[[17]](#footnote-17) The Memorandum seeks to promote “efficient and effective spectrum use by both agencies and non-Federal users.” To that end, the Memorandum established “the Interagency Spectrum Advisory Council (Council) to serve as the principal interagency forum for heads of agencies to advise NTIA on spectrum policy matters and to ensure that all decisions made by NTIA take into consideration the diverse missions of the Federal Government.” The Secretary of Commerce, acting through the NTIA, is to develop a national strategy, including topics such as availability of spectrum resources, optimization of spectrum management, plans for investment in technologies and recommendations for developing spectrum access and increasing the efficiency of spectrum use. More details on this are available in The National Spectrum Strategy.[[18]](#footnote-18)

**DOD:** DOD test and evaluation activities rely on sufficient spectrum. EMS supports the execution of increasingly complex live fire test events as well as collection of test event data needed to assess performance in support of fielding new military systems. Spectrum helps produce realistic testing and training environments for DOD applications, which is needed to expand geographically and in volume to meet increasing requirements. DOD has the requirement for increased access to RF spectrum. Fifty years ago, warfare was kinetic (blowing stuff up); now spectrum is a large part of modern warfare, including requirements for airborne equipment, weapon/weapons systems, and deployment of personnel.

**Impacts:** Aviation (crewed and UAS) impacts from inadequate spectrum access include loss of mission (flight did not occur), navigation/communication interference, and safety issues. Issues extend beyond low visibility operations like the ground proximity warning system and can create false warnings.Not having the necessary EMS impacts DOD, FAA, and Civil Aviation. Generally, if Civil Aviation is impacted, DOD feels it as well, and there needs to be a balance. There are many different areas of spectrum where DOD testing and training and commercial and civil aviation will interact.

DOD: Adverse actions against the EMS, commercial development, and regulatory constraints impede the military’s ability to sense, command, control, communicate, test, train, protect, and project force effectively. Spectrum repurposing and sharing acutely impacts DOD’s capability to execute increasingly complex test events and collect test data, which is critical in evaluating the operational effectiveness and performance of new military systems prior to fielding. The collection of telemetry data, which is transmitted using electromagnetic spectrum during live fire test events, is critical to this evaluation. The command and control of test vehicles (e.g., surrogate enemy target launched from the test range) relies on RF spectrum for uplink/downlink communications. Similarly, test range mandatory safety requirements, such as the capability to command destruct an unsafe or off-nominal test vehicle in flight, rely on adequate spectrum availability. Of particular concern are the 3 to 4 gigahertz frequency bands, which are currently the focus of multiple spectrum sell-off and sharing initiatives, but also the range where many S-band military systems operate. Spectrum sharing and sell-off initiatives could potentially limit the capability to adequately test critical military systems. Unfortunately, spectrum repurposing from DoD to commercial wireless applications removes access to specific portions of spectrum bands required to support critical test requirements.

In the 2022 WRP Report, WRP recognized issues associated with Development of Counter UAS (C-UAS) State and Federal Policy.[[19]](#footnote-19) There is a need to quickly identify a possible threat through a robust drone detection system with directional triangulation.[[20]](#footnote-20) Drone detection through electronic notification, pilot reports, or controller observed instances are some key elements to detection and decisive counter UAS mitigation efforts. Challenges include UAS security (mostly clueless and careless UAS operators, but potential for nefarious operators as well)) when drones are flown in areas that cause disruptions (safety or economic).[[21]](#footnote-21) The term “[counter-UAS system](https://www.law.cornell.edu/definitions/uscode.php?width=840&height=800&iframe=true&def_id=49-USC-1792285287-545385599&term_occur=999&term_src=title:49:subtitle:VII:part:A:subpart:iii:chapter:448:section:44801)” (C-UAS) means a system or device capable of lawfully and safely disabling, disrupting, or seizing control of an [unmanned aircraft](https://www.law.cornell.edu/definitions/uscode.php?width=840&height=800&iframe=true&def_id=49-USC-154073366-272915540&term_occur=999&term_src=title:49:subtitle:VII:part:A:subpart:iii:chapter:448:section:44801)or [unmanned aircraft system](https://www.law.cornell.edu/definitions/uscode.php?width=840&height=800&iframe=true&def_id=49-USC-1898768347-272915541&term_occur=999&term_src=).[[22]](#footnote-22) C-UAS technology may be impacted by a variety of elements such as geography, type of aircraft, communications, and spectrum. There is a need to test, measure, and develop capabilities of C-UAS systems on ranges like White Sands Missile Range. The lack of authority or approvals to affect the spectrum environment impacts the ability to successfully test and develop either the system or the tactics to implement it. Many efforts are underway to create/refine new policies to better address C-UAS, but this proves challenging given the rapid nature of UAS development. Government funding can be scoped out years in advance, which might leave a gap if technology and threats continue to outpace government actions. This highlights the need for standards for C-UAS technology.[[23]](#footnote-23)

**Findings:**

* It is important to have redundancy and standardization regarding new technology. A resilient NAS can ensure the mission is still capable in case of intentional or unintentional spectrum interference in the GPS navigation system that would render the system unusable. Divestment of ground-based navigation aids, TACtical Air Navigation (TACAN), and very high frequency omni-directional range (VOR), Distance Measuring Equipment (DME), non-directional beacon (NDB), and primary/secondary radars use different frequency bands and operate differently. There is a massive expansion of operators using Automatic Dependent Surveillance–Broadcast (ADS-B) and similar as they increase the amount of remote, autonomous uncrewed assets, especially delivery vehicles that will be in the thousands in urban airspace, which has much potential impact to spectrum.
* It is recommended that lessons learned and subsequent recommendations are captured from the transition to 5G as they will be applicable to future technology roll outs.
* This is an area where technology needs to better address resource conflicts. There are many efforts underway. For example, NASA has been working in 5G with different modalities and methods for UAS traffic management and various degraded communications. The FAA is working on low altitude rules, right-of-way rules, shielding, detect-and-avoid requirements, conspicuity, what that will look like in the low altitude regime, and other associated technologies. On the eVTOL advanced mobility front, they have been approved to run a project with major eVTOL companies, looking at digital certification. These companies are running regular certification and working side-by-side with a digital certification to figure out a more expedient way to build tech certification and software upgrades through digital twins.
* Proper frequency management improves safety for crewed airspace missions, especially given the proliferation of uncrewed aircraft.

**DYNAMICALLY MANAGED AIRSPACE**

**Issue:** Dynamically managed airspace looks to foster partnerships and could lead to optimizing constrained airspace in a much more flexible, quick, and agile way.

Optimizing airspace takes automated and sophisticated air traffic control tactics and systems. Climate change and impacts from weather cause many airline delays. The WRP Aviation/Airspace Deep-Dive Team identified three areas within dynamically managed airspace to explore:

* Need for Enhanced Collaboration Among All Users
* Space operations (Space Ports, Rocket Launches, Commercial Space Vehicles)
* Greater DOD Airspace Needs

**Need for Enhanced Collaboration Among All Users.** Airspace is finite; creating collaboration is needed between new entrants and existing airspace users, with a focus on how restrictions, such as weather, rocket launches, missile launches, military activity, and staffing shortages, impact operations.There aremany government efforts underway to address dynamically managed airspace. Later phases should include the user community and provide for more expeditious, efficient, and flexible operations (responsive to weather demands, volume demands, DOD requirements for exercises, etc.)

Dynamically managed airspace could benefit wildland fire response and airspace deconfliction for the broader NAS. There are specific issues relating to wildland fire suppression efforts and interest in the safe integration of UAS (new entrants), especially with BVLOS operations in the low-level wildland fire flight environment and how to integrate them safely. WRP members noted that the FAA has helped in acquiring the frequencies needed for temporary flight restrictions or air-to-air or air-to-ground operations from a land management/wildfire perspective.[[24]](#footnote-24)

**Findings:**

* Issues are interrelated and can be handled in a convergent way to include building Uncrewed Traffic Management (UTM), Advanced Air Mobility and Counter-UAS capabilities into existing FAA Infrastructure like the Automated Weather Observing System (AWOS) and Automated Surface Observing System (ASOS) systems (this can be used to accelerate adoption and collect data).
* The importance of accelerating airspace to upgrade systems required to support sophisticated and safe operations building on the transportation infrastructure to support UTM, AAM and C-UAS operations.
* There is aneed for information on the real-time status of special use airspace.
* Getting a better operating picture and better data fusion in the right place at the right time and presented in the right way enables intelligent decisions on airspace. This includes coordinating emerging technologies that will help provide a safer and more resilient NAS as infrastructure is integrated.
* It is important to view the cumulative impact, whether from GPS testing, a large-scale exercise, bad weather, potential air traffic controller staffing problems, or testing of new missile systems. This can add up to something detrimental. Ways to help alleviate some of these concerns are employing the three C’s; communicate, collaborate, and coordinate. Everyone needs the most advance notice possible so there can be more planning.

**Space operations (Space Launches (Ports), Rocket Launches[[25]](#footnote-25), High Altitude Balloons)**

Space launches and re-entries in the U.S. have occurred for decades and supported national security, research, and commercial enterprises. However, with the expansion of private space operations, the number of locations now used for launch and re-entry operations has increased from just a couple each year to around 200 each year. According to the FAA, it has licensed 658 commercial space launches from1989 to present. Of that number 117 were in CY2023 and 35, have occurred CY2024. There have been 44 FAA Licensed Reentries, of which seven were in CY2023 and 4 thus far in CY2024.[[26]](#footnote-26)FAA is forecasting launch and re-entry activity to increase to a range of 123-288 by FY2027, primarily from reusable vehicles and human space exploration.[[27]](#footnote-27)

There are 14FAA Licensed Spaceport Operators, of which SpaceX has the bulk of operations.[[28]](#footnote-28) The sites with the most launch activity are Cape Canaveral, Florida, followed by Vandenberg, California.[[29]](#footnote-29) This dramatic growth of space ports poses encroachment on both military and civil aviation. DOD and Space Force recognize this increase in commercial space operations and the role they play in national defense.

On April 2, 2024, the Secretary of Defense released a “Commercial Space Integration Strategy” that recognizes the opportunity presented by the commercial space sector and outlines how commercial space operations may be integrated into and enhance DODs interests in space-based services.[[30]](#footnote-30)

Airspace resiliency must consider demand versus capacity while providing equal and safe access for all. Private, commercial space enterprises in non-traditional locations seek access to the same airspace for their missions. Many municipalities view space ports as an economic benefit. Long-established East and West Coast ranges are impacted by the growth of new entrants to the space launch industry, affecting both DoD operations and civil operations in the NAS. Space ports are popping up in random places,[[31]](#footnote-31) impacting both DoD and civil operations throughout the NAS.Combining rocket launches with some of the DOD’s needed range access further congests airspace.

Notification regarding rocket and missile launches is important. FAA sends System Impact Report (SIR) and is somewhat antiquated and does not include graphics. It is difficult to visualize impacts and how they relate to other airspace closures and restrictions.

**Impacts:** Space operations take a considerable amount of airspace for launch and recovery, which impacts existing routes. If a space launch is cancelled at the last minute, it already has impacted general aviation. Multiple things occurring at the same time become a major problem as they may not be well coordinated. Short notice of rocket launches (one day or less) makes it difficult to plan. Some of the ATC initiatives or tools to mitigate airspace constraints result in delays which in turn result in cost. Launch windows vs. launch time are causing inefficiencies and delays. Executing DOD test events on schedule is impacted by limiting the available test windows. An example: test events involving live missiles must be closely coordinated with FAA. Small delays or deviations in the execution schedule can result in loss of airspace window and test delays. EMI conflicts from space operations further limit the amount of time and test window to execute on schedule.

Due to the nature of rocket launches, there is not always a precise window of impact as it can range from four to eight days. The area of impact and the re-entry area can fluctuate on the day of the launch because of orbital patterns around the earth. Another problem is instituting routes to block off the hazardous area so there is not a conflict. Canceling a launch at the last minute creates a problem because the airline has taken the delay, burnt extra fuel, and inconvenienced some passengers for an event that did not happen.[[32]](#footnote-32)

Members of the Deep-Dive team discussed some of the technical limitations of FAA’s System Impact Report to include (standardized) graphics to help provide advanced notice of particular space operations. There is a recognition that part of the issue may be a result in a gap in the data provided by the launch user itself. A live updating chart, a graphical NOTAM showing the ATCAs and TFRs, especially showing launches and recovery, helps provide a clearer picture of impacts before it is too late (e.g., before passengers are boarding the airplane). This would allow all airspace managers to reference and ensure they are tracking the event, add clarity to the process, and efficiently aid those who need to know. This is a systemic issue larger than WRP and the FAA is working through these issues. There are several Space Launch webpage resources,.[[33]](#footnote-33) Plan, Execute, Review, Train and Improve (PERTI) Advance Planning document that is disseminated every day from ATO SysOps has also proven to be helpful.

**Findings:**

* There is a need for better awareness for all users in a timely fashion when launches are occurring and an understanding by new users of impacts to the NAS.
* There is a need for continued consistency and coordination with all entities regarding environmental impacts from a regulatory perspective.
* As new spaceports come in, encroachment on airports and airspace must be considered.
* In general, DOD (USSPACECOM and USSF) supports growth of US space ports to spur competition and expand launch capabilities, but there is an encroachment concern with impacts to military training airspace and civil aviation impacts.
* Government-sponsored missions and launches and re-entry for national security and general public benefit should be given higher priority access to the available airspace than commercial launches and re-entries, which should be treated like other commercial aviation operations.
* New technology enables growth in space launches/crafts not previously considered or common within the WRP region such as space capsules.

**Greater DOD Airspace Needs**

The WRP Region has critical DOD training ranges, premier testing facilities, and unmatched airspace to meet DoD needs. For the services, it includes:

* Approximately 55% of the Army’s landholdings
* Over 33% of Navy’s landholdings
* 85% of Marine Corps’ Live Fire Rangesand67% of Marine Corps’ airspace
* Four of the largest Air Force range complexes: Edwards Air Force Base (AFB); Nellis AFB/Creech/Nevada Test and Training Range (NTTR); Luke AFB/Barry M. Goldwater Range East; and Utah Test and Training Range (UTTR)
* 75% of DoD Special Activity Airspace (SAA) is located within the WRP Region

ForDOD to accomplish its mission, it needs access to airspace, especially with newer aircraft. The current airspace model was built around WWII to accommodate 4th Gen aircraft weapons systems, and decades-old artillery systems. Longer range weapons, sensors, advanced aircraft, and modern ground, air, and space-based communication platforms were not considered. 5th and 6th generation aircraft (F-35/B-21) need larger volumes of airspace with higher ceilings, additional low-level airspace, and greater attributes (supersonic, spectrum, etc.). As a rule, most aircraft-related military operations are performed in strictly defined airspace, designed to accomplish any of several objectives. Typically, the following types of airspace are employed: Restricted Areas (RAs), Military Operations Areas (MOAs), Military Training Routes (MTRs), Warning Areas, and Air Traffic Control Assigned Airspace (ATCAA). There are basically three types of air events normally conducted by the military in such airspaces: test and evaluation (T&E), training, and operations.

