Acronyms

Acronyms	Definition
AEWQA	Agricultural Environmental Water Quality Assistance
AF	Acre-foot (volume of water)
AG	VRWRP Technical Advisory Group
BMP	Best Management Practice
BRIC	Building Resilient Infrastructure and Communities
BVBMI	Barbareño/Ventureño Band of Mission Indians
Cal OES	California Governor’s Office of Emergency Services
Caltrans	California Department of Transportation
CAUSE	Central Coast Alliance United for a Sustainable Economy
CCA5	California’s Fifth Climate Change Assessment
CDFW	California Department of Fish and Wildlife
CHRIS	California Historical Resources Information System
CIP	Capital Improvement Plan/Program
CNRA	California Natural Resources Agency
CoSMoS	Coastal Storm Modeling System (USGS)
CRWQCB	California Regional Water Quality Control Board
CSU	California State University
CW3E	Center for Western Weather and Water Extremes
CWSRF	Clean Water State Revolving Fund
DWR	California Department of Water Resources
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program (NRCS)
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
GDE	Groundwater-Dependent Ecosystem
GIS	Geographic Information System
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GWL	Global Warming Level
HUC	Hydrologic Unit Code
IPCC	Intergovernmental Panel on Climate Change
JJA/DJF/MAM/SON	Seasonal abbreviations used in figures: Jun–Aug; Dec–Feb; Mar–May; Sep–Nov
LARWQCB	Los Angeles Regional Water Quality Control Board
LCP	Local Coastal Program
LID	Low Impact Development
LiDAR	Light Detection and Ranging
MAR	Managed Aquifer Recharge

Acronyms	Definition
MDERP	Matilija Dam Ecosystem Restoration Project
MOWD	Meiners Oaks Water District
MS4	Municipal Separate Storm Sewer System
MWD	Municipal Water District
NAHC	Native American Heritage Commission
NCAN	Native Coast Action Network
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
OBGMA	Ojai Basin Groundwater Management Agency
OVLC	Ojai Valley Land Conservancy
OVSD	Ojai Valley Sanitary District
RALI	Resilient Agricultural Lands Initiative
RCD	Resource Conservation District
RWQCB	Regional Water Quality Control Board
SAFER	Safe and Affordable Funding for Equity and Resilience
SGMA	Sustainable Groundwater Management Act
SLR	Sea Level Rise
SPI	Standardized Precipitation Index
SSP	Shared Socioeconomic Pathway (IPCC)
SWP	State Water Project
TEK	Traditional Ecological Knowledge
TMDL	Total Maximum Daily Load
UCCE	University of California Cooperative Extension
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UVRGA	Upper Ventura River Groundwater Agency
VCWPD	Ventura County Watershed Protection District
VLT	Ventura Land Trust
VRWD	Ventura River Water District
VRWRP	Ventura River Watershed Resilience Plan
WEAP	Water Efficiency and Allocation Program (Casitas MWD)
WPD	Watershed Protection District (also called VCWPD)
WRP	Watershed Resilience Plan

For definitions and a full glossary of terms, please see **Appendix A**: Glossary of Terms.

Chapter 1

Introduction

This chapter introduces the Ventura River Watershed Resilience Plan and outlines why a coordinated, watershed-scale approach is needed as climate impacts intensify. It provides an overview of the watershed's unique character, its longstanding culture of stewardship, and the goals of this resilience planning effort.

Land Acknowledgment

The Ventura River Watershed is the homeland of the Chumash people, who remain present here and in active relationship with the watershed as a living system connecting to xutaš (closest English translation is 'Mother Earth'). Through embarking on this planning effort, and in conversation with Chumash leadership, we have learned that all planning and resilience efforts sit inside that reality. They also sit within the truth that the landscape has been shaped by colonization, missionization, removal, and by later land and water decisions that can continue harmful impacts. Naming that history matters because it is part of the conditions we are planning within and intertwined with our work. As we talk about resilience and stewardship in this plan, we do so with the awareness that Indigenous governance, knowledge, and presence are ongoing here. We offer this acknowledgement to set the tone for how we continue planning, with the intention of moving in partnership towards future endeavors.

Plan Purpose and Objectives

The Ventura River Watershed Resilience Plan (VRWRP) provides a coordinated framework to assess climate risks and strengthen watershed resilience within the Ventura River Watershed (see Figure 1). The VRWRP evaluates how projected climate hazards may affect interconnected water resource systems – including water supply, groundwater, flood management, ecosystems, water quality and cultural resources – and identifies strategies to reduce vulnerabilities and enhance adaptive capacity.

The Ventura River Watershed is a place defined by its rugged terrain, diverse habitats, rural character, and a long-standing culture of collaboration and local water stewardship. Its independence from imported water supplies has shaped a strong and resilient community of dedicated water and watershed managers with a deep commitment to environmental stewardship. Since the time of the watershed's first inhabitants, resilience has been rooted in adapting land and water management practices to evolving conditions.

Accelerating climate change introduces new and compounding challenges. Climate-driven impacts such as intense storm events, prolonged droughts, rising temperatures, and severe wildfires will likely challenge the ability of water managers to meet the needs of the watershed's natural and built communities. Drought specifically is a central climate vulnerability for the watershed, with intertwined ecological, economic, infrastructure, and equity consequences. Strategic coordination of multiple adaptation measures will be required for the watershed to remain resilient under a rapidly warming climate.

The resilience of the watershed's interconnected water resource systems reflects both natural watershed processes and a century of infrastructure development, land use decisions, and water management practices. The VRWRP evaluates how climate change may affect these systems and identifies vulnerabilities and risks associated with climate hazards. In addition to prioritizing collaboration and engagement with Tribes and overburdened communities, the VRWRP relies on analysis of future climate projections, climate hazards, and system vulnerabilities to recommend adaptation strategies and implementation actions that mitigate risks to water systems and overall watershed resilience.

Importantly, the development of the VRWRP reflects the community's proactive approach and builds off the momentum of past and ongoing actions. These ongoing and existing efforts, including the Ventura River Watershed Management Plan, the Groundwater Sustainability Plans (GSPs), and the Matilija Dam Ecosystem Restoration Plan, among others, have helped shape the current state of the watershed. The

VRWRP takes stock of that progress while acknowledging that the dynamic nature of the watershed invokes us to identify and evaluate future actions appropriate for an uncertain climate future.

While the VRWRP focuses primarily on assets, infrastructure, and resources located within the Ventura River Watershed boundary, some critical systems that serve watershed communities extend just beyond it, particularly along the Ventura coastline, where wastewater, transportation, and flood-management facilities are exposed to sea level rise and coastal hazards. These cross-boundary dependencies were considered qualitatively in the vulnerability assessment and strategy development, and assets with direct functional influence on watershed resilience (such as the Seaside Wastewater Transfer Station) were included. However, the VRWRP remains a watershed-based plan, and therefore does not comprehensively evaluate climate impacts on infrastructure located outside the watershed unless those impacts directly affect conditions within it.

Figure 1 Ventura River Watershed Overview

Basemap provided by Esri and its licensors © 2026.
Additional data provided by CPAD, 2025; NHD, 2024.

24-16486 WRP
Fig 1 Ventura River Watershed

VRWRP Vision Statement and Guiding Principles

The Vision Statement and Guiding Principles were developed to align the watershed network around a shared understanding of what resilience means for the Ventura River Watershed and to guide how partners work together throughout the project. Established at the outset, they were designed to unify participants behind a common vision and shared expectations for collaboration and outcomes. They were developed over a 10-month period through a public forum and a series of meetings with the Advisory Group and Watershed Council—two bodies that convene local agencies, Tribes, nonprofits, and community partners. The Vision and Guiding Principles were later presented to participants in the West Ventura focus groups led by the Central Coast Alliance United for a Sustainable Economy, where they were affirmed by community members.

Vision Statement:

We envision a resilient and thriving Ventura River Watershed—where water, communities, ecosystems, and cultural practices are interconnected and sustained for future generations, and where the benefits of resilience are shared equitably.

Through proactive collaborative planning, inclusive engagement, and science-informed strategies, we will strive to restore natural systems and processes, protect local water resources and enhance water security, and strengthen our collective capacity to adapt to increasing climate challenges. Our efforts will support sustainable watershed management that benefits both ecological health and community well-being.

Guiding Principles:

This vision is supported by guiding six guiding principles that will shape our collective action. These articulate the core values and overarching approach that shape decision-making throughout the planning process. The VRWRP's guiding principles include:

1. **Restore and Protect Ecosystem Health:** Support the resilience of the watershed by restoring habitat, removing invasive species, and protecting native biodiversity. Promote land stewardship that sustains natural functions and strengthens healthy soils, water, and ecosystems in a changing climate.
2. **Safeguard and Sustain Local Water Resources:** Protect and enhance local surface and groundwater by building on existing integrated watershed planning and implementing sustainable strategies. Support improved water reliability and quality and strengthen resilience to drought and other climate stressors that impact both people and the environment.
3. **Advance Climate Resilience through Action and Innovation:** Identify and implement proactive, place-based strategies and innovative solutions to address climate risks. Promote nature-based solutions, climate-resilient infrastructure, and land use decisions that reduce risk and support long-term adaptability.
4. **Promote Equity and Cultural Connection**: Ensure that Tribal and overburdened communities are meaningfully included in watershed planning and decision-making, and that investments reflect community-identified priorities and honor cultural relationships to land and water.

5. **Foster Stewardship and Education**: Promote community stewardship, connection to the river, and shared responsibility through access, education, and opportunities for meaningful participation in watershed resiliency efforts.
6. **Support Collaborative, Informed Decision Making**: Leverage local knowledge, Indigenous practices, and data-supported approaches to guide adaptive management, strengthen integrated land and water use planning, and build strong regional partnerships.

Statewide Watershed Resilience Initiative and Funding Program

To address increasing climate risks to water resources and to support inclusive, watershed-scale collaboration, the California Department of Water Resources (DWR) established the Watershed Resilience Pilot (WRP) Program. This program aligns with the three key priorities identified in the 2023 California Water Plan: climate resilience, watershed resilience, and equity. The program recognizes that climate hazards affect interconnected water resource systems across jurisdictional and sector boundaries. The WRP Program supports identification and prioritization of adaptation strategies and tracking progress toward long-term water resource resilience.

With funding authorized in the Budget Acts of 2021 and 2022, DWR launched the WRP Program in 2024, awarding funds to five regions across California. These pilots are intended to test and refine watershed-scale resilience planning approaches that integrate climate science, community engagement, and multi-sector water management strategies, resulting in detailed WRPs that take a headwaters-to-outlets approach. These plans aim to center equity in all water decisions, assess current water conditions and climate risks, analyze vulnerabilities, and develop adaptation strategies to reduce them.

The Ventura River Watershed was selected as one of the five pilot regions, each receiving approximately $2 million in grant funding, with the Ventura County Resource Conservation District (VCRCD) serving as the grantee. The watershed provides a valuable setting to pilot the program due to its reliance on local water supplies, strong collaborative planning history, diverse ecological and cultural resources, and repeated exposure to climate threats. Together, these characteristics and the resulting adaptation strategies will inform future WRP efforts statewide.

Plan Organization

The VRWRP is organized around DWR's Watershed Resilience Framework which provided guidance for each chapter in the VRWRP. Following this introduction, the VRWRP describes the **watershed network**, including the organizations, partnerships, and engagement efforts taken that informed this Plan's content. The following section then describes the **watershed's characteristics and current challenges**. Subsequent chapters discuss **climate vulnerabilities** and water sector risks, identify and evaluate **adaptation strategies**, and outline **implementation pathways** and performance-tracking approaches that support long-term resilience. For readability, and to conform with suggested page limits, supporting technical analyses, data summaries, and methods are mostly provided in supporting appendices.

Planning History and Context in the Watershed

The VRWRP builds on a long history of collaborative watershed planning that has shaped water management, ecological restoration, hazard mitigation, and community resilience efforts across the Ventura River Watershed. Foundational efforts include the 2015 Ventura River Watershed Management Plan and the 2019 Integrated Regional Water Management (IRWM) Plan, both of which established shared goals, documented watershed conditions, and supported coordinated project development across numerous agencies, land managers, Tribes, nonprofits, and community-based organizations. Additional related or relevant reports, programs, and planning efforts are listed in **Appendix B**: Related Reports, Resources, and Programs.

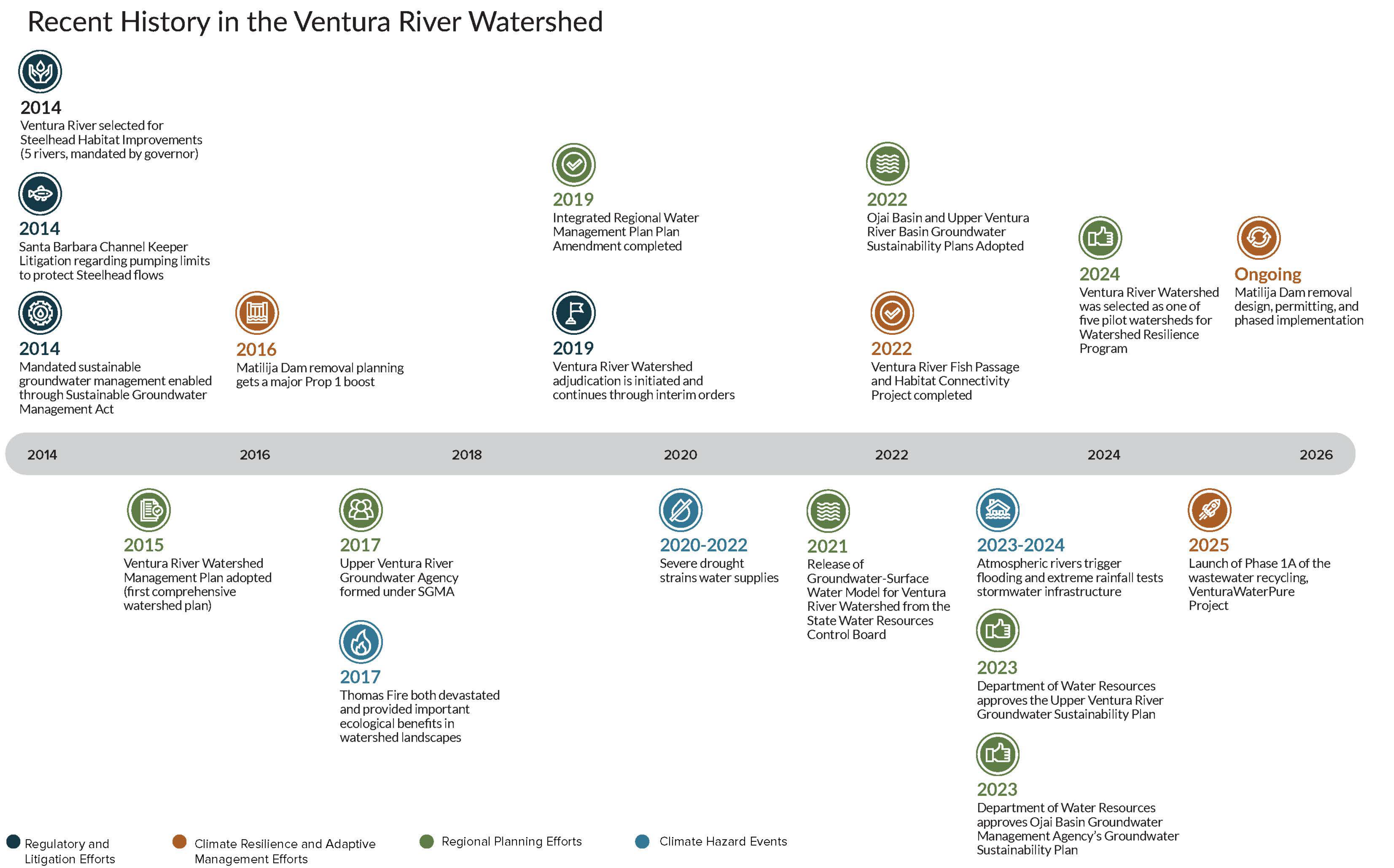
Since the completion of these earlier plans, the watershed has experienced significant changes—both in terms of climate pressures and in the policy, regulatory, and technical landscape guiding watershed decision-making. State and federal climate-science updates, evolving regulatory requirements, and improved engagement practices have strengthened expectations for inclusive, transparent, and science-informed water and land-use planning. At the same time, climate-driven hazards such as wildfire, post-fire erosion, extreme heat, extended drought, and high-intensity storm events have increased in frequency and severity, underscoring the need for a more integrated and forward-looking approach.

Several major developments since 2015 are now shaping watershed conditions and informing the need for the VRWRP:

- Large-scale ecological and geomorphic restoration efforts, most notably the Matilija Dam Ecosystem Restoration Project (MDERP), which is advancing major infrastructure, habitat, and sediment-management improvements designed to restore more natural hydrologic and ecological function.
- Watershed-wide Arundo (*Arundo donax*) removal and riparian restoration efforts, which have expanded substantially in recent years in response to Arundo's impacts on hydrology, wildfire behavior, habitat quality, and channel capacity. These coordinated programs involve public agencies, local organizations, and landowners and represent a significant ongoing restoration investments in the watershed.
- Accelerated work to improve fish passage and aquatic connectivity, including recent multi-benefit projects designed to enhance habitat conditions, remove barriers, and support recovery of sensitive aquatic species.
- Development of improved groundwater–surface water analytical tools, including State Water Board modeling efforts intended to support long-term adaptive management and provide greater clarity on surface-water/groundwater interactions.
- A watershed-wide water-rights adjudication initiated to clarify water-rights allocations and establish a coordinated framework for long-term water-management operations across the Ventura River Watershed basins. This basin-wide legal process involves groundwater and surface-water users throughout the watershed. While independent from the VRWRP, the adjudication may influence future coordination, governance, and water-management responsibilities. The VRWRP is therefore designed to remain flexible and compatible with a range of potential outcomes.

Alongside other changes, these developments reflect a rapidly evolving watershed context in which climate pressures, regulatory requirements, restoration activities, and collaborative initiatives intersect. They reinforce the need for a comprehensive, watershed-scale climate resilience plan that builds on past work while addressing the increasingly complex and compounding challenges facing communities, ecosystems, and water systems. A snapshot of this recent history and significant milestones in the watershed can be seen in Figure 2.

Figure 2 Recent History in the Ventura River Watershed



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2015 Ventura River Watershed Management Plan

In 2015, the Watershed Council released the Ventura River Watershed Management Plan (WMP), which was funded by a California Department of Conservation Watershed Coordination grant. The WMP is a comprehensive plan addressing the state of the watershed with extensive documentation. The Council membership, Watershed Coordinator, and consultants spent more than three years in collaboration with the ongoing IRWM Planning effort, developing the WMP. Over the past 10 years, the Council has been implementing the Plan's recommendations and program campaigns. Access the WMP here: https://venturawatershed.org/the-watershed-plan.

A few key topics that were *not* addressed in the WMP include: the Sustainable Groundwater Management Act (SGMA) and related implementation; climate change related hazards and adaptation strategies; and more robust engagement with - and participation of - Tribes and overburdened communities. These topics are being addressed in detail with the VRWRP. See below for brief summaries of each of these topics.

Sustainable Groundwater Management

SGMA, adopted by the California Legislature in 2014, led to the formation of Groundwater Sustainability Agencies (GSAs) and the preparation of GSPs for state-designated medium- and high-priority basins. These plans guide long-term sustainable groundwater management and avoid undesirable results such as chronic lowering of groundwater levels. SGMA also allows the creation of local funding mechanisms to support ongoing basin management.

There are two GSAs in the Ventura River Watershed: the Upper Ventura River Groundwater Agency and the Ojai Basin Groundwater Management Agency. Both have GSPs that have been approved by DWR and are now being implemented. Two other groundwater basins in the watershed—the Lower Ventura River and Upper Ojai basins—are designated low-priority due to limited use and low well yield and are not required to develop GSPs.

Climate Change Hazards and Adaptation

Following the development of the WMP, substantial research has been done at the local, state, and national level regarding climate change. While climate change models do not always agree on specifics, they largely support the conclusion that climate change will result in more intense wildfires, prolonged droughts, intense precipitation and extreme flooding, and higher temperatures. In 2018, climate researchers with the Desert Research Institute conducted an in-depth analysis of climate models and published a report on climate projections for Ventura County. This report, titled *Projected Changes in Ventura County Climate*, was incorporated into the 2019 IRWM Plan, with adaptation approaches included in Section 13. Access the report here: https://wrcc.dri.edu/Docs/VenturaClimate2019_lores.pdf.

Past Engagement with Overburdened Communities and Tribes

Following the completion of the 2015 Ventura River WMP, the Watersheds Coalition of Ventura County received grant funding to engage more meaningfully with overburdened communities and Tribes. Referred to as WaterTalks, the program resulted in development of needs assessments, capacity building, technical assistance, and implementation of much needed projects in overburdened communities across the County, including in the Ventura River Watershed. This six-year effort helped to set the stage for the work currently being conducted through this effort.

Chapter 2

Watershed Network

This chapter provides a clear picture of current watershed conditions, including water supply, groundwater, ecosystems, cultural resources, and community needs. It highlights the challenges and opportunities shaping resilience today, weaving in scientific data and community perspectives.

Introduction

The Ventura River Watershed Resilience Plan (VRWRP) was developed through a broad, multi-layered network of organizations, agencies, Tribes, community-based groups, and local community members whose decisions and experiences shape watershed health. This chapter documents how that watershed network was identified, expanded, and engaged throughout the VRWRP process, and how its structure and function were evaluated to support long-term, climate-resilient collaboration.

As the watershed transitions from planning to implementation, the roles of the Watershed Council, Advisory Group (AG), and broader watershed network are expected to evolve. The insights and recommendations from the California State University (CSU) assessment, combined with engagement findings presented in this chapter, provide a roadmap for enhancing watershed-scale coordination and supporting an implementation-ready network capable of advancing the VRWRP in the years to come. Next steps and future considerations for watershed network facilitation are discussed more in the conclusion of this chapter, in addition to Chapter 6 and Chapter 7.

Foundation of the Watershed Network

The Watershed Council forms the core of the watershed network for the VRWRP. Established in 2006 under the IRWM Program, the Watershed Council provides a long-standing forum that brings together water and wastewater agencies, local governments, land managers, environmental organizations, Tribal partners, community-based groups, agricultural representatives, and interested residents.

With regular public meetings, a public-facing website, newsletters, and a distribution list of more than 500 participants, the Council offers an established structure for transparent and inclusive collaboration. Throughout the VRWRP process, it served as the primary venue for sharing updates, presenting technical work, and gathering input, while also expanding engagement to additional community partners and Tribes.

The Watershed Council's existing Charter and Leadership Committee provided clear roles and expectations that supported effective coordination across a diverse network of partners. These structures helped bridge past watershed planning efforts with the climate-focused work of the VRWRP. Refer to **Appendix C**: Watershed Council Charter.

Governance Structure for the VRWRP

Developing the VRWRP required a governance structure that supported coordination, transparency, and shared decision-making across the watershed network. This section describes how the Watershed Council and the AG worked together to review materials, guide technical work, and ensure that diverse perspectives were included throughout the planning process.

Advisory Group Formation and Purpose

The AG was formed at the start of the project, drawing from the Watershed Council's Leadership Committee and expanding to include Tribal representatives, community-based organizations, agricultural partners, and other subject-matter experts. The AG played a central role in shaping the VRWRP by:

- providing subject-matter expertise;
- reviewing draft technical materials and chapters;
- grounding the plan in watershed-specific knowledge and lived experience;
- supporting transparency and accuracy; and
- documenting consensus and differing perspectives, consistent with the Council's Charter.

The AG met regularly with flexible participation to accommodate capacity. These virtual meetings were facilitated by the project team and supported with structured materials and follow-ups.

Advisory Group Protocols and Decision-Making

To guide its work, the AG developed a guidance document. Refer to **Appendix D**: Advisory Group Policies and Procedures. This document outlines:

- roles and expectations;
- how communication flows between the AG, Watershed Council, and project team;
- how AG feedback is incorporated; and
- how the group documents consensus and differences.

The AG used a consensus-based approach. When full agreement was not possible, differing views were noted so they could be reflected accurately in the VRWRP.

Review and Endorsement Process

After completing AG review, a compiled draft VRWRP was shared with the full Watershed Council and the public for broader feedback. The draft was presented for discussion at a public Watershed Council meeting in March 2026, with formal endorsement anticipated in June 2026 in accordance with the Watershed Council Charter.

Engagement Approach

Development of the VRWRP was supported by a coordinated, multi-tiered engagement approach designed to gather technical input, elevate community perspectives, and strengthen collaboration across the watershed network. Engagement activities occurred from August 2024 through March 2026 and included regular Watershed Council meetings, AG meetings, key-partner interviews, focused discussions with Tribal and overburdened communities, and public forums. Engagement activities evolved over time, moving from initial network formation and visioning to review of watershed conditions, climate vulnerabilities, and ultimately, development of adaptation strategies and implementation roadmaps. An overview of the engagement activities and associated timeline is displayed in Figure 3, and materials from engagement events can be found in **Appendix E**: Engagement Materials. Details on how feedback informed the drafting of this VRWRP can be found in **Appendix F**: Summary of Feedback Received.