Dynamic airspace and dynamically managed airspace have great potential to assist DOD airspace operations. This operational tool to manage airspace could provide the flexibility needed to assist all users of the NAS. Dynamic airspace is working towards real time deconfliction instead of blocking a piece of airspace (e.g., for 12 hours a day). This would provide for high impact, high intensity, high payoff uses for shorter, less frequent interruptions for test and training events.

Virtual (simulator) training only gets DOD so far; there is a need for live airspace to put the strains of the environment on the aircrew. Possibly fitting more realistic training into limited airspace resources within the constrained NAS must be evaluated.

An example of the DOD mission: The Nevada Test and Training Range (NTTR) is trying to integrate multiple ranges to replicate threats faced by warfighters. Peer competitors can employ large numbers of fifth-generation aircraft, along with integrating them with their ground-based air defense assets. This cannot be replicated on any one range, except on a small scale. One issue is the ability to have two forces (i.e., red, and blue force) with enough aircraft to replicate the long-range threats faced by new air-to-air and ground-to-air missile systems. The integration of ranges also tests the logistics required to support these forces across the vast distances faced in current wartime scenarios. NTTR is putting together working groups to best address the challenging use of airspace in the Western Range complex in a manner that replicates the threats warfighters needed to train DOD warfighters.

Between the DOD ranges is “regular” NAS airspace, which funnels most commercial airspace, as there are only so many ways to fly between locations. Currently, military aircraft can only transit between the different ranges in a non-maneuvering straight and level profile, which is suboptimal for DOD. As the southwest population increases, airlines have equity in the process of figuring out how to move people and continue commerce. Nellis (57thWing) has entered into a Cooperative Research and Development Agreement (CRADA) with a commercial entity to look at how to share data on airspace utilization.[[34]](#footnote-34)

**Long Range Airspace Corridors (LRAC)**. Requirements for testing continue to expand in all domains as the ranges of weapons increase and systems and tactics grow increasingly complex. The shortage of airspace for testing new weapons is a pressing issue. As noted in the 2022 WRP Report, DOD is looking into the development of long-range overland corridors.Within the United States, the western region offers some significant opportunities to create routes necessary to support flight operations of these systems. There has already been successful long-range testing in the WRP Region oftentimes through connecting and stitching ranges together.

One concept to help collaborative thinking on what might be possible is called the Joint Air Traffic Control Airspace (JATCAA). The JATCAA concept aims to combine the ATCAAs (ATC Assigned Airspace) along the southern border with the MOA Jackal to create a JATCAA that would leverage all the airspace in Arizona for training purposes. This concept is still in the early stages and would require collaboration with key airspace players (Luke, Davis-Monthan, Fort Huachuca, National Guard, etc.) and work with the FAA to establish JATCAA for bridge strategy (surveys, EAs) and for LOA combining ATCAAs into a JATCAA, and to develop dynamic scheduling.[[35]](#footnote-35) A joint initiative requires validation from the services first.

To further understand the issues and dynamics of DOD’s need for LRAC, a DOD-only WRP Airspace/Aviation call was held in January 2024 and consensus was reached that this was a DOD action item. WRP is standing by to assist with future collaboration between stakeholders, as needed.

**Impacts:** Peer competitors do not have the same level of scrutiny, bureaucracy, and policy debates on how to meet readiness, evolve warfare, and test weapons and capabilities. DOD is under much scrutiny to make sure it is done right, safely and without overly impacting the flying public, commercial or private. DOD will continue working with the FAA, other NAS users, and underlying land managers to develop a path for successful vehicle testing with minimized impact to the NAS and surface environment. There are many discussions on this subject, and they are evolving from warfare capabilities so quickly that they are trying to keep pace with peer competitors by creating many proposals.

With budgetary restraints, the ability to employ and deploy hypersonic[[36]](#footnote-36) testing becomes much more challenging. With these potential budgetary constraints, there will likely be fewer test and training events and those events become even more critical.

**Findings:**

* DOD Long Range Airspace Corridor (LRAC) Needs. DOD will continue efforts to coordinate amongst the services to develop solutions to best address DOD LRACs, and will share with the WRP for collaborative support, as appropriate.
* Challenges to consider include looking at route design that balances long-range system requirements with other operations in the NAS. The need for necessary infrastructure (e.g., communications, instrumentation, etc.) and conduct environmental analysis.
* DOD has need for more robust, more geographic dimensions, altitudes, etc., to test and train with modern technology or advanced capabilities.
* Dialogue through avenues like WRP enables input and understanding from the user community that allows them to take the information back to intergovernmental conversations as they develop possible proposals and potential solutions.

**Potential new technologies/entrants.** NAS continues to support new technology and entrants but that must be balanced among the many and varied users of the NAS. According to the FAA, it daily provides air traffic control for more than 45,000 flights carrying 2.9 million airline passengers across more than 29 million square miles of airspace.[[37]](#footnote-37)

UAS[[38]](#footnote-38) use continues to grow exponentially and conduct many new innovative missions.

For five years, there was a missed opportunity to get advanced technologies into the FAA Reauthorization bill to enable more uncrewed systems, beyond visual line of sight, and counter-UAS research and development. UAS, when flown outdoors, operate in the NAS, and are thereby subject to FAA regulation. As of March 16, 2024, all drones (regardless of type, business, public safety or recreation) must operate in accordance with the Remote ID rule including registering the drone.[[39]](#footnote-39) As of 12/31/23 the FAA has around 800,000 drones registered[[40]](#footnote-40) and is the fastest growing segment of aviation in the U.S. The FAA forecasts growth in the recreational small drone fleet from the present 1.69 million units to approximately 1.82 million units by 2027.[[41]](#footnote-41)

New technology enables flights that were not possible previously. For example, in November 2023, a Cessna 208B Caravan flew pilot-free over San Jose.[[42]](#footnote-42) In July 2023, the FAA released the FAA Advanced Air Mobility (AAM) Implementation Plan[[43]](#footnote-43) to address advanced technologies including electric aircraft, or electric vertical and landing (eVTOL) aircraft, with a pilot on board in passenger-carrying or cargo operations. FAA expects AAM will enter into service (EIS) sometime around 2025- 2026, with the first five years providing a growth period allowing for working out various issue as business feasibility of the technology is tested. More service expansion is expected into the 2030-2040, period, with a sustainable, long-term growth coming thereafter.[[44]](#footnote-44)

New technology within the next five or ten years will broaden access to the aviation system, changing it in a way not seen since the late 1950s with the advent of commercial jet aircraft. The entire aviation system was reimagined, from airspace, airport infrastructure, terminals, environmental and noise concerns, and fueling infrastructure. Currently, airlines cannot feasibly service small communities with little traffic. New types of aircraft, like battery electric powered airplanes, or new technologies, which include battery, electric, hydrogen, hybrid fuel cells, or sustainable aviation fuel, will change the way airplanes are powered in a cleaner, more efficient, and less expensive way, and potentially increase opportunities to smaller markets. A battery and electric powered aircraft can be configured for commuter traffic, cargo, or executive travel. Additionally, planes with nine seats can be flown with a single pilot and avoid the expense of TSA security (cutoff is ten seats), reducing costs and opening markets not previously feasible. The potential of a battery electric aircraft might minimize noise and the environmental footprint, lower the cost of flight training and potentially move the whole industry forward. Electric motors are not subject to density altitude restrictions like internal combustion engines. A challenge with battery electric aircraft is getting megawatt level power to an airport for charging. This will take a partnership with the federal government, Department of Energy, local utilities, and aircraft manufacturers.

There are long-term opportunities around sustainable aviation fuel, which is manufactured from waste byproducts that do not have a fossil fuel base and can lower the carbon footprint of aviation. Colorado Division of Aeronautics partnered with the National Renewable Energy Lab (NREL) to conduct a study[[45]](#footnote-45) looking at technology around alternatively powered aircraft, including battery-electric, hydrogen-hybrid and sustainable fuel technologies. The study will investigate regional air mobility, where people move within Colorado, where new aircraft technologies might align with their movements, and how the state’s existing system of airports can support these new aircraft and broader mobility. Although the aircraft technology is not here and certified, infrastructure needs to be planned if not somewhat in place.[[46]](#footnote-46)

It is anticipated there will be dramatic changes in emerging technologies and UAS space launch recovery within the next five years. The interests of crewed aviation with implementation of UAS and UAM into the NAS must be considered.

**Findings:**

* There is a need for a resilient, integrated NAS to enable safe and equitable use shared by diverse users. New technologies, regulations, policies, safety mitigations, etc., should not compromise safety, reduce availability or increase costs for the present and future generation of pilots and operators. All airspace and community stakeholders must be involved to ensure cooperation.
* New airplanes, like battery electric powered airplanes, or new technologies, which include battery, electric, hydrogen, hybrid fuel cells, or sustainable aviation fuel, will change the way airplanes are powered in a cleaner, more efficient, and less expensive way, which will increase opportunities. Quieter aircraft capabilities could adjust some of the flight paths that were once deemed inappropriate or unsupportable over certain areas, which might free up some of the congestion.
* Demand to accommodate technologies that are coming online sooner rather than later; they are not quite able to provide the amount of airspace needed for testing.
* A physical Uncrewed System (UXS) platform cannot carry out effective missions without the necessary supportive systems and technologies.

**RECOMMENDATIONS FOR WRP ACTION:**

* WRP to continue to be an effective forum and inform/set the stage for decisionmakers, noting the conflicts and priorities that need to be addressed on these issues. WRP to keep aware of new technologies/entrants.
* WRP to identify outcomes from relevant studies (ASSURE, [[47]](#footnote-47) NASA, etc.) that could help ensure sufficient access to spectrum for aviation operations. Appropriate (publicly shareable) information could be summarized and shared in the 2025 WRP Report.
* WRP to stay informed of efforts relating to Dynamically Managed Airspace and share publicly available information and serve as an effective forum.
* Invite FAA and other appropriate subject matter experts to highlight growth of current and new Space operations and locations (Space Launches (Ports), Rocket Launches, High Altitude Balloons) and opportunities to deconflict mission impacts.
* Continue to be aware of DOD Airspace Needs.

## **Water Security/Resilience**

**Background**

Water resource planning within the WRP Region is not for the faint of heart. The WRP six-state region is home to almost 20 percent of the U.S. population and 20 percent of its landmass but has only about 3 percent of the surface water of the lower 48 states.[[48]](#footnote-48) Planning challenges include unpredictable climate and extreme weather events, competition for water rights, aging and inadequate infrastructure, changing regulations and population and economic growth. Each of the WRP states has developed its own plan for dealing with water sustainability, and these plans vary according to the challenges faced in each state. Extreme events, including floods and drought, drive the need to plan and manage water systems and require a watershed-scale approach to assess vulnerability and find solutions.

For purposes of this report “Water Security”means having access to a reliable and affordable supply of water that is of suitable quality for its intended uses. Elements that assist in the establishment or recognition of water security include: (1) adequate and readily accessible data and predictions on water availability and infrastructure; (2) appropriate policy planning and implementation; (3) laws and regulations to promote water security; and (4) identification of best practices and implementation of new technologies that reduce water demand, increase and protect water quality and quantity, reduce flood risk, and enhance ecosystems.

**Water Resource Planning and Management Amidst Extreme Events**

This effort builds off the WRP Water Security effort completed in 2022, [[49]](#footnote-49) and this chapter outlines ways that WRP partners might work together more effectively. The Water Security Deep-Dive Team met eight times since the last WRP Principals’ Meeting to explore water resource planning and management more fully amidst extreme events.

Water is a global security issue. In addition to sustaining life, there are many competing uses and users that create significant short- and long-term security implications when water is in short supply. Water is important for such diverse needs as fighting fires, irrigation projects, Native American reservations, the national food supply, functioning industries, ecosystem health, and military operations in the western U.S. This section outlines select risk categories relating to water. For each category, it provides background information, issue definition, and findings. and identifies opportunities with a focus on cross-cutting programmatic issues. Risks to water supplies may be categorized as (1) complexity of regulatory laws and water resource management; (2) weather; (3) infrastructure; and (4) water quality.[[50]](#footnote-50)

**RISK CATEGORY: COMPLEXITY OF REGULATORY LAWS AND WATER RESOURCE MANAGEMENT.**

**Background:** The 2022 WRP Report provided a foundational overview of the complexity of the water laws and regulations that fall under various jurisdictions. While the administration and allocation of western water is largely governed by the states, the federal government plays an important role in the distribution of water associated with its reservoirs and dams and for federal purposes such as for parks, military, forests, wildlife species, and tribes. The federal government holds both state-law based and federal reserved water rights on federally-managed lands.[[51]](#footnote-51) Tribal water rights, which are often also federal reserved rights, may be quantified through basin-wide adjudications or negotiated settlements and generally must be authorized by Congress. For states, issues such as quantifying water rights for Tribes and federal lands are important considerations for determining the security of future water supplies, as federally-managed lands make up a significant percentage of lands across the West and include vast amounts of water, often with early priority dates that are senior to many other water rights holders.