Figure 3 WRP Network Engagement Timeline (2024-2026)

Phase 1: Network Formation, Early Coordination, and Scoping

August 2024 – January 2025

- **August 2024** – Watershed Council: VRWRP introduction
- **Fall 2024** – Key partner interviews
- **October 2024** – Watershed Council: Approval of role of Council as WRP Network
- **December 2024** – Watershed Council: Updates on VRWRP scope and timeline, and website launch
- **January 2025** – AG formation

Phase 2: Vision, Watershed Assets, and Challenges

March – June 2025

- **March 2025** – AG Meeting #1: VRWRP introduction and overview
- **April 2025** – Forum #1: Vision, goals, and watershed assets
- **June 2025** – Watershed Council: Review and approve vision statement

Phase 3: Network Assessment, Vulnerability and Technical Analysis

May – December 2025

- **May 2025** – AG Meeting #2: Identify climate hazard metrics and thresholds
- **May-June 2025** – Community focus groups (West Ventura & Casitas Springs)
- **May-June 2025** – Regional network assessment survey
- **July 2025** - Forum #2: Identify and prioritize watershed assets and discuss climate hazard impacts
- **July 2025** – AG Meeting #3: Review historical water budget and problem statements
- **September 2025** – AG Meeting #4: Review initial qualitative vulnerability assessment results
- **November 2025 – November 2025** - "AG meeting #5: Review of quantitative vulnerability assessment approach
- **December 2025** – Watershed Council: Regional network assessment results

Phase 4: Adaptation and Implementation Strategies

October 2025 – March 2026

- **October 2025** – Joint Watershed Council & AG Special Session: review key vulnerabilities and develop draft adaptation strategies and actions
- **December 2025** – AG Meeting #6: Tribal perspectives and Indigenous Knowledge Systems presentation; review draft adaptation strategies
- **February 2026** – Forum #3: Tribal resilience and implementation roadmaps
- **March 2026** – AG Meeting #7: Review compiled VRWRP
- **March 2026** – Watershed Council: VRWRP final presentation

Watershed Resilience Plan Website

The VCRCD created a VRWRP webpage to serve as a central, publicly accessible hub for project information. The webpage included meeting notices, presentations, summaries, and updates throughout the planning process. The final draft VRWRP was also posted online to support transparency and allow for broader review and input. Access the website here: https://vcrcd.org/venturawatershedresilience/.

Key Partner Interviews

At the outset of the project, the VRWRP team conducted interviews with key watershed partners, including water and wastewater agencies, land conservancies, Tribal leaders, environmental organizations, and resource managers. These conversations introduced the VRWRP pilot program, clarified its relationship to existing efforts, and solicited perspectives on climate-related concerns, vulnerabilities, and opportunities for added value.

Insights from key partner interviews informed early technical analyses, such as asset identification, climate-hazard prioritization, and assessment scope, and helped shape subsequent engagement activities. Interviews were held with:

- California State Parks
- Casitas Municipal Water District
- City of Ventura – Ventura Water
- County of Ventura – Watershed Protection District
- Ventura County Farm Bureau
- Meiners Oaks Water District
- Ojai Basin Groundwater Management Agency

- Ojai Valley Fire Safe Council
- Ojai Valley Land Conservancy (OVLC)
- Surfrider
- Upper Ventura River Groundwater Sustainability Agency
- Ventura Land Trust
- Ventura River Water District

Watershed Council Meeting Presentations

Throughout the project, the VRWRP team provided regular updates during public Watershed Council meetings. Presentations, which were delivered both in person and virtually, covering project progress, technical findings, and draft materials. These meetings provided an open forum for Watershed Council members and the public to ask questions, offer feedback, and help shape the direction of the VRWRP.

Advisory Group Engagement

The AG met roughly every other month throughout the planning process and played a central role at key decision points. AG members helped develop metrics and thresholds used in the climate vulnerability assessment, reviewed the analysis of risks and consequences, and contributed to the development of strategies and actions. Meetings were held virtually to support broad participation, and optional office hours offered additional opportunities to engage during critical review periods. Draft VRWRP chapters were shared with the AG as they were developed, and the full consolidated draft was reviewed prior to release for broader watershed network and public comment.

Forums and Workshops

Three major workshops were held to support deeper engagement at pivotal moments in the project. Two were in-person public forums, and one was a joint session with the AG and Watershed Council. These workshops included informational presentations, facilitated activities, and group discussions that helped generate input on assets, climate hazards, vulnerabilities, and potential resilience strategies.

Tribal Engagement

As a public entity and the lead agency for this project, the VCRCD followed formal state guidance for Tribal consultation while also investing in relationship-based engagement. After receiving a Tribal Consultation List and Sacred Lands File results from the Native American Heritage Commission, the VCRCD transmitted formal project notification to the Tribal contacts identified, along with a brief questionnaire inviting participation and requesting input on preferred engagement methods and areas of interest.

While no formal responses were received at that stage, engagement deepened through direct relationship-building with the Barbareño/Ventureño Band of Mission Indians (BVBMI). The Chairman and Tribal representatives contributed to multiple components of the plan, including cultural resources, stewardship perspectives, and adaptation strategies. They also helped host the final community forum titled "kišunuškuy – Planning for Resilience", which centered Tribal leadership and values.

The broader Chumash community also contributed. Long-time culture bearer Julie Tumamait-Stenslie provided ongoing cultural insights, and the Native Coast Action Network (NCAN) participated in AG meetings, reviewed adaptation strategies, and advised on integration of Indigenous perspectives. Tribal input meaningfully shaped strategies related to fire stewardship, riparian restoration, cultural landscapes, and implementation pathways.

The Barbareño/Ventureño Band of Mission Indians

BVBMI played a central role in shaping the VRWRP. Like many Tribal governments, BVBMI manages broad responsibilities with limited staff capacity, which shaped the timing of their engagement in the process. Once connected, Tribal representatives contributed meaningfully to the VRWRP's focus on cultural resources, place-based stewardship, and Tribal representation.

The BVBMI Chairman and Tribal representatives participated in an asset-manager interview for the vulnerability assessment, joined an AG meeting, and engaged directly with the project team throughout plan development, and co-hosted the final public forum on adaptation strategies. BVBMI also helped host the final public forum, "kišunuškuy: Planning for Resilience," creating space to share Tribal values, stewardship principles, and perspectives on implementation. Their leadership elevated Tribal visibility and ensured that Indigenous knowledge informed key elements of the Plan.

Broader Chumash Community Involvement

Beyond formal consultation with BVBMI, the VRWRP benefited from contributions across the wider Chumash community. Chumash Elder and culture bearer Julie Tumamait-Stenslie, whose family maintains deep ties to the watershed, provided long-standing cultural guidance and continued to share insights throughout the planning process as part of ongoing Watershed Council activities.

The project team also partnered with the NCAN, a Chumash-led nonprofit focused on climate resilience, cultural stewardship, and community capacity building. NCAN served as an advisory partner, participating in AG discussions, reviewing adaptation strategies, and helping integrate Indigenous perspectives and cultural resource priorities into the VRWRP.

Together, input from BVBMI, Chumash Elders, and NCAN strengthened the VRWRP's emphasis on Indigenous knowledge, fire and land stewardship, riparian protection, and culturally significant landscapes. Their guidance directly shaped several adaptation strategies and informed development of the cultural resources implementation roadmap. For more details and next steps to strengthen relationships, please see **Appendix G**: Full Tribal Engagement Report.

au' , o, ', (water) : Chumash Presence in Ventura River Watershed

"Climate change's impacts on water disproportionately disrupts Indigenous lifeways" acknowledge current Tribal Environmental Professionals.

Indigenous knowledge systems (IKS) offer Native knowledge, science and practice to climate adaptation strategies throughout Chumash homelands and homewaters, including the Ventura River Watershed. To include Chumash knowledge systems in watershed-wide planning, it is important to acknowledge the limitations and opportunities for Chumash people, as well as the role of Chumash IKS within broader conversations about Tribal and Indigenous climate adaptation strategies. Tribal climate adaptation professionals remind us that, "subsistence farming, hunting and gathering, ceremonial life, and languages have been and continue to be taught through intergenerational sharing. In contexts of intercultural communication, these practices are often referred to as Traditional Ecological Knowledge, Traditional and Indigenous Knowledges, or Indigenous Knowledge Systems. IKS are considered to be the lifelines of communities due to the deep seeded connection to the earth that has been with the people since time immemorial and has fostered crucial knowledge ranging from how to maintain food systems to how to support positive mental health. The collective information sharing is entwined with multiple aspects of society, such as ceremonies, songs, prayers, dances, clothing, food gathering and preparation, and so on."

The 2023 Tribal Water Needs Assessment Report for Ventura County found that Chumash respondents mirrored ITPEC STACC 2's findings that their relationship to water absolutely includes IKS, ceremonial, spiritual, food and lifestyle ways. Chumash respondents acknowledged that water creates life for all relatives. The 2023 Tribal Water Needs Assessment for Ventura County also identified ongoing gaps in access, engagement, and recognition of Tribal water needs.

Climate environmental professionals at the Institute for Tribal Environmental Professionals direct resource managers to build plans, policies, and programs grounded in IKS and to incorporate relationships and reciprocity, rather than foregrounding Western science. What work, collaborations, partnerships and funding sources can contribute to such a shift for our watershed? The VRWRP begins to explore foregrounding Native leadership and Chumash science here in Chumash homelands, however, iterative and long-term plans, actions, collaborations and partnerships need to be made in order to include Chumash IKS into stewardship of the Ventura River Watershed. Chumash people and knowledge systems need to contribute to all planning efforts and implementation in the Ventura River Watershed, which remains critical to Chumash life.

Focused Engagement with Overburdened and Frontline Communities

Providing equitable access to participation in the VRWRP development process was a key state and local priority. Early in the process, the VRWRP team identified disadvantaged communities, recognizing that these communities often face greater climate impacts and barriers to participation. Two areas in the watershed—the West Ventura Avenue neighborhood and Casitas Springs—meet the state's disadvantaged community criteria based on median household income.

Several equity-focused community-based organizations are active in watershed, including the Westside Community Council (Council), the Central Coast Alliance United for a Sustainable Economy (CAUSE), and the Merito Foundation. They continuously participate in the Watershed Council and had worked on equity-focused initiatives such as the WaterTalks Program. Building on CAUSE's prior outreach and needs-assessment work, and to ensure community input was reflected in project outcomes through accessible and inclusive engagement, the VRWRP partnered with CAUSE to lead targeted outreach in West Ventura Avenue and Casitas Springs.

CAUSE conducted in-person surveys and facilitated focus groups to understand community experiences with climate hazards and to elevate local priorities. In summer 2025, CAUSE collected 113 surveys, more than half in Spanish, by conducting outreach at high-traffic locations and through door-to-door visits. Respondents were predominantly West Ventura residents, most identifying as Latino and earning under $50,000 per year. Surveys captured neighborhood strengths, challenges, and lived experiences with extreme heat, drought, flooding, and wildfire.

In November 2025, CAUSE held two focus groups—one in Spanish with eight adult residents and one in English with thirteen Ventura High School youth. Participants received background information on watershed conditions and climate projections and contributed to structured discussions on key climate hazards. Through a voting exercise, residents identified the resilience strategies they viewed as most urgent and impactful.

Across both surveys and focus groups, several consistent themes emerged. Residents emphasized the need for:

- Expanded shade and cooling infrastructure
- Improved emergency communication, including multilingual alerts
- Accessible, culturally relevant outreach through trusted community spaces like schools

Participants also connected climate resilience to daily lived experiences, including housing conditions, transportation access, public safety, and the availability of green spaces.

These insights directly informed refinement of the VRWRP's adaptation strategies, particularly those related to extreme heat mitigation, equitable access to resilience infrastructure, and improved communication during climate-driven emergencies. Detailed findings, demographic information, and recommendations are included in **Appendix H**: CAUSE Engagement Final Report.

Assessment of Existing Regional Networks

To meet DWR's requirements for evaluating existing regional networks and identifying gaps in engagement, VCRCD worked with the CSU team to conduct a comprehensive assessment of the watershed's organizational landscape. This assessment examines how organizations currently collaborate, the sectors they represent, and where opportunities exist to strengthen coordination, inclusivity, and support for overburdened communities and Tribes. The CSU Regional Network Assessment is included below, with additional detail in **Appendix I**: CSU Network Assessment Report.