Legal doctrine of water law is split in the U.S. The eastern U.S. generally uses a riparian system, and landowners get a reasonable share of water; in times of shortage, landowners share water reductions. The prior appropriations laws evolved differently in the west, where surface waters were often diverted significant distances and applied to beneficial uses far from their source. For example, in the 19th century, Californian miners needed water to mine gold. Water was not always readily available near the mines, and the miners often had to transport water long distances to facilitate mining operations. Thus, the western U.S. evolved into a first in time, first in right system with the state having primary authority (although some western states employ a mixture of other water law doctrines). The application varies by state, but generally senior water users may be entitled to their flow right allocated for their beneficial use even in times of shortage; there is no sharing among water users. In the west, most sources are fully-appropriated, even in wet years. During dry years, when there is a shortage, the junior water rights holders may be curtailed, receiving only a portion or none of their water right. The system has created certainty for the allocation of water when it is available and has worked for more than a century. Many compacts, contracts, settlements, and other water agreements have created additional divisions of water resources. Such agreements are often based on the assumption that climate and hydrology would remain relatively constant. However, the variability of these systems challenged this assumption.[[52]](#footnote-52)

Federal agencies are not accustomed to asking states for a permit or to comply with state law, but Congress recognizes that states have the primary authority over the allocation and administration of water within their borders.[[53]](#footnote-53) A lack of understanding of this long-standing deference, and the complexity of laws and historic water uses across different western states, can create risks for those in need of water to accomplish their present-day purposes. While most western states share common principles for their systems of prior appropriations, each state approaches the administration and allocation of water in its own way. For example, each state has its own requirements for obtaining a water permit, certificate, or license. All states recognize historic uses. Many western water rights were developed before the territories became states, and before standardized administrative processes were developed. Often, there is no supporting paperwork, permit, or decree for these pre-administrative rights , but states still recognize these historic water rights. Federal agencies control, manage and own vast lands across the west, the agencies need water to fulfill their responsibilities, and they often need to participate in the state administrative and adjudicative processes when there is a valid waiver of sovereign immunity. For a state basin-wide adjudication that complies with the provisions of the McCarran Amendment,[[54]](#footnote-54) if federal agencies do not file their claims in a timely fashion, then the water right may be lost. Water rights adjudications often take decades to complete. While water rights settlements can provide an appealing alternative that enables the parties to construct their own solutions to limited water supplies, water rights negotiations often begin with parties holding deeply opposing positions.

**Issue:** Today’s water policies, laws, regulations, data, and tools were frequently developed in isolation from one another. This creates a systemic challenge requiring significant time for proponents to plan, fund, permit, and implement multi-sector, multi-benefit projects, particularly where those projects cross political boundaries.

In the West, tension among water users is common where water supplies are limited. For example, the federal government is required to safeguard its water rights on federal lands as these rights are considered property rights needed for federal purposes. The federal government must also claim its historic water rights when properly joined in general stream adjudications. Other non-federal users or claimants to water rights may be skeptical of the federal government’s motives in doing so. For example, ranchers who graze livestock on federal grazing allotments may claim stock water rights under state law, challenging federal ownership of such rights because it is the rancher’s stock that are putting the water to beneficial use, an inextricable component of any water right in the West. Conversely, it is often the federal government leasing those lands for grazing that is in the best position to provide the continuity needed so that those water rights (and their critical priority dates) are not lost through non-use.

Population growth in the southwest needs to be accounted for to ensure water security. This disconnect between water policy, water shortages and population increase needs to be more holistically considered and addressed.

Most state and federal agencies recognize the value in having data of the right temporal and spatial scale to make better short- and long-term decisions about water. This data is crucial for the western states to manage their limited water resources.

There are many data and science related resources to assist with the complexity of water rights and water resource management. In 2024, the [Western States Water Data Access and Analysis Tool (WestDAAT)](https://westdaat.westernstateswater.org/) launched and provides key information on water rights data.[[55]](#footnote-55)

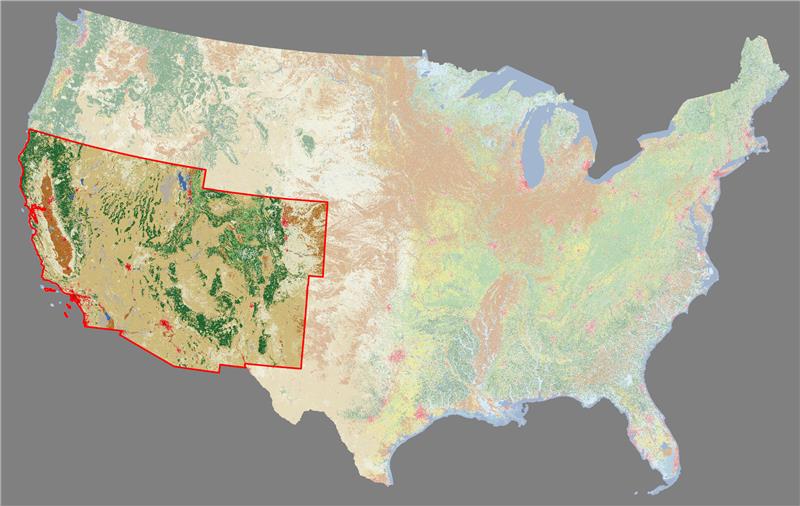
The USGS Drought Science Initiative in the Colorado River Basin (ASIST) science and technology framework focuses on connecting programs, partners, and projects. A focus of ASIST is to collaborate with partners and communicate science to promote better outcomes through science partnerships. Through partner feedback, USGS wanted to ensure that when it communicates about science, particularly for the Colorado River basin, the information is discoverable by all groups. With this feedback, USGS created a special [website](https://www.usgs.gov/special-topics/colorado-river-basin). From these conversations, USGS developed three priorities in connecting science to help mitigate drought:

* Timely, findable, and accessible science delivery.
* Science interpretation, synthesis, and storytelling about science.
* Platforms supporting communities and two-way communications.

USGS created a Science Portal to communicate current conditions continuously for many different systems. Before the creation of the Portal, much information on different trends and current conditions existed but not necessarily in a single location that fully describes the landscape. The Portal content includes trends and cascading landscape impacts; science for various uses (story telling); and community-driven content (two-way communication).[[56]](#footnote-56)

***Map provided by USGS and is based on NLCD 2021.***

***There is approximately 12,500 sq km of surface water in the 6-state region. This is approximately 3% of the water pixels in the 2021 CONUS map.***

**

**Findings:**

* At times agencies are inundated with data, yet there remains a need for reliable, continuous, accessible, and sufficient data to address various issues, including: administering state and tribal water rights, evaluating beneficial water use, estimating water use by invasive plants, mapping evapotranspiration and consumptive water use, planning future municipal water use, forecasting and mitigating droughts and floods, monitoring instream flows, and protecting aquatic species.[[57]](#footnote-57)
* Recommend using the “*Tools and Funding Opportunities*” created by USGS, which includes Federal, NGO, and Foundation tabs to indicate funding opportunities and additional information including the name of the program and fiscal year offering. The Tools tab lists agency tools that may be applicable to the specific area of interest and/or state. Each of the six states in WRP have a tab showing state offerings and grant opportunities.[[58]](#footnote-58)
* The importance of having good data from multiple sources to perform long-term planning. Multiple time scale of water resource data should be evaluated to help with accurate planning (e.g., both short- and long-term hydrology data and trends should be considered during planning and implementation.)
* A critical component to improving data collection and ensuring agencies have the needed staff and resources to make data accessible has been state and federal legislation to authorize and fund these agencies’ collaborative work. Sometimes, authorization comes many years before the funding.
* Future difficult technical and policy decisions will be required on several subjects, including local land use, root issues, and what can be problem-solved through infrastructure versus policy conversations around growth and development. Accounting for economic growth includes municipal, agricultural, and other uses, but does not always account for ecological needs.
* It is important to engage locally and collaboratively with utilities, municipalities and the public, and for planners to take water supply into consideration.
* There is a need to consider different jurisdiction and agency perspectives. For example, municipal land planners may be more focused on tax base instead of water supply.
* Population growth and policies supporting growth should be considered along with climate change and wildfire impacts; not doing so could exacerbate water insecurity.
* Specificity in planning documents is necessary between federal, state, tribal and local agencies for flood management and stormwater capture for both quality and quantity.
* Successful groundwater management and restoration requires coordination at all levels (e.g., city, county, tribal, etc.).
* Governments and agencies are encouraged to identify secondary and tertiary benefits in potential projects to leverage funding from multiple sources and maximize funding and environmental benefits.
* Dialogue and conversations to improve relations is very important to reach settlements, and the WRP meetings offered a great chance to initiate those conversations.

**RISK CATEGORY: WEATHER AND CLIMATE**

**Background:** Extreme events can lead to cascading impacts that require complex management paradigms.

Recognizing this variability and trying to develop a holistic approach can help state, federal and tribal authorities and private parties prepare and utilize these extremes for mutual benefit Opportunities exist to leverage public funding sources (e.g., federal, state and local) to identify how legislative authorities and planning activities can be more synergistic.

Related to real-time operations, select facilities in California have tested and implemented Forecast Informed Reservoir Operations (FIRO)[[59]](#footnote-59) to operate reservoirs more effectively by taking advantage of better information in storm and atmospheric river forecasting. It enables operators to lower surface reservoir levels in advance of a storm, sometimes in conjunction with managed aquifer recharge, (Flood-MAR), to reduce flood risk, while maintaining water conservation storage for water supply and environmental purposes during dry periods. FIRO is a decision support tool for water managers to help them balance the multiple authorized purposes these reservoirs serve.

**Issue:** Water policies are often based on historical hydrology and do not account for changes in climate and extreme events (such as more frequent floods and longer and deeper droughts). These changes create challenges and opportunities for managing the quantity and quality of surface water, groundwater, and ecosystems. Management of groundwater may be limited by adequacy of information on aquifer characteristics, groundwater levels and management activities.

Cascading events can have detrimental and cumulative impacts on engineering and natural systems. Some examples of cascading events include a heatwave alongside drought; intense rain (after snowpack melting); and wildfires after flooding. Changing climactic conditions and aridification may be addressed differently than short-term or flash drought.

Drought, wildfire, and debris flow events can lead to compounding flooding, and season run-off after wildfires can be especially concerning. [[60]](#footnote-60) Many studies show the impacts to source water quality from different extremes of fires (prescribed burn versus a moderate or intense fire). An example of a cascading event related to these characteristics would be drought leading to higher wildfire risks for fire, wildfire leading to higher mud or debris flow risk; and mud or debris flow following heavy precipitation leading to higher invasive species risk.

Multi-year droughts are difficult to discern from a potential new normal for the local climate. This is made yet more difficult by the variance of conditions from extreme drought to extreme wet. While scientists and engineers must continue to plan to use all available tools, the use of historical information to forecast future conditions should be done cautiously. Additionally, gathering information regarding the full picture of the water balance is made even more challenging due to the changing climate conditions.

Parameters like free water surface evaporation, plant evapotranspiration, and canal seepage are difficult to measure, but represent an important part of the water balance. As a result, these parameters relate to water security and should be considered during water planning initiatives.

An example to illustrate the importance of these parameters, in August 2022, Governor Newsom’s administration published a report titled, “California’s Water Supply Strategy - Adapting to a Hotter, Drier Future”[[61]](#footnote-61) founded on the observation that with the hotter, drier conditions, more soil moisture is being evaporated/transpired resulting in less runoff for similar precipitation events because some precipitation is going to recharge the depleted soil moisture.[[62]](#footnote-62)

Water in canals can be a sensitive area as some of those waters are claimed as water rights. If someone has a water right in a canal and they feel they are losing some of their water, they may want to line the canal. There are other considerations on how that will affect groundwater, but also how it will affect their water rights.

**Findings:**

* One goal should be to implement policies and projects to alleviate future disasters. For example, the California Department of Water Resources’ expediting ground water recharge during wet years. These projects can reduce flood risks in wet years while increasing water resiliency in dry years (e.g., flood managed aquifer recharge.
* Communicating the risks managed by water planners and how drought is characterized across differing time scales, definitions and drought indicators is challenging.
* Changing climatic conditions and aridification may be addressed differently than short term or flash drought.
* The federal government should continue working with stakeholders on a watershed basis. This helps recognize potential barriers to implementation, in areas such as conservation, stormwater capture, groundwater cleanup, desalination, water treatment, water transfer, etc. The Bureau of Reclamation’s Basin Study Program is one example of how this type of collaboration can work.[[63]](#footnote-63)
* As technology improves and weather and climate knowledge grow, water managers must continue to evolve their decision-making processes to take advantage of this new knowledge and apply it at the watershed scale across sectors (e.g., floodwater, groundwater, and ecosystem*.)*
* Capturing and storing stormwater for subsequent reuse in most locations requires new infrastructure that is expensive and may be difficult to site. Further, in most states, stormwater runoff is an important component of a region’s total water resources, and its capture and reuse may require acquisition of water rights. There are many tools for groundwater resilience including managed aquifer recharge (dedicated recharge basins, on-farm recharge, in-lieu, and floodplain inundation); water trading programs; zonal management; and strategic land repurposing.
* Recognizing major floods and droughts will occur and developing a holistic approach can help prepare for these extremes. Opportunities remain to leverage federal funding in conjunction with state funding programs and identify how authorities and planning can be more synergistic.
* It is important to connect flood and drought management as two parts of a whole to reduce flood risk and increase water security. Water security and drought preparedness are major parts of this, requiring collaboration among water sectors.
* Align federal, state, tribal, and local planning documents for flood management, water quality. This may also assist with financing and funding of projects in different sectors.
* Financing/Funding: Federal agencies coordinate projects with multiple benefits; improved coordination would better enable funding these types of projects.
* Federal agencies continue to work together, and opportunities exist for more collaboration with state, local and tribal entities. Water management planning could be more impactful if agencies are willing and able to plan and coordinate systematically funding projects.
* Removing barriers so federal agencies can aid quickly. Watershed assessments throughout the West will improve our understanding of what to expect. Future drought studies must evaluate future climate and hydrologic scenarios to determine what issues exist and how they can be alleviated. Additional mechanisms could be identified that provide rapid response for communities experiencing drought. The best drought responses alleviate immediate problems and lay groundwork to mitigate the next drought. Work today on water security is very consequential and will position Western states for more effective drought responses.
* There is a need to address tribal water rights to provide certainty for all water users. There are hundreds of tribes with unresolved water rights. Individual Indian allotments are also entitled to settled water rights under the *Winters* doctrine.
* Contaminants from wildfire are detrimental to the water and ecosystem. Develop or identify best practices to protect the future of the ecosystem and associated resources.
* Under California’s Sustainable Groundwater Management Act (SGMA), there is a new appreciation and understanding that unlined canals act as groundwater recharge basins.

**RISK CATEGORY: INFRASTRUCTURE**

**Background:** Community water infrastructure “includes all the man-made and natural features that move and treat water. While holistically it is all part of the same system, it is often convenient to think about infrastructure in terms of drinking water, wastewater, and stormwater.”[[64]](#footnote-64)One can identify different components when evaluating water infrastructure used for agricultural purposes (e.g., storage water, conveyance water, crop water, and return flow water), but all these components are interconnected per the above definition.

The U.S. Army Corps of Engineers (USACE) is working on managed aquifer recharge in Southern California in collaboration with Los Angeles and Orange Counties. Specific activities include coordinating the releases from USACE dams with the Counties so they can take advantage of aquifer recharge.

Land subsidence through aquifer depletion can result in permanent changes as soil subsides (collapse and consolidate.) This can cause inefficient operation or damage to infrastructure in the vicinity. Population growth in the West continues to stress water systems. Planning for growth is increasingly important to ensure a resilient water supply. If the supply is threatened, there can be unanticipated costs to source other water.

Though outside the focus of this report, these events affect other sectors of society. For example, the insurance landscape in the United States faces many uncertainties. Collectively, this uncertainty has resulted in stress on insurance markets or, in some cases, insurance companies leaving select markets (e.g., California ).

**Issue:**

* Loss of infrastructure (natural and built) has a cascading impact on the community.
* Maintenance and rehabilitation of existing natural and built infrastructure.
* Aging built infrastructure can require major upgrades or replacement. Need to address financing of costly upgrades and new physical structures.
* Need to perform preventative and corrective maintenance on built infrastructure and rehabilitation of natural infrastructure.
* Operation of infrastructure under existing climate conditions. Some current infrastructure was designed under different climate and hydrology assumptions. Periodic reviews are necessary to ensure these facilities continue to meet design and safety requirements.
* Wildland fire and post-fire impacts can place stress upon aging water infrastructure.
* There remains a need for clean drinking water in the West, especially in tribal and underserved communities. Fulfilling this need requires consideration of new and modernized infrastructure for moving water and water treatment.

**Findings:**

* The importance of utilizing natural infrastructure, also called *“*engineering with nature” or “nature-based solutions.” The Pajaro River Levee system in Monterey County, California, and the Upper Guadalupe River in San Jose, California, are examples of setback levee projects. These projects use the natural features and expand the floodplain to reduce water velocity and obtain percolation benefits. This approach is a long-term strategy and promotes flood resiliency as a solution for flood risk management.
* Excessive groundwater drawdown has potential impacts on infrastructure and the reduction of future water storage capabilities. Aquifer storage and recovery has the potential to capture water underground, reduce subsidence, and provide water supply during drought.
* Infrastructure assets have diverse ownership. These owner entities are responsible for managing the interconnectedness of their infrastructure assets with other relevant owner entities.
* A systems approach for operations and maintenance may help with water management planning and funding.
* The loss of infrastructure (natural and built) has a cascading impact on the community.
* Recognize the importance of indigenous knowledge. Application of traditional customary practices, native materials, restoration of watersheds, conserving storm water flows and recharging aquifers are all a part of indigenous knowledge that extends beyond water resource management to wildland fire and other practices. The tribes have ongoing initiatives to support these efforts.

**RISK CATEGORY: WATER QUALITY**

**Issue:**

* There is a need for water treatment facilities to treat contaminants that may not have been considered in the original design.
* There is a need for different types of treatment to meet various water needs (e.g., public health, aquatic species, and habitat).
* The complexities of reuse include the impact on downstream water rights relying on return flows, concerns related to emerging or barely detectable contaminants, and the technology used to treat recycled water.

**Findings:**

* Prioritizing opportunities that offer multiple benefits is important. For example, capturing storm water is a benefit to water quality and supply, drought resilience and flood mitigation measures.
* Performing watershed assessments and subsequent maintenance activities to reduce and remove fuels benefit water quality and quantity.
* Water recycling may ameliorate risks by improving water quality and providing a supplemental supply for approved uses.
* The water quality-quantity nexus requires awareness and thoughtful management to help build resilience to the impacts from hazards (e.g., flooding, drought, wildfire, etc.), develop adaptive, long-term water infrastructure management solutions, and improve short- and long-term precipitation and weather forecasts.
* Well-maintained forests and natural areas may have the cascading effect of reducing wildfire risk and improving water quality.

**Best Practice: State agencies collaborating with federal agencies to address water security.** Active engagement ensures that all relevant agencies understand their roles in hazard mitigation and contribute effectively to the plan's development and implementation.

**Highlight:** States have found that working with FEMA on Hazard Mitigation Planning[[65]](#footnote-65)is necessary and a significant resource. Planning helps communities guide investments to address long-term risk and reduce natural hazards. It brings together partners from government, private sector nonprofits, community stakeholders and the public to build risk reduction strategies that can be implemented using a number of public and private resources. Mitigation plans demonstrate the community's commitment across several different sectors, such as infrastructure, economic development, and historic and cultural resources, which reduce risks to natural hazards. Mitigation plans save lives, reduce risk from future disasters, and allow community leaders to make risk-informed decisions around investment in projects. Plans also help state and local jurisdictions adapt to climate change and direct resources where most needed. Specific requirements for State, local and tribal natural hazard mitigation plans come from 44 Code of Federal Regulations (CFR) Part 201.

Mitigation plans are living documents updated every five years as communities can change due to disasters, population growth, commercial development, and changes in leadership. These changes affect risk, vulnerability, and exposure to hazards. The average mitigation plan takes 2.5 years to complete. Once mitigation plans are developed, the community should start to implement projects and make progress on the goals and actions identified in the plan. Halfway through the plan, they should start thinking about updating the next plan.

State plans primarily address mitigation actions by state agencies. If a state completes an enhanced plan (beyond the standard plan), they can receive an extra 5% in HMGP funds after a disaster.[[66]](#footnote-66) It is important to have broad representation in mitigation plans. Mitigation planning is fundamentally a community planning process, embedded within emergency management. While it primarily addresses natural hazards, it also aims to bring together stakeholders from state agencies and different sectors within the community to develop strategies for more general risk reduction and resilience building.

Mitigation plans unlock funding opportunities for communities through Hazard Mitigation Assistance Grant programs (HMGP). These programs offer funding for a wide range of activities, including technical assistance, training, building code enforcement, planned development, and large-scale infrastructure projects aimed at reducing risk and vulnerabilities.

Mitigation grants can fund various actions, including property acquisition, structural relocation post-disaster, wildfire mitigation measures such as defensible space creation and hazardous fuels reduction, and infrastructure retrofitting to strengthen systems affected by disasters. Examples from states like Nevada,[[67]](#footnote-67) Colorado and Utah illustrate how they integrate mitigation plans with other planning efforts across state agencies. Colorado updated their enhanced mitigation plan in December 2023 and integrated climate change assessment data from several plans, including Colorado Department of Transportation’s “Changing Climate and Extreme Weather Impacts on Geohazards,” in their risk assessment portion of the plan.

The Colorado Water River plan was incorporated to create a common vision for drought flood and mitigation. They incorporated mitigation actions identified in the Drought Response Framework to promote a one-water approach for holistic thinking around the connection between water and land use. Regarding wildfire risk, Colorado mapped disproportionately impacted communities overlayed with wildfire hazard risk and will use the information for education awareness and outreach. They intend to support wildfire mitigation and workforce development through the Colorado Strategic Wildfire action programs and Workforce Development Grant program, and plan to assist and fund local communities and other partners implementing wildfire mitigation projects.

Utah’s enhanced plan was approved last month, and their status change will be completed in the next few months. Utah has worked with state agencies to ensure their new enhanced plan is in alignment on mitigation actions and goals. Utah is implementing water conservation practices in agriculture and will provide materials for the community and policy leaders to strengthen understanding. Additionally, Utah will review and update codes or statutes that influence water efficiency.

**RECOMMENDATIONS FOR WRP ACTION**

* WRP Water Security Team to continue efforts work through the water security risks identified. Invite additional subject matter experts to share information on best practices, and challenges associated with risks to water supplies, with a focus on the following areas:
  + Complexity of regulatory laws and water resource management
  + Weather
  + Infrastructure
  + Water quality
* Based on the above risk categories, explore multi-sector mitigation opportunities in water management through the lens of extreme events (such as drought, flooding, wildfire[[68]](#footnote-68), etc.) and identify science and data gaps for informed decision making.

## **Wildland Fire (Response/Prevention)**

**Background**

Wildfire mitigation poses a complex and growing challenge in the WRP region. Over the past 30 years, the number and severity of fires have increased across the U.S., particularly in the West. Large wildfires have caused devastating destruction to people, landscapes, properties, economies and natural resources. Fire seasons have transitioned into extended “fire years” due to several factors, including decades of fire suppression, leading to overstocked fuel in our nation’s forests and rangelands, and changing climate conditions, and longer, hotter, and drier fire years.

In many WRP states, the biggest land manager is the federal government. States, tribes and non-governmental organizations also have lead roles in addressing challenges to planning, preparation, mitigation, response and recovery processes and systems around wildland fire. Landownership dynamics, especially across the West, can complicate the mitigation process. Wildfire management encompasses the entire fire management cycle, including proactive landscape management, fuel treatments, landscape restoration, and wildfire suppression.

No one agency, bureau, state, etc. “owns” or has the adequate and necessary funding and authority to address wildland fire. Numerous agencies are involved in all pillars of wildland fire, both pre- and post-disaster, which creates silos, and yet at the same time there is a great need to work together as fires cross government boundaries.

There are many collaborative efforts in this field such as those by Council of Western State Foresters and Wildland Fire Leadership Council. WRP worked to leverage and not duplicate efforts. “The True Cost of Wildfire in the Western U.S.[[69]](#footnote-69)”, which describes the known and expected costs associated with wildfires in the western United States, was designed to inform leaders and decision-makers trying to improve wildfire response and mitigation in the region. Currently wildfire costs are mostly measured in suppression costs and structural losses.

The report shows there are many other costs not yet being accounted for, including impacts to human health, water supply, transportation, the labor market, tourism, and local economies. Some of these costs can be measured in financial terms but many cannot yet be measured. The report includes eight case studies illustrating the variety of costs that have been identified as implicit to wildfires. Although the report describes the total costs of wildfires across the country, it cannot arrive at a definite conclusion yet because of the identified data gaps. [[70]](#footnote-70)

The Wildland Fire Leadership Council (WFLC) approved and affirmed the National Cohesive Wildland Fire Management Strategy and its 2023 Addendum.[[71]](#footnote-71) Together, they outline the growing challenges and issues faced today, and provide a strategic framework for all stakeholders to address these challenges in a collaborative manner to achieve landscape resiliency, community resiliency and fire adaptation, and a safer, more effective wildfire response.

The team held 11 calls (either full Deep-Dive calls or particular issues) since the last WRP Principals’ Meeting to address the WRP priority of Wildland Fire Needs to Enhance Resilience to Avoid Cascading Disaster. This Deep-Dive team was new; therefore, there was more brainstorming to explore the issue and the ramifications more fully across state, federal and tribal perspectives. Additionally, the subject matter experts involved are mission-focused, which made them subject to being called away as needed, and setting up time to proactively plan can be more challenging for this group than for other groups.

The team identified five issues for further consideration:

1. **PREPAREDNESS BEFORE THE DISASTER:** Identify gaps and solution sets to more effectively coordinate integrated and collaborative wildfire planning and activities pro-actively across jurisdictional boundaries.
2. **MITIGATION:** Identify additional steps to achieve fuels management coordination, planning and treatments.
3. **AERIAL RESPONSE/DRONES:** The need for coordination regarding wildland fire, NAS, fire response and integration of UAS into wildland fire operations.
4. **POST-FIRE LANDSCAPE RESILIENCE AND RECOVERY:** Address post-fire recovery and identify what is missing to prevent cascading effects.
5. **SCIENCE, DATA AND TECHNOLOGY:** Identify science data and technology needs to understand wildfires, their impacts and how to mitigate them and support informed, risk-based decisions.

**PREPAREDNESS BEFORE THE DISASTER**

**Issue:** Identify gaps and solution sets to more effectively coordinate integrated and collaborative wildfire planning and activities proactively across jurisdictional boundaries. Mitigation funding can save resources long-term. A Federal Emergency Management Agency (FEMA) funded study suggests that $13 is saved for every $1 spent on federal mitigation grants.[[72]](#footnote-72) Adopting modern, hazard-resistant building codes can save $11 for every $1 invested in comparison to previous building codes.[[73]](#footnote-73)

Wildfires do not respect jurisdictional boundaries, and while a fire may start on one type of managed land, it can easily bleed into other areas. Federal mitigation efforts are especially important as many wildfires in the west start on federal lands and impact other lands and communities with fire, debris flow, post-fire flooding, financial losses, etc. This necessitates a collaborative, cross-jurisdictional approach to mitigating impacts. Forest Service lands are typically in headwaters and other landownership is intermixed. These land ownership dynamics require post-fire response to be a partnership with multiple agencies.

Mitigating the risk of high-intensity wildfire is a complex and growing challenge in the WRP region. Large fires have been responsible for devastating destruction; over the past 30 years there has been an increase in the number and severity of fires across the U.S. and in the west. Low-intensity fires at frequent intervals can be a healthy force in fire-dependent ecosystems. Restoring western fire-adapted ecosystems to a level where healthy fires are the norm, and catastrophic fires are the outlier will take substantial time and collaborative efforts.

Some of the tools available for this work, used in close collaboration with partners, include proactive use of prescribed fires,[[74]](#footnote-74) managing beneficial fires and mechanical treatments (which includes forest thinning and brush clearing). State forestry agencies, the U.S. Forest Service, the BLM, Tribes, non-governmental organizations, and industry have been engaging in high-intensity wildfire mitigation efforts.

State forestry agencies, for example, have been investing substantial funding and personnel into wildfire mitigation work and use state forestry action plans as the key organizing mechanisms for multi-stakeholder coordination, prioritization, and groundwork across the states. They also enter into Shared Stewardship and Good Neighbor Agreements with federal agencies; these Agreements have been pivotal to enabling cooperation across government and non-governmental entities. These agreements help delineate shared visions and strategies for addressing forest health and wildfire threats.

**Best Practice: Implement the Cohesive Strategy.** Partner and collaborate across boundaries and jurisdictions with agencies, tribes and organizations to mitigate the risk of high-intensity wildfire across boundaries and jurisdictions. This is supported by the recommendations in the Wildland Mitigation and Management Commission’s report which emphasize pre-fire mitigation through increased collaboration and shared decision-making at multiple scales inside the wildfire space.

**Best Practice: Wildland Fire Mitigation and Management Commission’s comprehensive approach with a strong emphasis on pre-fire mitigation and post-fire recovery.** The Commission is comprised of fifty [members](https://www.usda.gov/topics/disaster-resource-center/wildland-fire/commission/members) from diverse geographies and backgrounds and was tasked to find solutions to complex problems that span traditional silos. The Commission’s On Fire report is largely organized around the fire cycle with work that can be done before a fire occurs in built and natural environments, policies that can improve actions taken during a wildfire with an emphasis on response coordination across different bodies, and actions that can be taken as post-fire recovery. This report contains 148 consensus recommendations and includes both intermediate and long-term actions, summarized in seven key themes.