Introduction

A key first step in the DWR's Watershed Resilience Framework is to identify and evaluate the existing regional watershed network of organizations active within the Ventura River Watershed. These organizations work on issues such as water resources, conservation, the environment, wildfire, community engagement, and recreation, and potentially have an intersection with watershed resilience planning. For example, the network includes groups that already collaborate on watershed-related projects and programs, share data or expertise, or coordinate funding, materials, or labor.

There are several purposes for identifying and assessing the watershed resilience network: (1) to determine how existing partnerships can support watershed resilience planning; and (2) to identify opportunities to strengthen collaboration in implementing resilience strategies, particularly by enhancing engagement with overburdened communities and tribes.

To achieve these goals, the assessment focused on three main objectives:

- Creating an inventory of organizations actively working in the watershed;
- Identifying and describing existing collaborative relationships among these organizations; and
- Evaluating the overall health of the network, including how well it engages with vulnerable and historically excluded communities.

The watershed network assessment was conducted by the Center for Geospatial Science and Technology at CSU Northridge, the Institute for Watershed Resiliency at CSU San Bernardino, and the Loyola Marymount University Center for Urban Resilience—collectively referred to as the "CSU team"— in partnership with the Watershed Resilience Project team.

An interactive Story Map on the Ventura River Watershed Network is available at https://arcg.is/1KvzPO2.

Methods Summary

To complete the assessment of the existing regional network in the Ventura River Watershed, an online survey was sent to 72 community partners in May 2025. This survey collected information on several main topics from organizations that currently work in the watershed:

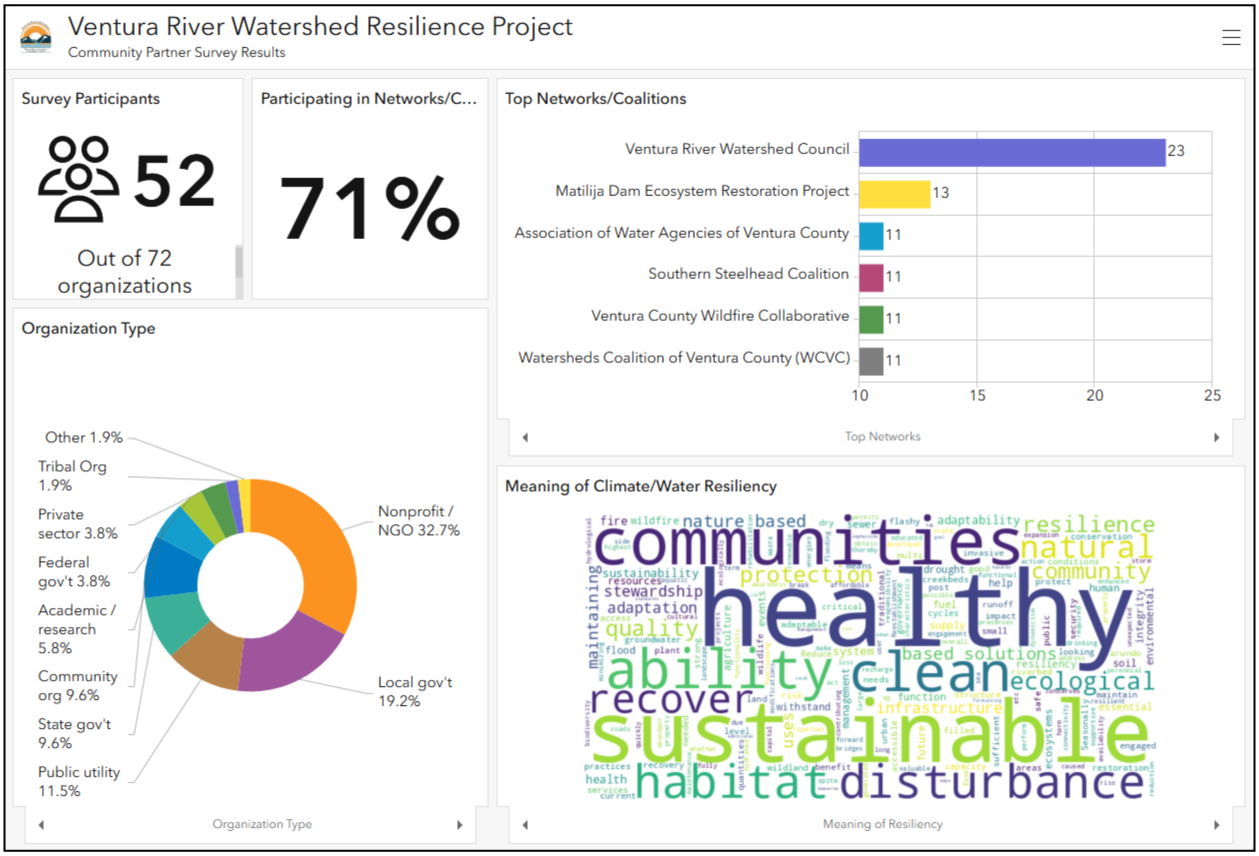
- Where they work and what issues they work on;
- How they currently collaborate with other organizations in the watershed; and
- Their priorities related to water and climate resilience issues.

More details regarding the survey methodology, including the specific survey questions used, can be found in **Appendix I**: CSU Network Assessment Report. To more accurately determine the geographic areas where these organizations operate, the CSU team followed up with several organizations based on their survey responses. To supplement the survey data, the team incorporated information gathered from meetings with key partners held between August and December 2024. While these meetings primarily focused on identifying climate risks and vulnerabilities and priority adaptation strategies, existing collaborations with other organizations also were discussed. The resulting dataset was analyzed using statistical, spatial, and social network analyses.

Results and Discussion

Of the 72 organizations invited to participate in the survey, 52 responded, resulting in a 72 percent response rate. An interactive dashboard summarizing survey results (shown in Figure 4) is available at https://t.ly/vrwrp-dashboard.

Figure 4 ArcGIS Dashboard Summarizing Community Partner Survey Results



Survey participants represented a diverse range of organization types. Approximately one-third were nonprofits or non-governmental organizations, 20 percent were local government agencies, 12 percent were public utilities, 10 percent were state government agencies, and another 10 percent were community-based groups. The remaining respondents represented academia and research institutions, federal agencies, the private sector, and Tribal representatives, members and organizations. Similarly, survey participants represented a broad range of sectors. Nearly one-quarter of the organizations focus on water resources, 20 percent on land management or conservation, and about 12 percent of the organizations each work on community, ecosystem/habitat, or wildfire issues. The remaining organizations work primarily on agriculture, recreation, energy, municipal, or Native/Tribal issues.

While the survey captured a broad range of perspectives, response rates were lower among those serving overburdened communities, which may limit the representativeness of these groups in the results. To minimize respondent burden and keep the survey concise, detailed questions about how organizations engage with these populations were not included. As a result, perspectives from these groups and information on engagement with these communities may be underrepresented in the overall findings. Complete profiles of community partners that completed the survey are provided in **Appendix I**: CSU Network Assessment Report. It's important to note that the local BVBMI was consulted and provided survey responses which are included in this assessment. Through the VRWRP, Tribal engagement has been strengthened and continues to expand; providing more connections among all key partners in the watershed.

In addition to the research and analysis conducted through this network assessment, a local community-based organization called CAUSE conducted outreach and engaged with overburdened communities in the watershed to assess their unique risks and impacts from climate hazards. The findings from their survey and focus groups can be found in **Appendix H**: CAUSE Engagement Final Report.

Spatial Characteristics

The geographic scope of respondents' work within the Ventura River Watershed spans a range of scales, from multi-watershed initiatives to highly localized, project-specific efforts. Eighteen organizations (approximately 35 percent) reported working throughout the entire Ventura River Watershed, although the survey did not capture the specific locations of their projects. Another 33 percent reported working across multiple watersheds, including the Ventura River Watershed, indicating that their resources and staff time are distributed across several regions. This suggests that many organizations take a watershed-wide, holistic approach rather than focusing solely on localized issues.

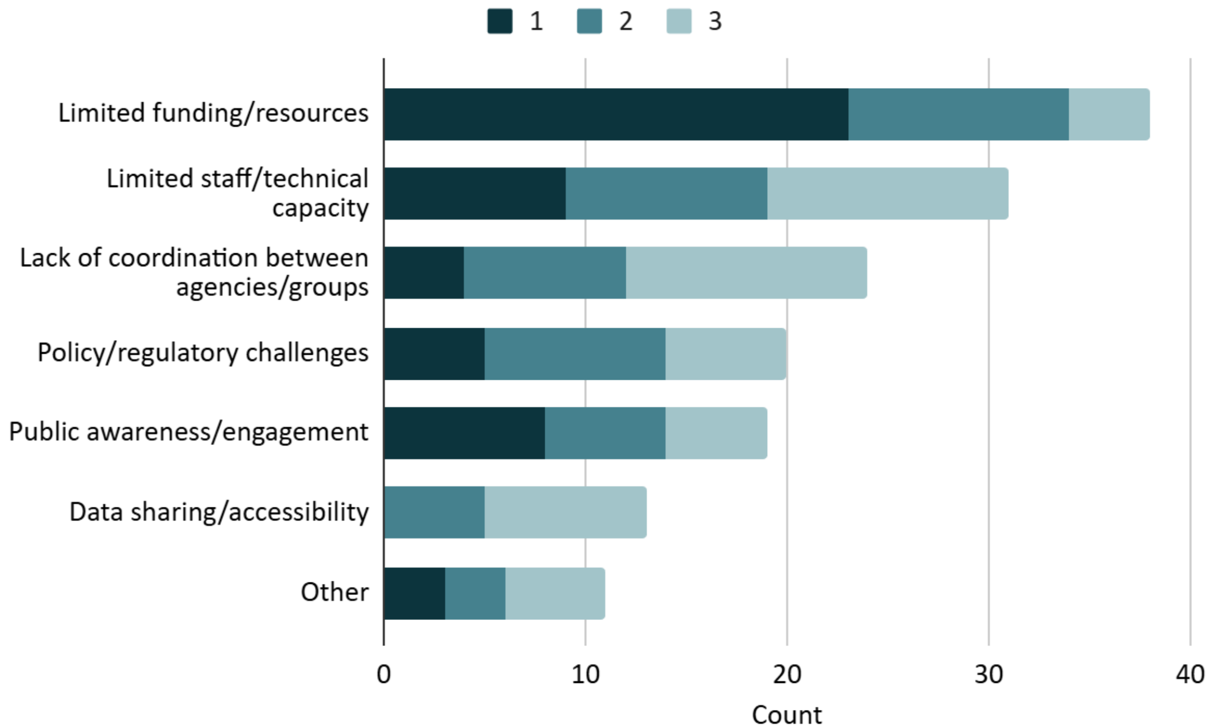
In contrast, a smaller but notable percentage of organizations have more defined service areas. Twelve organizations (23 percent) reported operating within a specific jurisdiction or boundary. For example, one organization focuses on "The Avenue/Westside Community," a highly localized area. Another organization, whose service area spans a landscape both within and external to the watershed boundary, noted that a portion of its water supply comes from the Ventura River, underscoring its particular interest in watershed resources. Additionally, four organizations (8 percent) work at project-specific locations, indicating a narrow but highly focused scope of work. One respondent indicated that they currently have no projects within the watershed. An interactive web map showing where each surveyed organization works is available at https://t.ly/vrwrp-webapp.

General Collaboration Characteristics

Collaboration is widespread among the surveyed organizations, with 71 percent indicating participation in regional networks or coalitions within the Ventura River Watershed. The survey identified a high level of collaborative diversity, naming a total of 29 distinct networks and coalitions. The Ventura River Watershed Council emerged as the single most important collaborative body, with 44 percent of all responding organizations reporting participation in it. Collaborations within the watershed are perceived as generally successful: 85 percent of respondents rated their regional networks as either "very effective" (35 percent) or "somewhat effective" (50 percent). However, the 15 percent that remained neutral suggests clear potential to strengthen the impact and perceived value of these partnerships. When asked how often collaborative efforts result in tangible outcomes that address community needs, 39 percent of respondents answered, “very frequently,” 56 percent said “occasionally,” and 6 percent said “rarely.”

Figure 5 illustrates how respondents ranked the primary barriers to successful collaboration. Notably, 44 percent identified limited funding and resources as the primary barrier, and 73 percent ranked it among their top three challenges.

Figure 5 Main Barriers to Successful Collaboration (Ranked 1-3)



When asked what additional partnerships might strengthen their work, organizations primarily highlighted the critical need for greater financial and systemic support across the watershed. The most common need was for increased funding and resources from higher-tier partners, particularly state and federal governments. This financial constraint is often tied to a deeper issue: the difficulty of coordinating numerous public and private entities to move large, area-wide projects forward. As one respondent noted, this fragmentation leads to frustrating "starts and stops" that hinder sustained, regional progress.