The Commission highlighted the need for increased collaboration inside the wildfire space with shared decision-making at multiple scales throughout the process. They explored how to shift mechanics from response to getting out in front of the problem. This includes not only those actions taken in advance of a fire to reduce the costs and losses associated with that fire, but importantly includes recovering into a more resilient position. Recovering better positions communities, agencies, organizations, and partners more effectively for the next impact. They endorsed using fire more proactively in the natural environment. Simple use of prescribed fire or even wildfire managed for resource benefits, to include more comprehensive thought around fire and the public health impacts of it. There were good discussions within the Commission about balancing smoke production from things like prescribed fire and public health and identified the need to improve and invest in science and technology. Absent taking a more modernized approach and keeping research up to date, responsible agencies run the risk of significantly falling behind. Impacts of fire are expensive; by investing significantly more in the mitigation on the front end and in smarter post-fire recovery, costs can be reduced relative to the impacts of fire.[[75]](#footnote-75)

**Best Practice: Utilize tools to address wildfire risk on public lands.** BLM uses two tools to address wildfire risk on public lands in California: Statewide Wildland Urban Interface Fuel Treatment Programmatic Environmental Assessment (SWFT) and Good Neighbor Authority Agreement (GNA)[[76]](#footnote-76). SWFT Programmatic Environmental Assessment (pEA) provides an analytical framework for fuels reduction and vegetation management on BLM administered lands in California and northwestern Nevada, focusing on land within one mile of the wildland urban interface (WUI), to reduce the intensity, severity and spread of wildfire. Fuel treatments include manual and mechanical treatments, prescribed fire, use of herbicides, grazing and maintenance. BLM used its WUI layers with CAL Fire and Forest Service risk maps to create an action area of Very High- and High-Risk BLM lands within one-mile buffer of WUI. Lands beyond one mile were added covering critical infrastructure, ingress/egress routes, and other values at risk. The action area covers approximately 930,000 acres of BLM-administered land and includes all vegetation types. BLM treats up to 20,000 acres per year, with projects ranging from 1 to 10,000 acres and individual treatment units ranging from 1 to 500 acres. BLM informally consulted with USFWS and NMFS.[[77]](#footnote-77)

BLM determined the effort of preparing and completing the environmental assessment for SWFT alone was not subject review under Section 106 of the National Historic Preservation Act (NHPA). California BLM has an agreement with the State Historic Preservation Officer (SHPO) to streamline BLM obligations under Section 106. The environmental assessment was finalized, finding no significant impacts, in August of 2023.[[78]](#footnote-78)

GNA agreements allow BLM to enter into sole source contracts or cooperative agreements with a state, county, or tribe for a broad range of watershed restoration services, including treatment of insect and disease infected trees, hazardous fuels reduction, or any other activities to restore or improve forest, rangeland, and watershed health. The GNA also authorizes the sale of timber and allows the state to retain sales revenue to fund BLM authorized restoration services on BLM land under the existing agreement or contract or another authorized good neighbor project in the state.[[79]](#footnote-79), [[80]](#footnote-80)

DOD has fire management programs for installations in high fire threat zones in the West, including wildland fire management plans, interagency response agreements, fire prevention plans, wildland fire risk assessment plans, among others.

**Findings:**

* Plan, prevent, respond, and recover as if there is not a division between the lands. Ideally, treat it as one landscape or ecosystem. Sort through jurisdictional issues and improve agency collaboration, cooperation, planning, response and recovery.
* There is a need to enhance long-term resiliency, such as using fire-resistant construction and addressing invasive species.
* Identify ways to streamline federal agencies’ fire response/post-disaster assistance.[[81]](#footnote-81)
* Improve contracting tools, build out contractor capacity in both the public and private sectors, and develop statewide tools (statewide IDIQ) to accomplish the work more quickly.
* The land management mix, especially in the Western United States, necessitates robust partnerships with multiple agencies.
* It is important for federal agencies to work with nearby and adjacent landowners to ensure there are egress and ingress routes in case of emergency. This will greatly assist with tribes, given that much of their lands are surrounded by federal land, and often there is only one route into a tribe and there may need to be alternative routes in case of a disaster.
* There is a need for an interagency disaster organization at the regional level focused on how to respond to fires; consider pre-season deployment of the interagency disaster teams to get ahead of the problem.
* Integrate post-fire and disaster programs based on the holistic needs, risks, and prioritize resources to timing.
* Conduct a hazard risk analysis – pre- and post-fire analysis to get ahead of debris flows. This will help with resource allocation.
* WRP should learn more about the U.S. Forest Service’s proposal to amend land management plans regarding Old-Growth Forest Conditions Across the National Forest System.[[82]](#footnote-82)

**MITIGATION**

**Issue:** Identify additional steps to achieve fuels management coordination, planning and treatments for landscape resiliency and post-fire impact mitigation.

Cross-boundary, collaborative fuels management and mitigating post-fire impacts are crucial to landscape and watershed health and resiliency.

In the short term, when a fire is active there is concern that the effects may spread to directly harm humans, infrastructure, budgets, and natural resources. The post-fire effects can be equally devastating to communities and economies by way of the cascading effects of post-fire of construction and housing delays, residents moving away, subsequent flooding and debris flows that continue to damage properties, and inadequate post-fire recovery systems and programs to help residents.

With a large wildfire, there is a significant updraft. There is a great amount of material in an updraft, including burn off from plants and vegetation, which creates a pyrocumulus cloud. These clouds cause more tornadic activity because of the higher heat. The greater the intensity of the fire, the more intense the pyrocumulus cloud will become. Downbursts can be beneficial but come with an outflow boundary. The outflow boundary comes down to the surface with a great deal of force, then blows across the terrain, which can cause erratic fire movement. Lightning occurs and leads to potential ignition in areas where there is no rainfall from the pyrocumulus cloud. Deposits of the ashes and soot across the surface leads to additional compounding threats, such as minerals and metals in the water system and vegetation, preventing photosynthesis and damaging crops. There are many cascading impacts from a fire.[[83]](#footnote-83)

Many resources and best practices in this area have been developed that may help overcome silos. For example, theTactical Fire Remote Sensing Advisory Committee (TFRSAC), an interagency group that has a longstanding community of practice focusing on remote sensing support to wildland fire operations. It acts as a forum for remote sensing experts and wildfire support personnel to share ideas and build awareness of ongoing activities and needs in the wildfire and R&D communities. The Committee meets twice per year.[[84]](#footnote-84)

DOD has NWCG and state qualified firefighters to handle some fire incidents. They also implement prescribed fire projects for hazardous fuel reduction, ecosystem management, and military training purposes.

**Findings:**

* Conditions have deteriorated as climate change and fire suppression have contributed to overstocked forest landscapes, and as invasive species have been encouraged by catastrophic fires.
* It is important to pull in regulatory agencies early in the consultation process, so they understand the proposed action and what to evaluate regarding species effects.
* It would help if agencies formalized their processes on consistently integrating fuel management into their plans.
* Pre-planning in areas of high-risk fire to address control and deforestation. Consider the use of controlled burns and traditional fire burns. Allocate resources proactively, pre-disaster, treating non-native grasses that make desert eco-systems susceptible to fire.
* Like the recovery issue outlined later, consider the use of natural resources such as plants to assist with fire suppression. Examples to consider are BLM’s eco-restoration resilience.[[85]](#footnote-85)

**AERIAL RESPONSE/DRONES**

**Issue:** The need for coordination regarding wildland fire, NAS, fire response and integration of UAS into wildland fire operations.

Wildfire response often requires immediate access to large quantities of sterile airspace with minimal itinerant aviation traffic; emergencies require air assets to get up and running quickly and safely.UAS/drone intrudersare a major problem as they are hard to see and can disrupt firefighting operations. Generally, when an unplanned, unidentified UAS is in the fire area, manned aircraft are moved (depending on the size of the fire, they could be moved to another side of the fire or returned to base). Temporary Flight Restrictions (TFRs) may be activated to assist fire response. Airspace deconfliction is critical to ensure safe access to airspace for responding aviation assets that must occur real-time. Memorandums of Understanding (MOUs) and Letters of Agreement (LOAs) that define roles and responsibilities for airspace deconfliction play a significant role in ensuring safety of flight.

Counter technology is growing along with the drone industry and may be a solution to this issue. Drone detection technology may detect the location of the pilot and provide an avenue to educate and intervene so operations may continue.

**Findings:**

* Importance of establishing TFRs to reduce commercial drone incursions.[[86]](#footnote-86)
* There is an increase in requests for aircraft to participate in the hazard relief effort, where wildland fires are concerned.
* Persistent, dynamic communication systems are desired.
* Importance of having sufficient electromagnetic frequency spectrum for radio frequency communications without interference and safe navigation. It is also necessary to determine how to relay messages and address the decision-making priority, that is, who and what are the priorities. Transponders can work but they have shadowing issues (e.g., mountains). It is important to produce a solution, so equipment does not need to be retrofitted for the next 10-20 years after implementation.
* There is a need for real-time data collection and dissemination for coordinated UAS operations in the wildland fire environment. Robust and redundant information-sharing protocol and system is needed for safe integration within the response and recovery effort.
* Sense-and-avoid technologies that synchronize for harmonious coordination over the wildland and RX environment. UDS / UTM Infrastructure will be critical in WUI and remote environments: Airspace regulations in low altitude.
* As UAS technologies mature for the wildland fire and prevention environments, these technologies should be commensurate with application software solutions that advance situational awareness and planning capabilities for airspace management and integration within the wildland fire environment.
* Opportunities to work together can increase situational awareness, facilitate proper training opportunities and promote preservation of protected areas. To be successful, the different stakeholders should actively involve each other to increase situational awareness.
* Firefighting, Search and Rescue, Law Enforcement, Utility or other Critical Infrastructure Restoration, Damage Assessments Supporting Disaster Recovery Related Insurance Claims, and Media should be thoroughly familiar with the process by which they may apply for waivers from TFRs.[[87]](#footnote-87)
* Another important source of valuable information on the Collaborative Wildfire Risk Reduction Program, Wildfire Crisis: Landscape Investments, and other issues.[[88]](#footnote-88)

**POST-FIRE LANDSCAPE RESILIENCE AND RECOVERY:**

**Issue:** Address post-fire recovery and identify what is missing to prevent cascading effects.

Roughly thirty agencies (USFS, USGS, NRCS, FEMA, etc.) are involved in post-fire response across the west.

DOD has wildland fire incident reporting and data management, burn severity and perimeter mapping, fire line rehabilitation, emergency stabilization and erosion control, and long-term restoration capabilities.

**Best Practice: Emphasize post-fire management.** The U.S. Forest Service has attempted to emphasize post-fire management and include it in the full fire management cycle, from proactive landscape management, (fuel treatments, landscape restoration), to wildfire response. The goal of the USFS post-fire program is to use post-fire response and recovery to return the landscape to its baseline proactive landscape management as soon as possible.

The 4R’s of the USFS post-fire response are: 1) Repair, 2) Emergency Response, 3) Rehabilitation, 4) Recovery.

Repairs mitigate or eliminate resource impacts of fire suppression and restore the area to the most natural appearance possible. This work includes trash collection and removal, treatments for the control of invasive species, repairing dozer lines and other disturbed sites typically through seeding and erosion control actions, and repairing roads and bridges from heavy equipment use. The repair is short term and starts before fire containment. Many landscape disturbances happen in fire suppression. USFS inventories the impacts on the ground and plans for suppression repair which is funded through wildfire suppression. The goal of suppression repair is to try to “disappear” these actions off the landscape with erosion control protection to set the area back to where it can be part of the productive land base.

After Repair, the next step is Emergency Response. After a fire, a landscape may have an increased chance of flooding and debris flow; these impacts happen over multiple years if the landscape has not fully recovered, creating the possibility of cascading disaster. The Burned Area Emergency Response (BAER) program focuses on post-fire risk management. They work to identify imminent post-wildfire threats to critical values and take immediate actions to manage unacceptable risk with protective measures.

These actions are taken within a year of the fire to try to manage the elevated risk of post-fire flooding and debris flow for the protection of life, infrastructure, and critical natural resources. BAER is a post-fire risk management program, not a restoration program. The response team tries to get ahead of flooding, debris flows, and the invasion of invasive species while protecting the resources to maintain the systems on the ground long-term. If many road treatments are done, for example, the USFS will ensure the road drainage is able to sustain the post-fire increase in water flow and keep the road on the landscape with early mitigation work, rather than going back to make greater repairs later.[[89]](#footnote-89)

While the fire may be contained, there is potential for debris from upstream or leaves or dried tinder to be able to blow across it, ignite, and then carry the fire past the containment line with different impacts pre-fire, during fire and post-fire.[[90]](#footnote-90)

There are many successful post-fire landscape response and recovery examples across the west:

* The Colorado Post-Fire Recovery Playbook (2021) was sponsored by Coalitions and Collaboratives. It is a guide for counties, tribes, municipalities, and water providers to use following a wildfire, offering tools and resources from the different parties involved in post-wildfire recovery.
* The Wildfire Ready Watersheds Program, through the Colorado Water Conservation Board, is designed to help communities plan for and mitigate post wildfire effects. Wildfire Ready Watersheds.
* New Mexico’s [After Wildfire Guide](file:///C:\Users\AmyDuffy\Documents\Western%20Regional%20Partnerhip\SC\2024\2024%20REPORT\afterwildfirenm.org) helps New Mexico communities recover after wildfire by providing ideas on mobilization, assistance resources, and technical information about post-fire treatments to address the catastrophic effects of a wildfire on the land and to prepare for potential flooding.
* Utah has their post-wildfire outreach team, which is a group of subject matter experts that assemble to provide guidance to communities following a wildfire.

There are many GIS and related resources to assist, such as:

* CalFire (www.fire.ca.gov) provides a GIS Mapping and Data Analytics webpage[[91]](#footnote-91) that provides insights to wildfire mapping in its Fire and Resource Assessment Program (FRAP). Such data analysis would benefit from more frequent and more extensive data collection, including data for atmospheric collection from met towers and lidar.
* The US Forest Service maintains a website for Geospatial Data.[[92]](#footnote-92)
* A wildfire website at [www.firemap.sdsc.edu](file:///C:\Users\sduff\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\VVSX2DVJ\www.firemap.sdsc.edu )and select the layers depicting webcams and historical fires. The historical fire areas may be tracked back to 1878.
* The National Interagency Fire Center website has its NIFC Open Data Site of Federal interagency wildland fire maps and data at <https://data-nifc.opendata.arcgis.com/>.