However, the feedback also identified clear opportunities to expand and diversify the network in targeted ways. Respondents specifically called for better coordination with landowners and land conservancies to support on-the-ground restoration and wildfire resilience efforts on private lands. They also called for deeper engagement with grassroots community groups and youth initiatives, such as the Ventura-River Action Network, to enhance public participation, as well as closer collaboration with technical organizations and academic institutions to leverage specialized data and expertise. Several respondents specifically identified the U.S. Forest Service as a key collaboration partner that would be particularly beneficial. Overall, while the existing network is active, its impact could be greatly strengthened through dedicated external funding and more streamlined multi-agency coordination.

Climate and Water Resilience

Meaning of Resiliency

Organizations were asked to answer the open-ended question, "*What does watershed resiliency mean to your organization?*". Responses were analyzed to identify key themes. The resulting word cloud (Figure 6) visually summarizes these themes, with the most frequently mentioned words appearing most prominently. The dominant concepts—"healthy," "sustainable," "communities," and "habitat"—show that organizations view resiliency as an interconnected concept, emphasizing a sustainable system in which the long-term health of natural habitats and human communities are mutually supportive.

Figure 6 Word Cloud Analyzing Responses to the Meaning of Watershed Resiliency

Climate Resilience Plan

Among the organizations surveyed, 50 percent (26 organizations) reported having a dedicated climate vision or plan, while an additional 15 percent indicated that one is in development. The remaining organizations either did not have a plan (25 percent) or were categorized as "Other" (10 percent).

"Other" explanations highlight varied approaches, including participation in regional plans, incorporation of resilience goals within broader strategic documents, and reliance on state or agency-led efforts such as Groundwater Sustainability Plans created under the Sustainable Groundwater Management Act and Urban Water Management Plans. Several respondents emphasized collaboration as a key means of advancing resilience through shared planning efforts. This highlights the importance of regional planning efforts like the VRWRP, which allow multiple organizations to participate in and benefit from the development of a resilience plan.

Climate Hazards and Resilience Challenges

Organizations were asked to identify up to three of the most urgent climate hazards affecting water resources in the Ventura River Watershed based on their perceptions. Figure 7 shows how frequently each hazard was identified across different sectors. Drought emerged as the overwhelming top concern, selected by 42 respondents (81 percent), and was identified as a critical hazard by all sectors except for energy. This was followed by wildfires, selected by 32 respondents (62 percent) and flooding, selected by 29 respondents (56 percent). The six "Other" responses included hazards such as development pressures and pollution, suggesting that organizations view climate change impacts as closely linked to existing human-driven stressors on the watershed's water resources.

Figure 7 Most Urgent Climate Hazards Identified by Sector

Respondents were asked to select up to three hazards

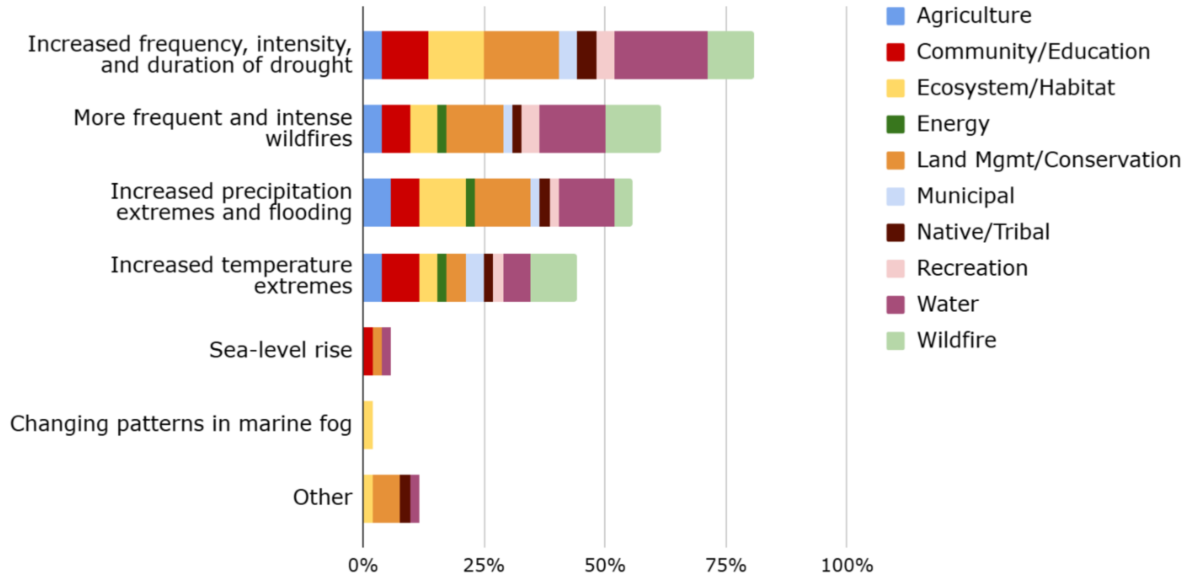
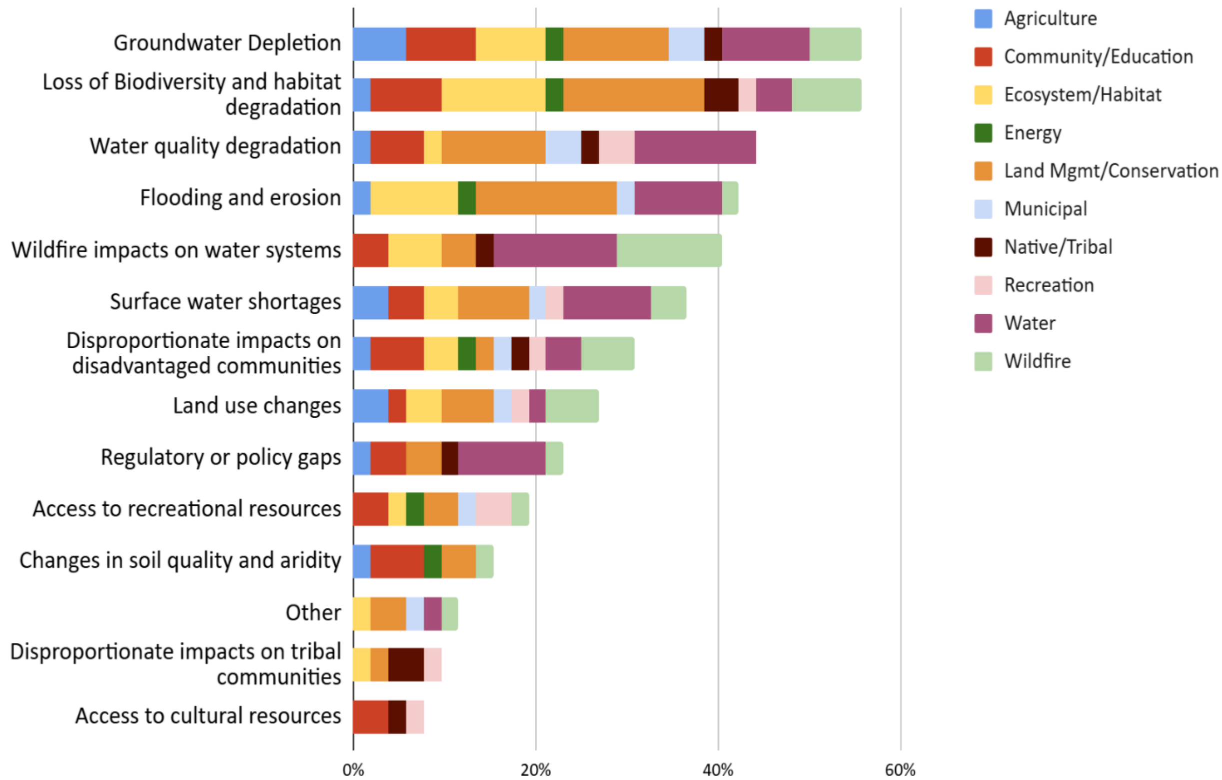


Figure 8 presents the primary perceived challenges to water and climate resilience, based on respondents' identification of up to five urgent issues. Groundwater depletion and loss of biodiversity and habitat degradation emerged as the most frequently cited perceived challenges, both of which were selected by 29 respondents (56 percent). Notably, concern over groundwater depletion was not equally reflected within the Water sector—only five of the 12 organizations (42 percent) identified it as a top issue, with one respondent noting that regional planning had found climate change to have limited impacts on local groundwater. Additional "Other" challenges mentioned included reduced sediment delivery to the coast, increased wildfire risk to communities, and the Matilija Dam.

Figure 8 Most Urgent Water and Climate Resilience Challenges by Sector

Respondents were asked to select up to five resilience challenges

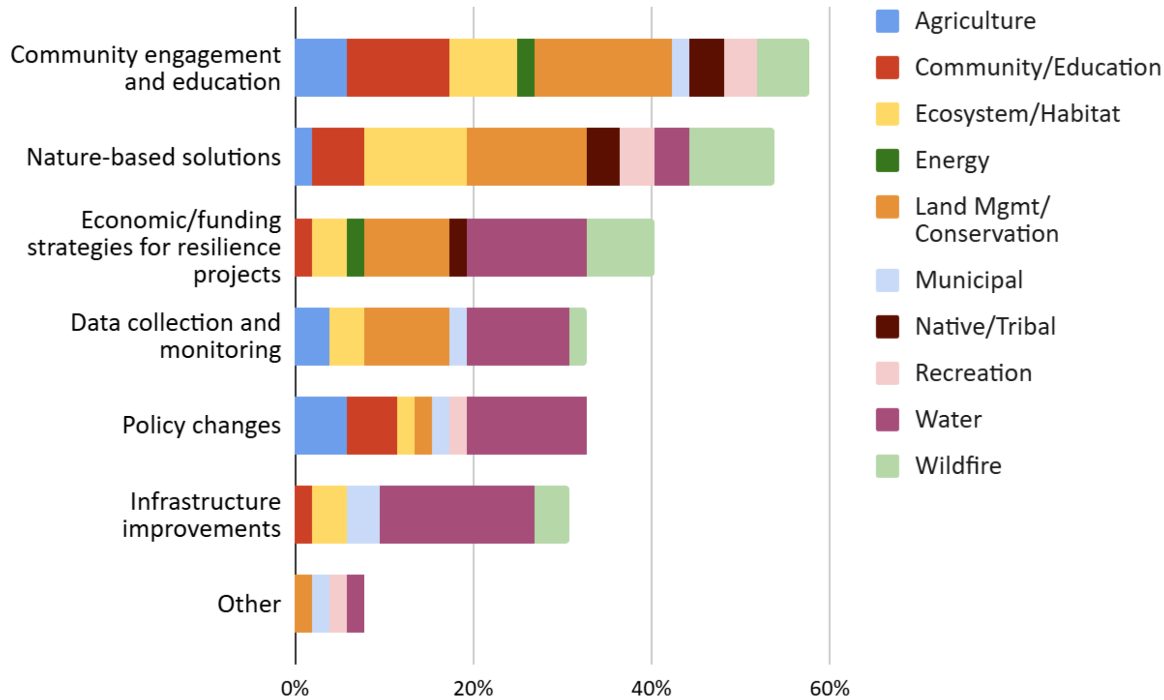


Resilience Strategies and Implementation Challenges

The strategies prioritized by organizations indicate a strong emphasis on engagement and nature-based solutions. Community engagement and education (58 percent) and nature-based solutions (54 percent) were the two most frequently identified approaches for advancing climate adaptation and resilience in the watershed (Figure 9). Collectively, respondent priorities reflect a focus on strengthening both social and ecological resilience by harnessing public awareness and the restorative capacity of natural systems.

Figure 9 Priority Resilience Strategies by Sector

Respondents were asked to select up to three strategies

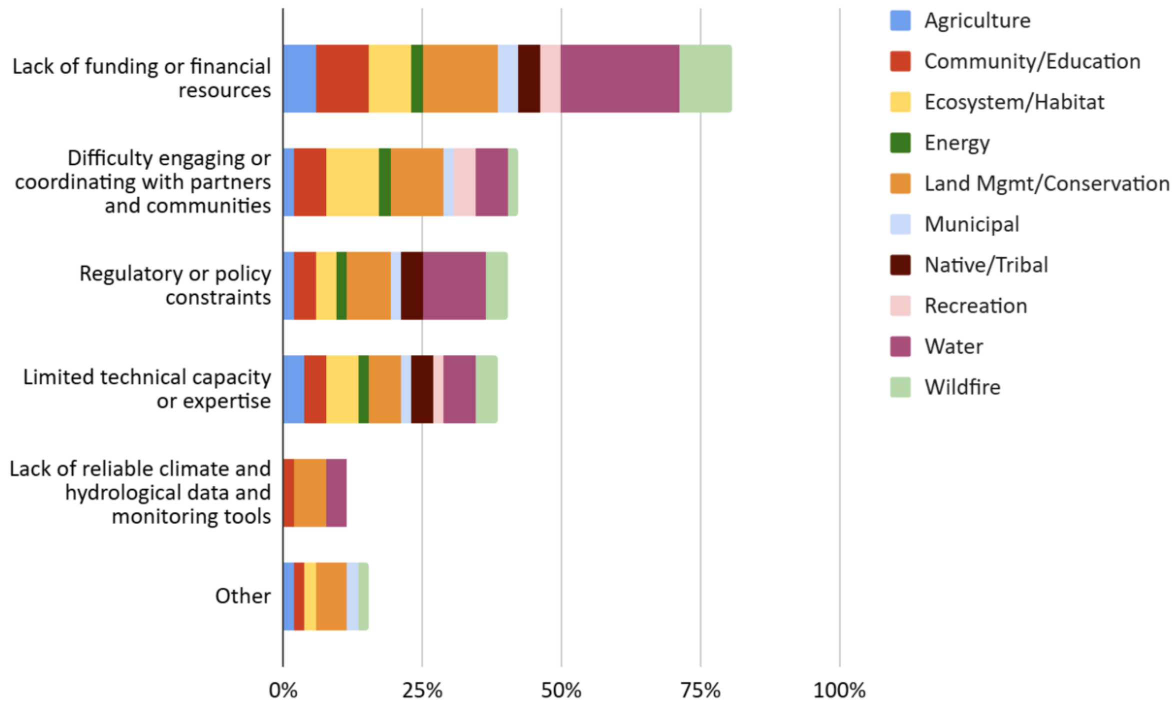


However, the implementation of adaptation and resilience projects remains significantly limited by resource and governance challenges. As shown in Figure 10, a staggering 81 percent of respondents identified a lack of funding as the most pressing challenge. Beyond financial constraints, implementation is further hindered by coordination difficulties, with 42 percent of respondents citing difficulty engaging or coordinating with partners and communities and 40 percent identifying regulatory or policy barriers. Additional "Other" responses referenced issues such as resistance to change, staffing challenges, and authority constraints.

Of particular interest were responses from the Water sector given their role in supporting water resource resiliency that benefits human-environmental landscapes and diverse activities across the watershed. Water sector responses highlighted a strong focus on resilience strategies such as infrastructure improvements, funding and economic approaches, expanded data collection and monitoring, and policy changes. Like other sectors, Water sector respondents identified key challenges, including limited funding and financial resources, regulatory and policy constraints, gaps in technical expertise and capacity, and difficulties with community and partner engagement. Together, these challenges underscore the need for increased investment, better coordination across regulatory frameworks, and stronger, more collaborative partnerships throughout the watershed.

Figure 10 Main Challenges to Implementing Climate Adaptation and Resilience Projects by Sector

Respondents were asked to select up to three challenges



Key Partner Engagement Meetings

Early in the project, the VRWRP team met with 13 key partner organizations to gather detailed insight on climate-related concerns, current priorities, and perspectives on watershed conditions. Recurring issues included drought, water supply reliability, flooding and erosion risks, and financial barriers to implementing climate-resilient projects. Drought emerged as a primary concern, affecting water availability for supply, ecosystems, and agriculture. Flooding and erosion risks, particularly those affecting critical water infrastructure, were also identified as major challenges, with several partners emphasizing the need to plan for future watershed conditions following the removal of Matilija Dam. Wildfire risk, compounded by invasive species such as Arundo (*Arundo donax*), was highlighted as a significant threat to infrastructure, habitats, and community safety. Post-fire sediment transport and erosion were recognized as factors that further intensify these vulnerabilities. Extreme heat was additionally cited as a growing concern, particularly for overburdened communities and the water operations workforce.

In addition to environmental risks, key partners—including the Ventura County Watershed Protection District, City of Ventura – Ventura Water and Public Works departments, and local water mutuals—expressed significant concern about the funding limitations and structural financing barriers associated with implementing climate resilience projects. Although each organization faces unique funding challenges, all emphasize the need for more accessible and more flexible funding mechanisms. Addressing these financial barriers is essential to advancing effective climate adaptation strategies. **Appendix I**: CSU Network Assessment Report provides more details about the key partner engagement meetings.

Centering Tribal Perspectives in Watershed Health and Resiliency

Survey results underscore a clear and urgent need to meaningfully include and elevate Tribal perspectives and traditional ecological knowledge in watershed health and climate resiliency planning. Tribal governments, representatives, and members bring place-based knowledge and long-term stewardship practices that are essential for addressing compounding climate, water, and ecological challenges.

In the Ventura River Watershed, the BVBMI was identified as a regional Tribal representative organization with a primary focus on community and education and serving their members while maintaining a geographic focus across the entire watershed. BVBMI participates in regional networks and coalitions, including involvement in the Matilija Dam Ecosystem Restoration Project, and collaborates with a wide range of partners such as the California State Coastal Conservancy, CSU Channel Islands, Ventura County agencies, and multiple local nonprofits and land trusts.

Despite this broad collaboration, BVBMI characterized the overall effectiveness of partnerships as neutral, noting that tangible outcomes occur only occasionally. The most significant barriers to successful collaboration were identified as limited staff and technical capacity, followed by limited funding and resources, and lack of coordination among agencies and groups. These constraints reflect broader systemic challenges faced by Tribal entities engaging in regional water and climate initiatives.

BVBMI articulated a definition of watershed resiliency (Figure 6) rooted in responsibility, ecological restoration, and land-use restraint: planning around existing water supplies without reliance on imported state water, removing barriers to ecological systems such as dams, and preventing development within floodplains. This perspective emphasizes long-term sustainability and ecosystem integrity.

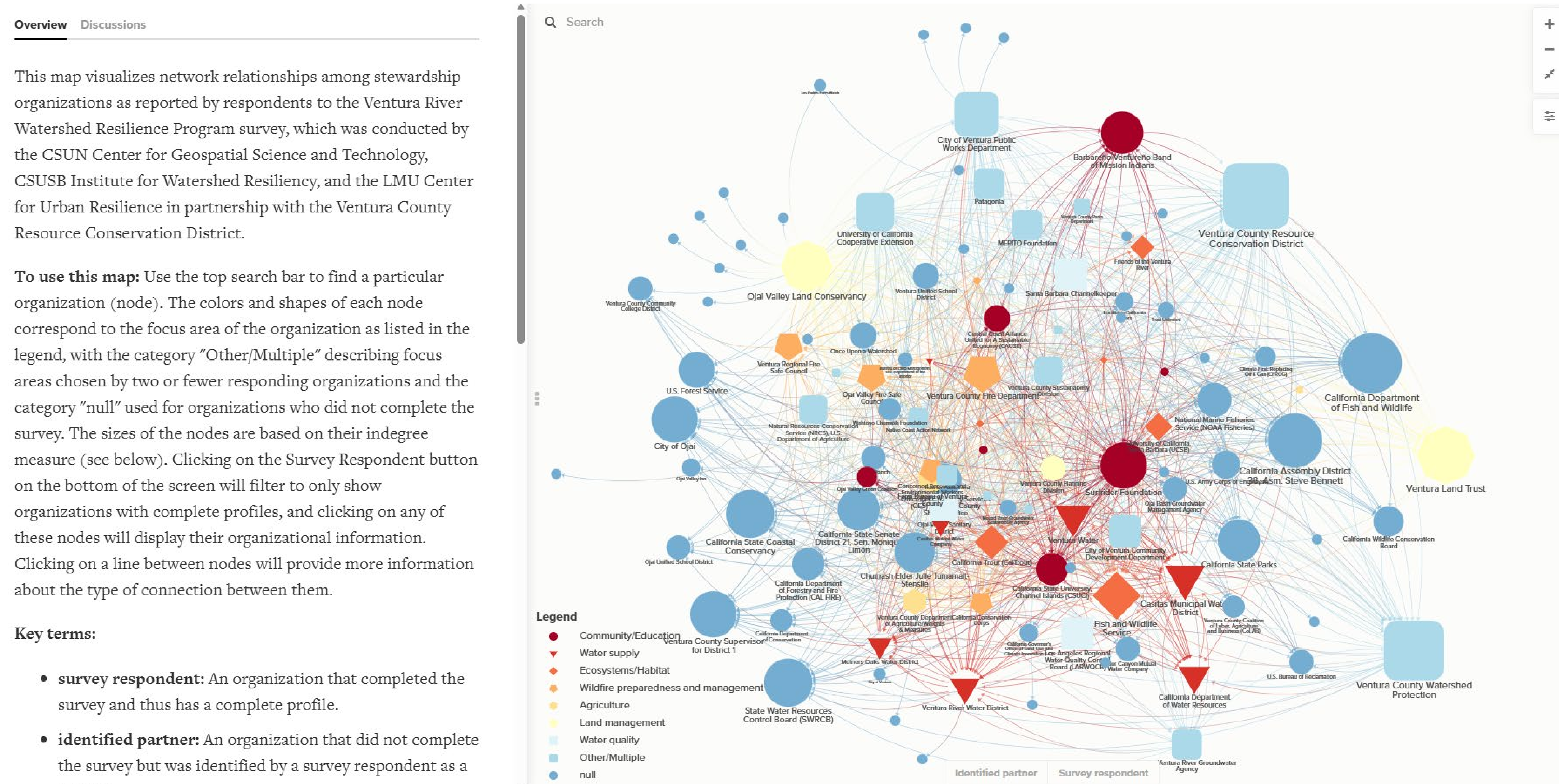
BVBMI also identified increased drought frequency and severity, extreme heat, and the impacts of legacy development as the most urgent climate hazards (Figure 7). Related water and climate resilience challenges include disproportionate impacts on disadvantaged communities and Tribal members, loss of biodiversity and habitat degradation, declining water quality, and limiting government policies and institutional structures (Figure 8). Priority adaptation and resiliency strategies highlighted by BVBMI include community engagement and education, as well as nature-based solutions such as riparian restoration and wetland enhancement (Figure 9). However, implementation of these strategies continues to be hindered by lack of funding and limited technical expertise (Figure 10).

Collectively, these responses reinforce the need for watershed initiatives to move beyond consultation toward sustained investment in Tribal capacity, leadership, and partnership. Supporting Tribal governments, representatives, and community members as full partners is essential to achieving equitable, resilient, and ecologically sound watershed outcomes.

Social Network Analysis

Social network analyses were completed based on the responses to the two network questions on the survey. Respondents were first asked to name the organizations they collaborate with, choosing from a list of 74 pre-populated organizations from across sectors and scales as well as the option to write in organizations not listed. A follow-up question asked what types of collaboration respondents had with each listed organization: general collaboration, information or expertise, and funding or resource sharing. The results illustrate a network of 114 organizations with collaborative, informational and funding relationships related to water resilience across the Ventura River Watershed. Figure 11 shows a visual of the entire network as displayed through the online platform Kumu. This interactive tool can be explored at https://t.ly/vrwrp-kumu.

Figure 11 Interactive Network Map Produced Through the Online Platform Kumu



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Degree Centrality

Degree centrality measures how many total connections, or ties, an organization has, with *outdegree* measuring the number of outgoing ties (i.e., the organization named others as partners) and *indegree* measuring the number of incoming ties (i.e., the organization was named by others as a partner). **Appendix I**: CSU Network Assessment Report provides more detail on network terminology definitions. In general, organizations with high indegree are the leaders, looked to by others for advice, expertise or information.

Focusing on the information network, there were a total of 1,052 incoming and outgoing information ties, as visualized in Figure 12. Network analysis revealed that a total of 32 organizations were weakly or not at all connected to the information network with zero or one information ties, including the six disconnected organizations visible in Figure 12. Another six organizations, or 5 percent of the network, hold 21 percent of the information ties. The top indegree organizations have between 14 to 18 incoming ties, and include the California Department of Fish and Wildlife, Ventura County Watershed Protection District (VCWPD), OVLC, Surfrider Foundation, California State Parks, and VCRCD.