**Findings:**

* Many of these issues also apply to water security.
* Flooding has risks of immediate cascading effects (life and loss) and long-term effects (water quality, levee damage, etc.).
* Contaminants can enter the water supply.
* There is a need for post-fire management to be part of the fire management cycle.
* Have strong collaboration with the many levels of government to determine whether any areas are at risk of flooding. (USGS, FEMA U.S. Army Corps of Engineers, State, etc.)
* Importance of gray infrastructure solutions, including building structures like debris basins and erosion control features to mitigate flood risks, to complement nature-based solutions, such as reducing hazardous fuels on federal and private forestry programs on private lands.
* Importance of native grass bank supply in nursery stock, including for reforestation. Need to ensure enough stock is available on an annual basis to address potential fires along with the manpower to assist in emergency seeding.
* Recommend a strong, coordinated outreach and risk analysis by the many federal agencies to assist with post-fire response.
* Post-fire flooding and debris flow analyses necessitate interagency coordination to ensure the delivery of consistent and unified risk assessments to communities, facilitating response and recovery efforts effectively.
* Need to develop a comprehensive package of tools and resources to assist communities in the recovery phase.[[93]](#footnote-93)
* Work with USFS new National Post-Disaster Recovery Team on areas of mutual collaboration.
* Review the Wildland Fire Mitigation and Management Commission Reports and recommendations.[[94]](#footnote-94)
* Identify opportunities to leverage efforts more fully.

**SCIENCE, DATA AND TECHNOLOGY**

**Issue:** Identify science, data and technology needs to understand wildfires, their impacts and how to mitigate them, and support informed, risk-based decisions.

Science, data, and technology has not kept pace with the extent of wildland fire and post-fire impacts, or been fully integrated into decision-making for fire, land and community managers.[[95]](#footnote-95)

Specifically, the team identified the need for science-driven tools that can help agencies and organizations address a variety of wildfire issues. To date, it has been a challenge to develop an aggregate tool that can be utilized by both DOI and USDA agencies and other decision-making bodies. In addition, it is important to concede that one model will not provide all the answers. Utilizing several data points however, to see where they intersect, can provide a point of inflection where action or preparation for response can occur.

**Best Practice: Utilize current tools.** The Burn Intensity and Debris Flow Probability maps that USGS produces are used by Emergency Managers at the federal, state, and local levels.

The Burned Area Emergency Response (BAER) team analysis produces the burn intensity map. These are based on geography, soil type and rainfall simulations for intensity, time and duration across the landscape. To obtain the data, they use various field techniques, which include emergency response using notification processes through rain gauges, stage gauges, turbidity sensors and water quality monitoring to inform organizations that may or may not manage those water resources.

Debris flow analysis is GIS centric, because it is spatial data, but is now an automated process. Once USGS receives the burn intensity map from the BAER team, USGS can turn it around in 24-48 hours. Landscape recovery is modeled by the land manager, BLM or NPS. USGS provides the data, such as rainfall, to help determine how effective it is to do seeding or contour filling in terms of soil moisture for plant growth to support that activity.[[96]](#footnote-96)

USGS provides the Forest Service with debris flow mapping and modeling, which gives an idea as to where the highest risks are and how much material could potentially come off hill slopes in the area. It also suggests the kind of treatments to use in dealing with risks, especially in the very high and very critical areas where there are unacceptable risks to communities, economies, and natural resources. With this, information needs are prioritized, and a response strategy is developed while considering natural recovery. The USFS then determines whether the system is likely to bounce back quickly, or it will need extra time and attention before threats may start to subside.

USGS uses rain gauges and sensors to detect rising water levels. The rain gauge is a standalone system that transmits via satellite. Once a threshold meter is set and receives rainfall, it is the first indicator in the burn scar of potential debris flow formation. A non-contact radar sensor hangs in a channel over the water. As the water level rises, it sets off an alert. The pressure transducer also measures water levels and acts as a trip sensor alerting emergency managers that a flow is occurring based on the height of the water. These tools provide information to determine if there is in fact a risk to the public downstream. Alerts and notifications are made through the USGS's [Water Alert](https://accounts.waterdata.usgs.gov/wateralert/) notification mechanism. This data is public, not proprietary; the public can sign up for water alerts.

The [National Water Dashboard](https://dashboard.waterdata.usgs.gov/app/nwd/en/?aoi=default) is an interactive map and GIS platform, where users can hover over various gauges, showing a hydrograph of stream flow of a channel and a second graph of precipitation or turbidity of the water. [[97]](#footnote-97)

AirNow and the Fire Information for Resource Management System US/CANADA are tools that look at wildfire locations. These maps can be utilized to keep situational awareness about where fires are occurring, where the smoke is, and what smoke degradation is going to look like.[[98]](#footnote-98)

**Findings:**

* Coupling the predictive model with meteorological models can determine where the risks lie.
* Hazards are easier to figure out. Risk is based on probabilities. Probabilities are where risk is measured and where you put your values. Risk is the probability of impacts to values. Agencies differ on the weights placed on different values.
* It is necessary to understand the potential geologic response (post-fire landslide, etc.), both from looking at debris flow and rockfall. There are many areas with major increases in rockfall, even in low severity areas, because ground cover holds it together.
* The use of additional technology, perhaps even with AI analysis, might provide additional fire predictive tools. However, although models are helpful, in the end fire cannot be predicted. Coupling the predictive model with meteorological models and rapid-fire detection technology can determine where the risk lies and target warnings regarding potential flooding.
* Data challenge is that no one agency or bureau has all the data.
* Implement the Cohesive Strategy: The Wildland Fire Leadership Council is convening science, data, and technology experts in June 2024 to address a broad scope of issues in this space and how to proceed in developing solutions based on current, in-depth research and how to ensure that results make it to the field for use in decision-making.

**RECOMMENDATIONS FOR WRP ACTION:**

WRP Wildland Fire Team to work through the issues identified more fully across state, federal and tribal perspectives. Invite additional subject matter experts to share information on best practices, and challenges, with focus on the following areas:

* Preparedness Before The Disaster
* Mitigation
* Aerial Response/Drones
* Post-Fire Landscape Resilience and Recovery
* Science, Data and Technology

# **Tribal Engagement Committee (TEC)**

**Stand up of TEC per 2022 WRP Principals’ Meeting Action:**

At the 2022 Principals’ Meeting, the Tribal Engagement Temporary Working Group recommended establishment of the WRP Tribal Engagement Committee which was accepted by WRP Principals at their 2022 Meeting. The TEC has four Committee Co-Chairs:

* Elveda Martinez, Walker River Paiute Tribe
* Will Micklin, CEO, Ewiiaapaayp Band of Kumeyaay Indians
* LeRoy N. Shingoitewa, Hopi Tribal Council Representative
* Floyd W Velasquez Sr., Emergency Services Administrator, Morongo Band of Mission Indians

**Background**

Within the WRP Region there are 172 Federally Recognized Tribes.[[99]](#footnote-99), [[100]](#footnote-100) Federally Recognized Tribes “*are acknowledged to have the immunities and privileges available to federally recognized Indian Tribes by virtue of their government-to-government relationship with the United States as well as the responsibilities, powers, limitations, and obligations of such Tribes*.”[[101]](#footnote-101) The percentage of Indian Trust land within each of the WRP States ranges from 0.5% to 27.6%.

From its inception, WRP has recognized the importance of Tribal participation and input on WRP’s activities and focus, as noted in the WRP Mission Statement. From 2010 through 2014, WRP had a Tribal Relations Committee. That Committee was integrated into the other WRP Committees; each of the WRP Committees has a Tribal Co-Chair. TETWG was established by WRP Principals in 2017 and continued through December 2022 when it became a permanent WRP Committee. This was not intended to supplant any existing forums for tribal-agency engagement.

**TEC Focus**

The TEC held regular calls that: have facilitated information-sharing among tribal members and state and federal agencies in the WRP Region; sought tribal input on WRP efforts; and received updates on timely and important issues. The TEC served as an effective forum to empower technical staff from multiple agencies to find innovative, cross-program solutions to identified tribal issues. As expressed by one long-time tribal representative in WRP, the WRP provides another level of communication among tribal leadership, tribal staff, tribal organizations, federal or state leadership, and specialists working to achieve effective outcomes, and this Committee has assisted to promote outreach to tribes to obtain greater engagement in WRP. Tribal members are still encouraged to participate in all WRP Committees. Their expertise is needed and sought.

TEC guiding principles and areas of collaboration included:

* WRP seeks to increase tribal participation
* WRP is a forum that empowers technical staffs from multiple agencies to find innovative, cross-program solutions to identified tribal issues
* WRP continues to honor the government-to-government relationship unique to tribal sovereign nations, and to foster a collaborative atmosphere that generates solutions to tribal issues, while recognizing that no tribal entity speaks for another
* WRP does not supplant or usurp federal agencies’ responsibilities to consult with tribes
* Tribes engaged in WRP have identified and applied solutions to priority issues that would not have been possible but for WRP. Many WRP Partners provide technical support and assistance

**WRP TEC Subcommittee Actions**

To delve into issues more fully, the WRP TEC established an outreach subcommittee. Its goal was to develop a communication/outreach plan to encourage additional Tribal participation in WRP; as much as possible, it will leverage existing structures. It is hoped that over the next year tribal participation in WRP will continue to increase. There is a Tribal leadership listing for the WRP Region, but it needs to be constantly updated due to turnover. Current solution sets they are working through are:

* Continue communications to TEC and seek input on ways to augment efforts
* Continue to hold TEC outreach subcommittee calls; seek additional input and participation
* Empower TEC members to reach out to their colleagues and invite them to participate in WRP
* Present WRP to existing Tribal organizations
* Ask Regional, State and National Tribal Organizations and State/Federal agencies for information on Tribal events to share with the TEC

# **WRP Sentinel Landscape Temporary Working Group**

**Recommendations Regarding Continuation of the**

**WRP Sentinel Landscape Temporary Working Group**

*(As presented to the WRP Principals at their 2024 Meeting)*

**SUBJECT:**

Recommendations regarding continuation of the WRP Sentinel Landscape Temporary Working Group.

**SUMMARY:**

The WRP Steering Committee recommends the continuation of the WRP Sentinel Landscape Temporary Working Group.

History:

* Per 2017 WRP Principals’ Meeting, WRP SC is enabled to establish working groups to address strategic priorities adopted at a Principals’ meeting that fall outside of existing committee structure or overlap committee jurisdiction. The working group activities are to be limited in time and scope. SC will apprise the Principals of their activities at the following annual meeting.
* Sentinel Landscapes Partnership is a coalition of federal agencies, state and local governments, and non-governmental organizations that coordinate with each other and work with private landowners and other land managers to advance sustainable land management practices around military installations, ranges, and operating spaces. The partnership was founded in 2013 in a Memorandum of Understanding by DoD, USDA, and DOI. The partnership’s mission is to:
  + Strengthen Military Readiness
  + Preserve Natural Resources
  + Support Agricultural Productivity
  + Increase Access to Recreation
* 12 Sentinel Landscapes are established, one of which is in the WRP Region (Fort Huachuca).
* Per 2022 WRP Principals’ Meeting, the WRP Sentinel Landscape Temporary Working Group was created and has proven to be an effective forum to assist Sentinel Landscape designations within WRP Region. Within the WRP Region, four proposals were submitted for final consideration for the 2024 designation cycle: Great Salt Lake (UT); Mojave Desert (CA); San Diego (CA); and Eastern New Mexico. It is anticipated new Sentinel Landscapes will be announced in early May.[[102]](#footnote-102)

Purpose:

* Continue to share information with WRP members about the collaboration opportunities through Sentinel Landscapes.
* Continue to support and build western partnerships to adequately apply for a designation by sharing information, making interagency connections, strategize on solutions, connecting with their headquarter members on the Federal Coordinating Committee, and providing lessons learned from previous application cycles.
  + Currently there are three areas within the WRP region that might submit for the next Sentinel Landscape Designation Cycle. Expressions of Interest could come out as early as January 2025.
* Provide members of the Federal Coordinating Committee and agency headquarters with relevant information on shared resource concerns and challenges facing the WRP region.
* Update WRP Principals on actions and recommendations at their next WRP Principals’ Meeting.

**ACTION NEEDED:** Accept recommendation to continue WRP Sentinel Landscape Temporary Working Group.

# **WRP Acknowledgements**

## **WRP Steering Committee and WRP Committee Co-Chairs: Acknowledgements**

**Thank you to the following WRP Steering Committee members and WRP Committee Co-Chairs for their sharing of expertise and time:**

**WRP Steering Committee Members**

* Christian Bato, Senior Regional Advisor, Office of Congressional and Intergovernmental Affairs, Department of Energy
* Tim Brass, DNR Assistant Director, Parks, Wildlife and Lands, Executive Director’s Office
* Scott J. Carpenter, Integrated Services Division - Operations Branch Chief, Regional Ops Center; Meteorologist-In-Charge, NOAA/National Weather Service
* Jerry Davis, Deputy State Director, Resources & Planning, Bureau of Land Management, Arizona
* Emily Fife, State Conservationist, Utah, USDA - Natural Resources Conservation Service
* Jeff Fleming, Deputy Regional Director, Southwest Region, U.S. Fish and Wildlife Service
* Faviola Garcia, Deputy Regional Administrator, Federal Aviation Administration
* Jason Golumbfskie-Jones, Deputy DOD Regional Environmental Coordinator and Government Affairs Director, Navy Region Southwest
* Brian Hyer, Director, State and Local Affairs, Office of Intergovernmental Affairs, Department of Homeland Security
* Julie Jordan, Federal Facilities Coordinator; U.S. EPA Region 9; Strategic Planning Branch; Enforcement Division
* Courtney Kerster, Washington, D.C. Director, Office of Governor Michelle Lujan Grisham
* Jason Kusek, Assistant Chief, U.S. Border Patrol Headquarters
* Jennifer Madello, Acting Deputy Regional Director, National Park Service, Pacific West Region
* John Moreno, Senior Construction Engineer, South Pacific Division - US Army Corps of Engineers
* Mike Mower, Senior Advisor for Community Outreach, Utah Governor’s Office
* Daniel Nyquist, Deputy Director, National Preparedness, FEMA Region 8
* Connie Reitman, Tribal Subject Matter Expert, F. Hogan Institute on Cultural Studies
* Alanna Riggs, Executive Liaison Assistant to the Commanding General, US Army Intelligence Center of Excellence, Fort Huachuca
* Rob Rule, Assistant Director, Partnerships, Western U.S., and the Pacific, REPI Program, OASD (EI&E)
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* Billy Shott, Deputy Regional Director, National Park Service, Pacific West Region
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* Floyd W. Velasquez, Emergency Services Administrator, Morongo Band of Mission Indians

**Natural Resources Committee Co-Chairs**

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**Tribal Engagement Committee Co-Chairs**

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* USDA-NRCS Tribal Engagement, Activities and Opportunities by Mr. Pedro Torres, National Tribal Liaison, National Resources Conservation Service, January 2024.

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* AZ BLM Presentation re Fort Huachuca Sentinel Landscape by Mr. A. Scott Feldhausen, Gila District Manager, Bureau of Land Management, March 2023.
* Forest Service (Coronado National Forest) Presentation re Fort Huachuca Sentinel Landscape by Mr. Kerwin S. Dewberry, Forest Supervisor, Coronado National Forest, USDA Forest Service, April 2023.
* A Sentinel Landscapes Federal Coordinating Committee Perspective by Mr. Mark Defley, National Coordinator, Working Lands for Wildlife Landscape Conservation Initiative, USDA - Natural Resources Conservation Service, April 2023.
* NRCS Presentation re Fort Huachuca Sentinel Landscape by Ms. Keisha Tatem, State Conservationist, Arizona State Office, NRCS - and - currently Acting Director, Policy and Program, May 2023.
* Lowcountry South Carolina Sentinel Landscape by Ms. Kate Schaefer, Director of Land Protection, Open Land Trust, Analysis Division, USDA NRCS, May 2023.
* USFWS Working with Sentinel Landscapes by Mr. Jeff Fleming, Deputy Regional Director, Southwest Region, U.S. Fish and Wildlife Service and Mr. Jonathan Martinez, U.S. Fish and Wildlife Biologist, Military Lands Conservation Coordinator, Southwest Region, U.S. Fish & Wildlife Service U.S. Fish and Wildlife Service, June 2023.
* Great Salt Lake Sentinel Landscape Proposal Update by Tyler Smith, Installation Resiliency Program Manager, Utah Department of Veterans and Military Affairs, January 2024.
* Mojave Desert Sentinel Landscape Proposal Update by Mr. John Gamelin, Director Governmental and External Affairs, MCI-West Camp Pendleton, January 2024.
* San Diego Sentinel Landscape Proposal Update by Mr. Jason Golumbfskie-Jones, Deputy DOD Regional Environmental Coordinator and Government Affairs Director, Navy Region Southwest, January 2024.
* Eastern New Mexico Landscape Proposal Update by Mr. Jeff Davis, Real Property Accountability Officer AFSOC 27 SOCES/CEIAP, January 2024.

**Thank you to the following[[108]](#footnote-108) for their sharing of expertise and time in the Sentinel Landscape Temporary Working Group calls and meetings:**

* Alan Bittner, Deputy State Director, Resources, Bureau of Land Management (BLM) -Colorado
* Melanie Barnes, State Director, BLM - New Mexico
* Nathan Bomysoad, Senior Environmental Analyst, OPAV N4I3- Pentagon
* Astor Boozer, Regional Conservationist-West, USDA – NRCS (WRP SC Member)
* Tim Brass, DNR Assistant Director, Parks, Wildlife and Lands, Executive Director’s Office (WRP SC Member)
* Christopher Campbell, Deputy Regional Forester, Intermountain Region, USDA Forest Service
* Scott J. Carpenter, Integrated Services Division - Operations Branch Chief, Regional Ops Center Meteorologist-In-Charge, NOAA/National Weather Service (WRP SC Member)
* Danielle Chi, Deputy State Director, Resources, Bureau of Land Management, California, Department of the Interior, Region 8 & 10[[109]](#footnote-109)
* Brian Croft, Regional Military Lands Conservation Coordinator, U.S. Fish & Wildlife Service
* Jeff Davis, Real Property Accountability Officer, AFSOC 27 SOCES/CEIAP
* Jerry Davis, Deputy State Director, Resources & Planning, BLM – Arizona
* Mark Defley, National Coordinator, Working Lands for Wildlife Landscape Conservation Initiative, USDA-NRCS
* Madeline Drake, Assistant Secretary for Biodiversity and Habitat, California Natural Resources Agency
* Jonathan Feldman, REPI Program Manager, Air Force
* Emily Fife, State Conservationist, Utah, USDA-NRCS (WRP SC Member)
* Jeff Fleming, Regional Director, U.S. Fish and Wildlife Service
* Mark Freese, Habitat Division Director, Nevada Department of Wildlife
* John Gamelin, Director Governmental and External Affairs, Marine Corp Installations West Camp Pendleton
* Brian Garrett, Deputy Director, Utah Dept of Veterans and Military Affairs
* Michael Gates, District Manager - West Desert, BLM
* Jason Golumbfskie-Jones, Deputy DOD Regional Environmental Coordinator and Government Affairs Director, Navy Region Southwest (WRP SC Member)
* Kristin Graham Chavez, Assistant State Conservationist for Field Development, NRCS - NM
* Wendy Haskins, Director Ecosystem Resources & Environmental Planning, USDA Forest Service Southwestern Region
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* Jason John, Science and Policy Lead for Biodiversity and Habitat, California Natural Resources Agency
* Jasmine Kleiber, Wildlife Staff Specialist, Technical Review Program Lead - Habitat Division, Nevada Department of Wildlife
* Elaine Kohrman, Assistant Director, National Post-Disaster Recovery, USDA Forest Service, Washington Office
* Jason Laney, Warning Coordination Meteorologist, National Weather Service - El Paso
* Michelle (Shelly) Lynch, District Manager, BLM - California Desert District
* Kristen Madden, Chief, Division of Migratory Birds, USFWS – Southwest Region
* Jonathan Martinez, Fish and Wildlife Biologist, Military Lands Conservation Coordinator, USFWS - Southwest Region
* Lisa McCauley, Wetland Reserve Enhancement Partnership & Healthy Forest Reserve Program Manager, Sentinel Landscapes Federal Coordinator, USDA-NRCS
* Amber Morin, Program Coordinator, Fort Huachuca Sentinel Landscape Partnership
* Xavier Montoya, State Conservationist, New Mexico, USDA-NRCS
* Jennifer Norris, Ph.D., Executive Director, California Wildlife Conservation Board
* Daniel Nyquist, Deputy Director, National Preparedness, FEMA Region 8
* Deb Oakeson, Director, Geospatial Technology and Applications Center, USDA Forest Service
* Jennifer Oelke Farley, Environmental Planning and Conservation, Office of the Deputy Assistant Secretary of the Navy (Environment and Mission Readiness)
* Jason Parris, Program Manager/Senior Test Analyst, Operational Test and Evaluation (DOT&E)/Scientific Research Corporation
* Paul Raymond, West Traverse Sentinel Landscape Manager, DOT&E/Scientific Research Corporation
* Alanna Riggs, Executive Liaison Assistant to the Commanding General, US Army Intelligence Center of Excellence, Fort Huachuca (WRP SC Member)
* Shawn Rose, DAF Chief, Readiness and Environmental Protection Integration (REPI), USAF
* Rob Rule, Assistant Director, Partnerships, Western U.S. and the Pacific, REPI Program, OASD(EI&E) (WRP SC Member and MRHSDP&A Committee Co-Chair)
* Tonda Sallee, Program Management Specialist, Readiness and Environmental Protection Integration Branch, Air Force Civil Engineer Center, Installations Directorate
* Alan Shepherd, DSD – Resources, Lands, and Planning (NV930), Nevada State Office Bureau of Land Management
* Anna Shepherd, Region Community Planning and Liaison Officer, Navy Region Southwest
* Tyler Smith, Installation Resiliency Program Manager, Utah Department of Veterans and Military Affairs
* Sherri Schwenke, Deputy Regional Forester, New Mexico, USFS – New Mexico
* Carlos Suarez, State Conservationist - California – Davis, USDA-NRCS
* Jon Suk, Meteorologist in Charge, National Weather Service - San Diego
* Keisha Tatem, State Conservationist - Arizona - Phoenix USDA-NRCS
* Colonel Daniel Whitley, Deputy Commander, MCI-West Camp Pendleton (WRP SC Member)
* Jeffrey Zimmerman, Deputy Regional Director, NOAA/National Weather Service/Western Region

1. Please see acknowledgments at the end of this report for further details. [↑](#footnote-ref-1)
2. Thank you to the 41 agencies (representing federal, state and tribal entities) that responded to this survey. [↑](#footnote-ref-2)
3. Id. [↑](#footnote-ref-3)
4. SoCal is the largest and most complex. https://www.faa.gov/air\_traffic/nas/metroplex [↑](#footnote-ref-4)
5. https://www.faa.gov/space/spaceports\_by\_state [↑](#footnote-ref-5)
6. Previously known as Special Use Airspace (SUA). [↑](#footnote-ref-6)
7. Including Uncrewed/unmanned Aircraft Systems (UAS), Advanced Air Mobility (AAM) and Regional Air Mobility (RAM) operations [↑](#footnote-ref-7)
8. E.g., GPS, Data Communications (Data Comm), Area Navigation (RNAV), Required Navigation Performance (RNP) [↑](#footnote-ref-8)
9. See CFR Title 14 Part 77.9: https://www.ecfr.gov/current/title-14/chapter-I/subchapter-E/part-77 [↑](#footnote-ref-9)
10. # Per FAA Notice Criteria Tool anything exceeding 200' AGL automatically requires a study. Other structures may require study depending on their distance from an airport or navigational aid. The Notice Criteria Tool tells proponents of proposed or existing structures whether they must file a study, based on height and latitude/longitude. See https://oeaaa.faa.gov/oeaaa/external/gisTools/gisAction.jsp?action=showNoNoticeRequiredToolForm

    [↑](#footnote-ref-10)
11. https://www.faa.gov/about/office\_org/headquarters\_offices/ato/service\_units/techops/safety\_ops\_support/spec\_management [↑](#footnote-ref-11)
12. Ensuring Aviation Safety and Efficiency through Strategic Radio Frequency Management by Mr. Michael Weiler, Spectrum Engineering Services Group Manager, Federal Aviation Administration, March 2024. [↑](#footnote-ref-12)
13. https://www.faa.gov/air\_traffic/technology/radardivestiture/terminology [↑](#footnote-ref-13)
14. Id. [↑](#footnote-ref-14)
15. Id. [↑](#footnote-ref-15)
16. Since 1994, the Federal Communications Commission (FCC) has completed approximately 100 spectrum auctions, raising billions for the U.S. Treasury. <https://www.fcc.gov/auctions-summary> [↑](#footnote-ref-16)
17. https://www.whitehouse.gov/briefing-room/presidential-actions/2023/11/13/memorandum-on-modernizing-united-states-spectrum-policy-and-establishing-a-national-spectrum-strategy/ [↑](#footnote-ref-17)
18. https://www.whitehouse.gov/wp-content/uploads/2023/11/National-Spectrum-Strategy.pdf [↑](#footnote-ref-18)
19. Congress is considering legislation to expand C-UAS authorities to detect, identify, track, and mitigate UAS operations and cease assets without notification. This creates the need for careful policy development between Federal, State, Local, Tribal and Territories on such issues as spectrum monitoring, jamming, cyber actions, data collection and storage, and privacy issues just to name a few. Furthermore, law enforcement, security and safety personnel will need to be trained, certified, and credentialed to conduct C-UAS actions. This directly effects all levels of government and will require much coordination, cooperation, compromise, to execute. [↑](#footnote-ref-19)
20. Technology to detect, track and identify, and mitigate is also evolving. UAS mitigation technologies may be kinetic, non-kinetic, or natural. UAS detection technologies include radio frequency, radar, electro-optical/infrared and acoustic. There are aviation safety communication concerns and many legal issues regarding communication interference and public privacy laws. [↑](#footnote-ref-20)
21. https://www.gao.gov/video/aviation-safety-federal-efforts-address-unauthorized-drone-flights-near-airports#:~:text=According%20to%20FAA%20officials%2C%20many,airport%20operations%20and%20traffic%20patterns. [↑](#footnote-ref-21)
22. # 49 U.S. Code § 44801

    [↑](#footnote-ref-22)
23. <https://www.rtca.org/sc-238/> [↑](#footnote-ref-23)
24. Please see WRP Wildland Fire Deep-Dive for more information on this topic; a cross-over issue. [↑](#footnote-ref-24)
25. Ground or air launched via “mothership.” [↑](#footnote-ref-25)
26. All statistics from <https://www.faa.gov/data_research/commercial_space_data>, (accessed April 1, 2024). [↑](#footnote-ref-26)
27. https://www.faa.gov/sites/faa.gov/files/FY%202023-2043%20Full%20Forecast%20Document%20and%20Tables\_0.pdf [↑](#footnote-ref-27)
28. https://www.faa.gov/data\_research/commercial\_space\_data [↑](#footnote-ref-28)
29. Id. [↑](#footnote-ref-29)
30. https://media.defense.gov/2024/Apr/02/2003427610/-1/-1/1/2024-DOD-COMMERCIAL-SPACE-INTEGRATION-STRATEGY.PDF [↑](#footnote-ref-30)
31. For example: In Nevada large pieces of desert land purchased to build [space ports](file:////Users/AmyDuffy/Documents/Western%20Regional%20Partnerhip/MRHSDP&A/2023-2024/Airspace/2024/DOD%20Only%20-%20Jan%202024/space%20ports%20in%20Nevada%20are%20something%20to%20watch.%20Individuals%20are%20buying%20large%20pieces%20of%20the%20desert%20claiming%20they%20are%20going%20to%20build%20space%20ports.%20Ms.%20Duffy%20noted%20a%20related%20article.). [↑](#footnote-ref-31)
32. American Airlines Rocket/Missile Launch Impact and Airspace Closure Restrictions by Mr. Paul Amen, Manager, Air Traffic Management and Airfield Operations, American Airlines, September 2023. [↑](#footnote-ref-32)
33. [Commercial Space Transportation | Federal Aviation Administration (faa.gov)](https://www.faa.gov/space):Official FAA Commercial Space Home Website maintained by the ATCSCC Space Office.

    <https://spaceflightnow.com/launch-schedule/> - A calendar that has worldwide “scheduled” launches for Rockets; does not include airspace closures for military exercises.