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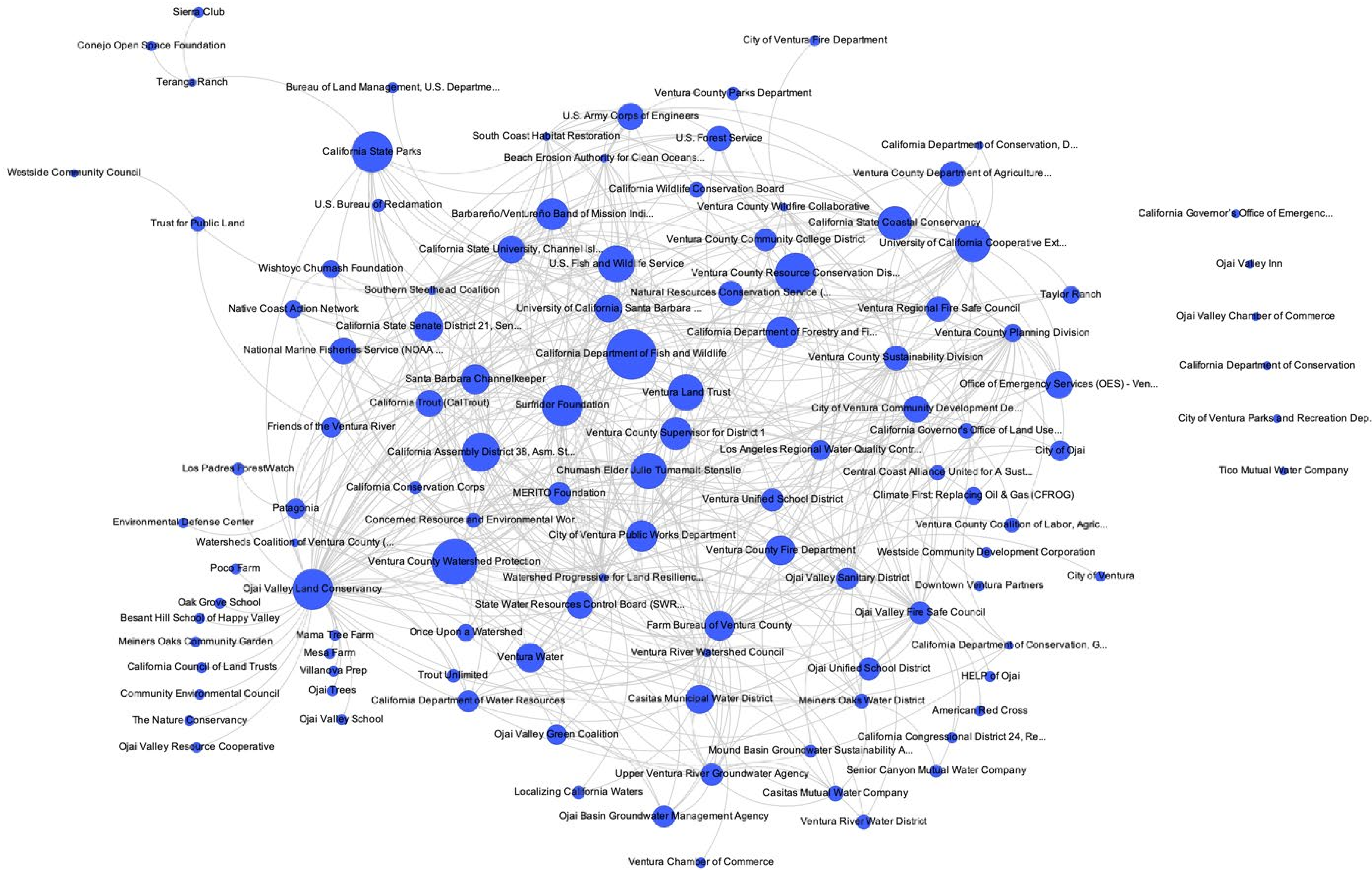
Figure 12 Visual Representation of the Information Network, with Node Sizes Based on Number of Indegree Ties



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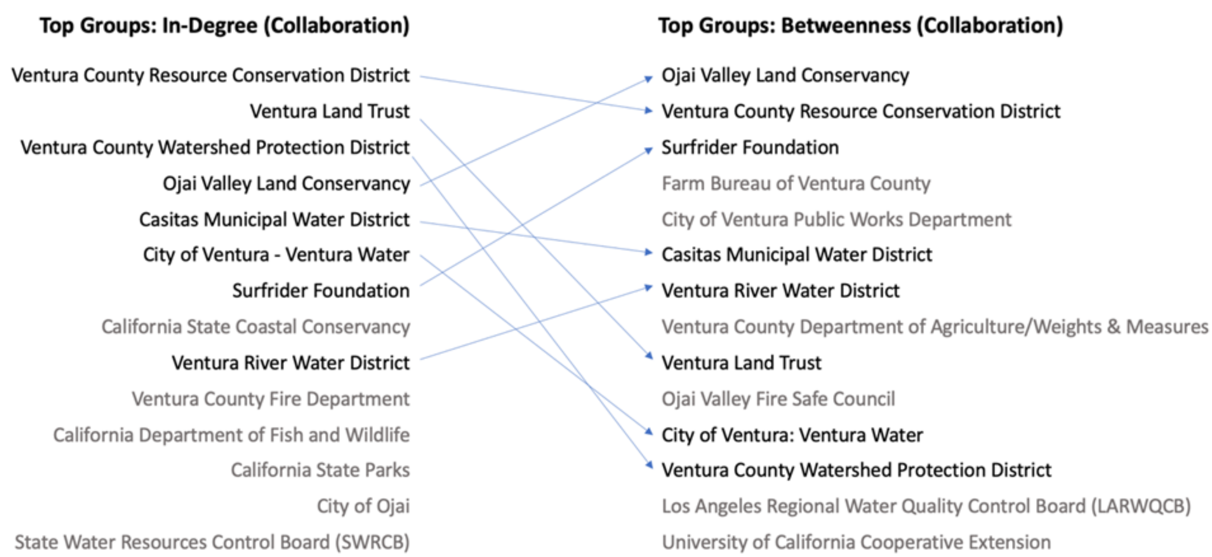
Betweenness Centrality

Betweenness centrality measures the number of times an organization lies between two other organizations that otherwise would not be connected. Further information is provided in **Appendix I**: CSU Network Assessment Report, but in general, this bridging or brokering position is considered a measure of influence. A bridging organization connects a diverse—and often expansive—set of actors who would otherwise remain disconnected. A brokering organization goes beyond this by actively mediating relationships between two unlinked organizations or clusters within a network, facilitating specific interactions, exchanges, or collaborations between them. Across all three relationship types (collaboration, information, funding), betweenness was highest in the information network. In the information sharing network, the OVLC had the highest betweenness score of 1340, which was more than three times greater than the second highest betweenness score of 401 held by Surfrider Foundation. Thus, these two organizations are considered highly influential in the network, often serving to connect organizations that would not be connected without this bridge between them.

Overall, it is notable that organizations with highest betweenness are often, but not always, the same as those with the highest indegree. This is shown for the collaboration network in Figure 13, where only eight of the 14 highest-ranked organizations appear in both top indegree (leadership) and top betweenness (influence) for collaboration ties. This indicates that organizations occupy different roles within the network, and their distinct strengths should be strategically considered when developing network approaches to achieve specific objectives.

Figure 13 Top Ranked Organizations for Indegree (Leadership) and Betweenness (Influence) Centrality in the Collaboration Network



Network Strengths and Opportunities

Overall, social network analysis revealed a robust network of organizations working on water resilience in the Ventura River Watershed. Two groups ranked among the top indegree and betweenness for all three relationship types: the OVLC and the VCRCD. This indicates that these two groups have the ability to lead and influence other watershed resilience organizations. This opportunity is highlighted further in the case studies below. Another notable finding is that betweenness was highest in the information network, suggesting that more organizations are playing a bridging role in information sharing. Betweenness was the most concentrated in the collaboration network, suggesting that just a few organizations are playing a bridging or brokering role in collaborative work related to watershed resilience. These organizations have an important role in bringing together collaborative efforts; however, high betweenness can also indicate that large numbers of organizations are peripheral or have limited interest, opportunities, or capacity to collaborate. Increasing collaboration among weakly connected organizations can improve overall network resilience.

As mentioned above for the information network, and shown for other networks in **Appendix I**: CSU Network Assessment Report, a large number of organizations were weakly or not at all connected when looking at individual relationship types. The least connected network was the funding network, which had the fewest number of ties and the lowest indegree and betweenness scores (Figure D-3, Tables D-7 & D-8). We note that many of the respondents are public agencies that may receive budgetary allocations and may not require external funding, or smaller non-governmental entities that may not have the opportunities or capacity to apply for external funding, which may partially explain this finding.

There were 11 organizations holding only one tie across all network types, including one responding organization: the Council. This suggests an opportunity for targeted outreach to these groups, and the groups themselves can utilize the tools created through this project to seek out collaboration opportunities (see Case Studies below) and become better connected and integrated into the network.

Case Studies

The resources included in this report—such as the community partner profiles in **Appendix I**: CSU Network Assessment Report, along with the dashboard, Kumu map, and interactive mapping tools—provide practical means for identifying collaboration strengths and opportunities within the Ventura River Watershed. The following case studies demonstrate how these tools can be applied in practice; however, they are intended as examples rather than prescriptive guidance.

Strength: Ojai Valley Land Conservancy

The OVLC exemplifies a core strength in the watershed network by leveraging collaborations for large-scale resilience work. Its mission to protect and restore the natural landscapes of the Ojai Valley, coupled with its vision to lead the Valley's response to climate change, is backed by high network centrality. The social network analysis confirms OVLC is a critical partner in the collaboration network, ranking first in "betweenness" and fourth in "indegree". The Kumu map visually demonstrates these extensive connections, while OVLC's partner profile (**Appendix I**: CSU Network Assessment Report) highlights its substantial capacity, including managing over 2,600 acres of open space and mobilizing over 7,100 volunteer hours in 2024.

This robust capacity translates directly to project success, most notably in securing a $7 million CAL FIRE Forest Health grant to lead the Ventura River Watershed Riparian Resilience Program, a watershed-scale effort to remove invasive Arundo and restore riparian forest health. Potential collaborators can use the interactive map to confirm service area overlap with OVLC. Its high network centrality and proven grant and philanthropic success demonstrate it can serve as a powerful anchor to connect partners, navigate regulatory processes, and mobilize the substantial resources required for capital-intensive climate adaptation.

Opportunity: Partners for Westside Community Council

The Westside Community Council is a nonpartisan group dedicated to improving community unity and quality of life on the Westside of the city of Ventura since 1994. Although the Council is eager to partner, it cites a "lack of coordination between agencies/groups" as a major barrier to successful collaboration. The Council explicitly seeks partners who can "help inform the community" and facilitate feedback, signaling a strong willingness to engage but a clear need for external expertise to bridge the gap between residents and technical resources.

To bridge this gap, the Council should utilize the report's tools. They can use the interactive map to find organizations with overlapping service areas, then reference the Kumu map (which lists missions and focus areas) to screen potential partners. Following this process, the Council might identify CAUSE as a valuable ally for social justice and advocacy work, such as hosting water quality workshops. They could also target and engage with key City of Ventura departments, such as Parks and Recreation, a previous project partner. A partnership here could enable the Council to implement additional tangible projects—like urban greening and stormwater management—that directly link resident input to visible, on-the-ground improvements for watershed health.

Recommendations

Based on the watershed network analysis and community partner feedback received, the following recommendations are offered to support improved collaboration and a stronger Ventura River Watershed network. Implementing these recommendations will help build stronger relationships among community partners, reduce duplication of effort, and improve the network's capacity to address watershed challenges collaboratively.

Strengthen Multi-Agency Coordination and Collaboration

- Formally recognize and provide additional funding support to the Ventura River Watershed Council to play a sustained convening and coordination role across the watershed network.
- Distribute leadership responsibilities to reduce over-reliance on a few organizations.
- Establish clearer coordination mechanisms and governance structures to improve communication and collaboration across jurisdictions, agencies, organizations, and sectors.
- Facilitate structured cross-sector dialogue to better align shared understanding of climate hazards and priority adaptation strategies among community organizations, water service providers, and public agencies, with the goal of advancing integrated, multi-benefit solutions.
- Continue investing in regional planning and implementation efforts, such as the VRWRP, to enable multiple organizations to participate in and benefit from shared planning processes grounded in common problem statements, resilience goals, and strategies.

Maintain and Evolve Network Tools as Living Resources

- Identify a responsible entity, such as the VCRCD, and secure dedicated funding to support the ongoing maintenance and development of the network assessment tools (i.e., Community Partner Profiles web app, Community Partner Survey dashboard, Kumu social network map).
- Establish a regular update cycle for survey data and community partner profiles to reflect the current state of collaborative partnerships and capture changes in relationships and priorities over time.