    [International Affairs | Federal Aviation Administration (faa.gov)](https://www.faa.gov/space/additional_information/international_affairs) - This website includes the location of all International Spaceports. [↑](#footnote-ref-33)
34. Nevada Test & Training Range Welcome to the Arenas by Mr. John Barton Esch, Deputy Director Nevada Test and Training Range Nellis Air Force Base, Nevada, October 2023. [↑](#footnote-ref-34)
35. JATCAA is Where its ATCAA by Gregory J. Harrell, Manager, Air Traffic Control Libby Army Airfield, October 2023. [↑](#footnote-ref-35)
36. For more information please see, Hypersonic Weapons: Background and Issues for Congress at https://sgp.fas.org/crs/weapons/R45811.pdf [↑](#footnote-ref-36)
37. https://www.faa.gov/air\_traffic/by\_the\_numbers [↑](#footnote-ref-37)
38. UAS (also known as unmanned/uncrewed aerial vehicle, remotely piloted vehicle, and drone) consists of an aircraft designed to operate anywhere on a wide spectrum of operations between fully autonomous and piloted remotely and the equipment to control it.Uncrewed aircraft are currently used for government (federal, including military, state, and local law enforcement), recreational (flyers, modeler community-based organizations, certified remote), commercial, and research purposes. [↑](#footnote-ref-38)
39. https://www.faa.gov/uas/getting\_started/remote\_id [↑](#footnote-ref-39)
40. https://www.faa.gov/node/54496 [↑](#footnote-ref-40)
41. https://www.faa.gov/sites/faa.gov/files/FY%202023-2043%20Full%20Forecast%20Document%20and%20Tables\_0.pdf [↑](#footnote-ref-41)
42. https://www.foxbusiness.com/technology/aviation-breakthrough-pilot-free-plane-flies-san-jose [↑](#footnote-ref-42)
43. <https://www.faa.gov/sites/faa.gov/files/AAM-I28-Implementation-Plan.pdf> [↑](#footnote-ref-43)
44. https://www.faa.gov/sites/faa.gov/files/FY%202023-2043%20Full%20Forecast%20Document%20and%20Tables\_0.pdf [↑](#footnote-ref-44)
45. https://www.codot.gov/news/2023/may/colorado-division-of-aeronautics-begins-alternatively-powered-aircraft-study [↑](#footnote-ref-45)
46. Colorado Division of Aeronautics and National Renewable Energy Laboratory Alternatively Powered Aircraft Study by David Ulane, Director, Colorado Division of Aeronautics, August 2023. [↑](#footnote-ref-46)
47. See completed research, https://www.assureuas.org/research/?tx\_status=completed. [↑](#footnote-ref-47)
48. Based on NLCD 2021 data (analysis by USGS). [↑](#footnote-ref-48)
49. <https://wrpinfo.org/media/1839/building-resilience_2022-wrp-report_final.pdf> - Water Security Chapter begins on page 73. [↑](#footnote-ref-49)
50. Water Laws and Regulations “Bucket”, presentation to WRP Principals’ Meeting by Stephen Bartell, U.S. Department of Justice, ENRD, December 2022. [↑](#footnote-ref-50)
51. E.g., National Park Service (NPS), Forest Service (USFS), the Bureau of Land Management (BLM), Department of Defense (DoD) facilities, and other federal lands. [↑](#footnote-ref-51)
52. Water Laws and Regulations “Bucket”, Note 47 [↑](#footnote-ref-52)
53. See, e.g., the Mining Acts of 1866 and 1870, the Desert Land Act of 1877, § 8 of the Reclamation Act of 1902, § 10 of the Federal Water Power Act of 1920, § 1 of the Flood Control Act of 1944, § 301(a) of the Water Supply Act of 1958, § 101(b) and (g) of the Clean Water Act of 1972. [↑](#footnote-ref-53)
54. 43 U.S.C. § 666 (1952) [↑](#footnote-ref-54)
55. https://westdaat.westernstateswater.org [↑](#footnote-ref-55)
56. Colorado River Basin USGS Science Portal by Dr. Katharine Dahm, Senior Scientist, Rocky Mountain Region, USGS, August 2023 [↑](#footnote-ref-56)
57. Water Data and Water Security “Bucket”, presentation to WRP Principals’ Meeting by Ms. Michelle Bushman, Assistant Director and General Counsel, Western States Water Council (WSWC), December 2022. [↑](#footnote-ref-57)
58. Overview of Western Regional Partnership States- Tools and Funding Opportunities by Mr. Jack Simes, Area Manager, Southern California Area Office, Bureau of Reclamation, August 2023 [↑](#footnote-ref-58)
59. http://cw3e.ucsd.edu/FIRO/ [↑](#footnote-ref-59)
60. [↑](#footnote-ref-60)
61. https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Water-Resilience/CA-Water-Supply-Strategy.pdf [↑](#footnote-ref-61)
62. Additionally, the California Department of Water Resources (DWR) has released its final [California Water Plan Update 2023](https://lnks.gd/l/eyJhbGciOiJIUzI1NiJ9.eyJidWxsZXRpbl9saW5rX2lkIjoxMDAsInVyaSI6ImJwMjpjbGljayIsInVybCI6Imh0dHBzOi8vd2F0ZXIuY2EuZ292Ly0vbWVkaWEvRFdSLVdlYnNpdGUvV2ViLVBhZ2VzL1Byb2dyYW1zL0NhbGlmb3JuaWEtV2F0ZXItUGxhbi9Eb2NzL1VwZGF0ZTIwMjMvRmluYWwvQ2FsaWZvcm5pYS1XYXRlci1QbGFuLVVwZGF0ZS0yMDIzLnBkZj91dG1fbWVkaXVtPWVtYWlsJnV0bV9zb3VyY2U9Z292ZGVsaXZlcnkiLCJidWxsZXRpbl9pZCI6IjIwMjQwNDAyLjkyNzY1MzExIn0.jPGqsvP-KuGmPgWx6LTcyHAOVhsfgv4Abnh-sNJe9iM/s/2592879885/br/240015636170-l). It is the State’s strategic plan for sustainably and equitably managing and developing water resources. Other California reports related to need for better co-management of water to reduce risk and impacts of flood and drought events are: [Potential State Strategies for Protecting Communities and Fish and Wildlife in the Event of Drought](https://cwc.ca.gov/-/media/CWC-Website/Files/Documents/2024/01_January/Drought-Strategies-White-Paper_Final.pdf) (California Water Commission, 2024) and [Coordinating Flood & Groundwater Management, Considerations for Local Flood Managers](https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Flood-Management/Flood-MAR/Flood_GW_Brochure_Final.pdf) (CA DWR, 2023).  [↑](#footnote-ref-62)
63. https://www.usbr.gov/watersmart/bsp/ [↑](#footnote-ref-63)
64. https://www.epa.gov/sustainable-water-infrastructure/things-local-officials-should-know-about-sustainable-water#:~:text=A%20community's%20water%20infrastructure%20includes,water%2C%20wastewater%2C%20and%20stormwater. [↑](#footnote-ref-64)
65. There are FEMA resources to assist with state hazard mitigation plan updates (<https://www.fema.gov/sites/default/files/documents/fema_hma_drought-mitigation-policy-aid_09282023.pdf> ). [↑](#footnote-ref-65)
66. 28% of states or 14/50 (CA, CO, FL, GA, IA, MO, NV, NC, ND, OH, PA, SD, WA, WI) currently have enhanced plans. Additional requirements of an enhanced plan include demonstrating capabilities in grants management, integrated planning with other state and regional agencies, commitment to a comprehensive mitigation program, effective use of existing mitigation programs, and providing implementation support for local governments. [↑](#footnote-ref-66)
67. Webinar on NV state planning effort: <https://westernstateswater.org/events/supporting-drought-resilience-through-state-planning/> [↑](#footnote-ref-67)
68. For more information on wildfire, please see WRP Wildfire Chapter. There are opportunities for the two Deep-Dives to collaborate on this topic. [↑](#footnote-ref-68)
69. https://www.thewflc.org/sites/default/files/TrueCostofWildfire.pdf [↑](#footnote-ref-69)
70. Remarks by Ms. Laura Schweitzer, Executive Director, Council of Western State Foresters and the Western Forestry Leadership Coalition, presentation to WRP Principals’ Meeting, December 2022. [↑](#footnote-ref-70)
71. https://forestsandrangelands.gov/documents/strategy/natl-cohesive-wildland-fire-mgmt-strategy-addendum-update-2023.pdf [↑](#footnote-ref-71)
72. Multi-Hazard Mitigation Council (2019.). Natural Hazard *Mitigation Saves: 2019 Report.* <https://www.nibs.org/files/pdfs/NIBS_MMC_MitigationSaves_2019.pdf> [↑](#footnote-ref-72)
73. Building Codes Save: A Nationwide Study ES-1 November 2020. <https://www.fema.gov/sites/default/files/2020-11/fema_building-codes-save_study.pdf> [↑](#footnote-ref-73)
74. Controlled and intentional fires to eliminate hazardous fuel; done under ideal weather and air quality conditions to minimize risks. [↑](#footnote-ref-74)
75. Overview of Wildland Fire Mitigation and Management Commission Report Findings and Outcomes by Kathy Holder, Utah’s State Hazard Mitigation Officer - and - Member of the National Wildland Fire Mitigation and Management Commission; Tyson Bertone-Riggs and Annie Schmidt, Coordinators, Wildland Fire Mitigation and Management Commission, February 2024. [↑](#footnote-ref-75)
76. GNA is also available to other federal agencies, including the USFS, FWS, and NPS. [↑](#footnote-ref-76)
77. Statewide Wildland Urban Interface Fuels Treatments - Programmatic Environmental Assessment and Other Tools by Dr. Danielle K. Chi, Deputy State Director, Resources, Bureau of Land Management (BLM), California and Jessica Gallimore, State Fuels Program Lead, BLM, California, December 2023. [↑](#footnote-ref-77)
78. Id. [↑](#footnote-ref-78)
79. Id. [↑](#footnote-ref-79)
80. Western Governors support the use of GNA and as noted in WGA Resolution [2024-02](https://westgov.org/resolutions/article/policy-resolution-2024-02-national-forest-and-rangeland-management), National Forest and Rangeland Management, urge Congress to extend the authority to all federal land management agencies and authorize those entities to increase the flexibility of GNA. [↑](#footnote-ref-80)
81. In WGA Policy Resolution 2021-06, Disaster Preparedness and Response, Western Governors note that strengthening federal emergency management processes to promote single, comprehensive points of contact would streamline state-federal coordination in disaster response and help ensure states and territories can allocate resources where they are most needed. [↑](#footnote-ref-81)
82. [Federal Register, Vol. 88, No. 243. December 20, 2023.](C://Users/sduff/Downloads/DOT_FRDOC_0001-1578_content.pdf) [↑](#footnote-ref-82)
83. The Climatological Impacts of Megafires and Response by Sunny Wescott, Lead Meteorologist – Collaboration Cell, Infrastructure Security Division (ISD), Cybersecurity and Infrastructure Security Agency (CISA), Department of Homeland Security (DHS), August 2023. [↑](#footnote-ref-83)
84. <https://fsapps.nwcg.gov/nirops/pages/tfrsac> POC: [everett.hinkley@usda.gov](mailto:everett.hinkley@usda.gov) [↑](#footnote-ref-84)
85. https://www.doi.gov/pressreleases/biden-harris-administration-announces-161-million-landscape-restoration [↑](#footnote-ref-85)
86. https://www.fs.usda.gov/visit/know-before-you-go/recreational-drone-tips [↑](#footnote-ref-86)
87. That process is found at: <https://www.faa.gov/uas/advanced_operations/emergency_situations> [↑](#footnote-ref-87)
88. [Confronting the Wildfire Crisis | US Forest Service (usda.gov)](https://www.fs.usda.gov/managing-land/wildfire-crisis): https://www.fs.usda.gov/managing-land/wildfire-crisis [↑](#footnote-ref-88)
89. USDA Forest Service Post Fire and Post-Disaster Response and Recovery by Elaine Kohrman, National Post-Disaster Recovery Team Leader, USDA Forest Service and Cara Sponaugle (Farr), National Post-Fire Program Leader, USDA Forest Service, October 2023. [↑](#footnote-ref-89)
90. The Climatological Impacts of Megafires and Response by Sunny Wescott, Lead Meteorologist – Collaboration Cell, Infrastructure Security Division (ISD), Cybersecurity and Infrastructure Security Agency (CISA), Department of Homeland Security (DHS), August 2023. [↑](#footnote-ref-90)
91. <https://www.fire.ca.gov/what-we-do/fire-resource-assessment-program/gis-mapping-and-data-analytics> [↑](#footnote-ref-91)
92. <https://www.fs.usda.gov/main/r5/landmanagement/gis> [↑](#footnote-ref-92)
93. Western Governors Policy Resolution 2021-06, Disaster Preparedness and Response, urges the federal government to prioritize the funding of these important efforts, as they should have a positive effect on maximizing the value of restoration work and, more importantly, addressing the needs of communities affected by wildfire. [↑](#footnote-ref-93)
94. [Aerial Wildland Firefighting Equipment Strategy](https://www.usda.gov/sites/default/files/documents/wildfire-commission-aviation-report.pdf), completed in early 2023.

    [On Fire: The Report of the Wildland Fire Mitigation and Management Commission](https://www.usda.gov/sites/default/files/documents/wfmmc-final-report-092023-508.pdf), completed in September 2023. [↑](#footnote-ref-94)
95. As outlined in the Cohesive Strategy Addendum. [↑](#footnote-ref-95)
96. Predictive and Post-Wildfire Capabilities: US Geological Survey Response to Wildfires in the western United States by Mark Gunn, Deputy Director for Data, US Geological Survey, New Mexico WSC, August 2023. [↑](#footnote-ref-96)
97. Id. [↑](#footnote-ref-97)
98. The Climatological Impacts of Megafires and Response by Sunny Wescott, Lead Meteorologist – Collaboration Cell, Infrastructure Security Division (ISD), Cybersecurity and Infrastructure Security Agency (CISA), Department of Homeland Security (DHS), August 2023. [↑](#footnote-ref-98)
99. Some States recognize tribes that are not Federally Recognized. [↑](#footnote-ref-99)
100. The latest list of Federally recognized Tribes is found at 88 FR 54654, <https://www.federalregister.gov/documents/2024/01/08/2024-00109/indian-entities-recognized-by-and-eligible-to-receive-services-from-the-united-states-bureau-of> [↑](#footnote-ref-100)
101. Id. [↑](#footnote-ref-101)
102. New Sentinel Landscapes were [announced](https://www.defense.gov/News/News-Stories/Article/Article/3776193/dod-interagency-partners-designate-5-new-sentinel-landscapes/) on May 15, 2024 (after the 2024 WRP Principals’ Meeting) and include: the Great Salt Lake (UT), Mojave Desert (CA) and Eastern New Mexico Sentinel Landscapes. [↑](#footnote-ref-102)
103. Names are listed with their title and affiliation applicable during their participation. [↑](#footnote-ref-103)
104. Names are listed with their title and affiliation applicable during their participation. [↑](#footnote-ref-104)
105. Names are listed with their title and affiliation applicable during their participation. [↑](#footnote-ref-105)
106. Changed positions since the timing of this report. [↑](#footnote-ref-106)
107. Changed positions since the timing of this report. [↑](#footnote-ref-107)
108. Names are listed with their title and affiliation applicable during their participation. [↑](#footnote-ref-108)
109. Changed positions since the timing of this report. [↑](#footnote-ref-109)