- Expand data collection and network assessment tools, including development of a shared communication platform, to capture information on specific projects, interests, and needs of community partners and facilitate partner matching and identification of collaboration opportunities.

Improve Network Connectivity and Inclusive Participation

- Expand and diversify participation in the watershed network by proactively engaging underrepresented and weakly connected organizations, including Tribal governments and representatives, small community-based groups, farms, and groundwater sustainability agencies.
- Support organizational capacity-building through financial assistance and training opportunities to strengthen participation in the watershed network.
- Identify and share resources to help organizations strengthen engagement with historically overburdened communities.

Secure and Coordinate Sustainable, Large-Scale Funding

- Pursue coordinated, multi-agency funding strategies that support long-term, watershed-scale implementation and reduce fragmented, short-term project cycles.
- Invest in both critical watershed network nodes and weakly connected organizations to improve overall network resilience.

Expand Strategic Partnerships for On-the-Ground Impact

- Deepen and expand partnerships with Tribal governments and representatives, private landowners, land conservancies, grassroots organizations, youth initiatives, and academic and research institutions to strengthen implementation capacity and community engagement. This may include but is not limited to prioritizing and supporting the meaningful inclusion of Tribes and their perspectives, honoring the dynamic environmental relationships and cultural experiences that inform their stewardship within the region.
- Engage community partners to identify desired collaborators that are currently less active in the watershed, such as the U.S. Forest Service, and take steps to strengthen or establish those partnerships.
- Continue and strengthen collaboration with state agencies that have invested in the watershed, including the Department of Water Resources, Wildlife Conservation Board, Coastal Conservancy, Department of Conservation, CAL FIRE, and the State Water Resources Control Board.

Summary and Conclusion

The Ventura River watershed network assessment reveals a well-established network with significant, yet untapped capacity for climate resilience planning. The network's core focus is building a "healthy" and "sustainable" system, particularly water systems, that benefit both "communities" and "habitat." Organizations are unified in identifying the top threats: drought (81 percent), wildfires (62 percent), and flooding (56 percent). Interestingly, most organizations (50 percent) have a dedicated climate plan, and preferred resilience strategies focus heavily on community engagement and nature-based solutions. Although collaboration is generally strong, 85 percent of respondents say their partnerships are at least “somewhat effective”—the main challenge preventing real progress is a lack of funding and resources. In fact, 81 percent of respondents identify insufficient funding and resources as the top barrier to successful collaboration.

The social network analysis identified several influential organizations—most notably the OVLC and the VCRCD—as key anchors of leadership and expertise, particularly in information sharing. The accompanying network tools—including the online dashboard, interactive Kumu map, and organizational profiles—serve as practical resources for partners to identify overlapping service areas, assess technical expertise, and strategically engage collaborators for specific project needs. Together, these tools can help reduce one of the most common barriers to effective collaboration: coordination challenges.

Overall, the network is well-structured and guided by a clear vision for resilience; however, its potential remains significantly constrained by limited financial resources and fragmented coordination. Moving forward, efforts should focus on securing large-scale, streamlined funding and strategically leveraging key organizations to advance multi-benefit projects, while also strengthening engagement with grassroots groups and community partners.

Additionally, addressing the complex needs of the Ventura River Watershed requires embracing diverse perspectives, knowledge systems, and management strategies. The Watershed Council offers a framework for inclusive collaboration that, when integrated with the expertise of the broader network, strengthens collective capacity and positions the watershed to adapt to evolving resiliency challenges. This integrated approach supports dynamic, forward-looking strategies that ensure today's efforts remain effective and sustainable for generations to come.

Chapter 3

State of the Watershed

This chapter provides a clear picture of current watershed conditions, including water supply, groundwater, ecosystems, cultural resources, and community needs. It highlights the challenges and opportunities shaping resilience today, weaving in scientific data and community perspectives.

Introduction

This chapter builds upon the foundational 2015 Ventura River Watershed Management Plan (WMP) and describes the current condition of the Ventura River Watershed, establishing the baseline for understanding how future climate hazards will affect water resources, ecosystems, infrastructure, and communities. It provides an integrated look at the watershed's physical setting and summarizes how historical climate extremes have shaped present-day vulnerabilities.

This State of the Watershed assessment builds on numerous existing regional studies and datasets, including the 2018 Projected Changes in Ventura County Climate report, the 2019 Integrated Regional Water Management (IRWM) Plan, the Ventura River Watershed Management Plan (2015), and more than 40 additional technical reports compiled during the assessment. These studies provided foundational hydrologic, ecological, infrastructure, and climate-risk information that shaped the selection of indicators, informed system characterizations, and ensured that this assessment builds on prior regional planning efforts. The compilation of these datasets enabled a consistent, watershed-wide picture of current conditions and provided critical reference points for identifying data gaps, historical trends, and emerging climate-driven stressors. See **Appendix B**: Related Reports, Resources, and Programs, for a list of existing regional efforts that influenced the VRWRP.

The chapter also introduces the watershed's water-resource systems which serve as the organizing structure for the VRWRP: water supply, flood management, groundwater, ecosystems, water quality, and cultural resources.

These water resource systems are examined alongside historical and observed climate hazards, including drought, extreme heat, wildfire, flooding, sea-level rise, and declining marine fog, to illustrate how climate hazards translate into impacts on people, the environment, and critical services. A watershed wide historical water budget further contextualizes how limited storage capacity, precipitation-dependent supplies, and interconnected groundwater–surface water systems influence watershed resilience under changing climate conditions. Together, these components provide the context for the watershed's key vulnerabilities and problem statements, which form the bridge to the adaptation strategies and implementation roadmaps presented in later chapters.

While this chapter draws from the best available data on hydrology, climate hazards, ecological conditions, and watershed infrastructure, several limitations in historical monitoring records (including limited and inconsistent historical records, sparse data on certain hazards, and insufficient records on cultural resource impacts) introduce uncertainty in how past events are interpreted and compared. A more detailed discussion of data gaps and limitations is provided in **Appendix J**: Data Gaps and Limitations on Historical Hazards.

Changing Land Use in the Watershed

Displacement of Indigenous Chumash communities, combined with decades of infrastructure development, land use change, and climatic stressors such as drought and extreme heat, has fundamentally altered the watershed's hydrologic and ecological systems by disrupting natural flow regimes, sediment transport, and disturbance processes through dams, surface water diversions, groundwater pumping, channelization, and long-term fire suppression. At the same time, land uses including irrigated agriculture, urban runoff, septic systems, roadway drainage, livestock operations, and post-wildfire erosion contribute to water quality impairments.

Overview of the Ventura River Watershed

Table 1 Quick Facts on the Ventura River Watershed

Main Tributaries & Subwatersheds	Matilija Creek, North Fork Matilija Creek, San Antonio Creek, Cañada Larga Creek, Coyote Creek
Jurisdictions	Of the watershed area in Ventura County: County of Ventura (49.1 percent), U.S. Forest Service (47.7 percent), City of Ojai (1.9 percent), City of Ventura (1.2 percent). A small corner of the watershed is in Santa Barbara County (3.9 percent of the entire watershed).
Population	43,785
Headwaters	Transverse Ranges
Mouth	Pacific Ocean (Santa Barbara Channel)
Area	226 sq. mi., 144,833 acres
Elevation	Highest: 6,010 ft. Lowest: sea level

Source: Ventura River Watershed Management Plan, 2015

Subwatersheds

The watershed is comprised of key tributary systems including the Matilija Creek, North Fork Matilija Creek, San Antonio Creek, Cañada Larga Creek, and Coyote Creek—all integral to the watershed's overall hydrologic function and ecological health. The watershed includes six primary subwatersheds, each defined by topographic ridgelines that channel water into the main river system. These sub watersheds, listed with their corresponding hydrologic unit codes (HUC), correspond to the Ventura River's major tributaries:

- **North Fork Matilija Creek** (HUC-12: 180701010101): Known for supporting critical habitat for endangered species and natural sediment transport processes.
- **Matilija Creek** (HUC-12: 180701010102): Contains the Matilija Dam, which is currently targeted for removal to restore ecological and hydrologic connectivity.
- **San Antonio Creek** (HUC-12: 180701010103): A critical steelhead tributary with cold-water habitat and accessible spawning grounds. San Antonio Creek's confluence with the Ventura River is below the Robles Diversion, which also supports significant groundwater recharge and agricultural uses.
- **Upper Ventura River** (HUC-12: 180701010104): Encompasses much of the watershed's residential areas, conveying critical runoff from tributary sub watersheds for habitat and groundwater recharge.
- **Coyote Creek** (HUC-12: 180701010105): Contains Lake Casitas, the watershed's primary reservoir. While naturally drained by Coyote and Santa Ana Creeks, Lake Casitas relies on the Robles Diversion to import Ventura River water, making it the cornerstone of regional water supply and storage.
- **Lower Ventura River** (HUC-12: 180701010106): Includes the urbanized areas near the watershed's outlet to the Pacific Ocean, where issues like water quality and flooding are particularly prominent.

Collectively, these heirarchial hydrologic units, shown in Figure 14, form the structural and ecological foundation of the Ventura River Watershed (HUC-10: 1807010102).

Figure 14 Subwatersheds of the Ventura River Watershed

Basemap provided by Esri and its licensors © 2026.
Additional data provided by CPAD, 2025; NHD, 2024; US EPA, 2022.

24-16486 WRP Climate Modeling Subwatersheds

Climate, Hydrology, and Ecology

The watershed has a Mediterranean climate, characterized by distinct wet and dry seasons. Rainfall varies significantly across the Watershed, from about 15 inches annually near the coast to over 35 inches in the mountainous headwaters. Streamflow is highly variable and "flashy," meaning that flows can rise rapidly in response to storm events and decline just as quickly afterward, resulting in short-duration peak flows followed by extended low-flow conditions. Major floods occur approximately every five years (Ventura River Watershed Council, 2013), with notable high-flow events during the wet winters of 2017 and 2023 that produced significant flooding and sediment transport throughout the watershed. In contrast, extended dry periods such as the 2012–2016 drought and the 2020–2022 drought led to reduced baseflows, disconnected stream reaches, and sections of the Ventura River and its tributaries running dry, particularly in the upper watershed and smaller tributary systems.

Groundwater and surface water are closely connected in many parts of the watershed, with groundwater providing baseflows critical for aquatic habitats during dry periods, particularly in the lower reaches of San Antonio Creek and Ventura River. In the upper basins, stream reaches are predominantly losing, meaning surface water percolates into the subsurface and contributes to groundwater recharge. In contrast, lower watershed reaches tend to be gaining, where shallow groundwater is forced to the surface by bedrock controls, sustaining perennial flow conditions. In the headwater areas, distinct groundwater basins are largely absent; instead, streamflow is supported by subsurface flow pathways and mountain front recharge processes that gradually feed downstream surface and groundwater systems.

Ecology in the Ventura River Watershed is shaped by these climate and hydrologic dynamics, resulting in a diverse mosaic of upland, riparian, and aquatic habitats that respond quickly to shifts in flow, sediment movement, and disturbance. Steep topography and flashy hydrology drive natural sediment transport and periodically reset riparian vegetation, while the estuary and perennial and intermittent reaches support habitat for sensitive species such as southern California steelhead (*Oncorhynchus mykiss*), tidewater goby (*Eucyclogobius newberryi*), and a variety of riparian bird species. These ecosystems have been substantially altered over time by infrastructure, land use change, invasive species (particularly the rapid spread of giant reed [*Arundo donax*; Arundo]) and legacy flow modifications, which together have fragmented habitat, reduced natural channel function, and increased wildfire and flood vulnerability. In recent years, large-scale efforts to restore ecological processes have accelerated, including watershed-wide Arundo removal and native revegetation efforts, and major fish passage projects that aim to rebuild resilient, connected ecological corridors under a changing climate.

Major Developments Influencing Current Watershed Conditions

The watershed has recently experienced several major developments that reshape its ecological function, water resource conditions, and management priorities. These changes reflect both climate-driven pressures and significant policy, regulatory, and restoration initiatives underway across the region. The following efforts form an important part of the current State of the Watershed and help provide context for the climate resilience strategies developed in the VRWRP.

Large-scale ecological restoration and sediment-management efforts like the Matilija Dam Ecosystem Restoration Project are advancing major infrastructure upgrades, habitat improvements, and sediment-transport restoration intended to reconnect upstream and downstream systems and improve long-term resilience. Watershed-wide invasive species removal and riparian-restoration efforts have expanded substantially, led by agencies, land trusts, and collaborative partners. Removal of Arundo (one of the watershed's most significant ecological stressors) has accelerated through CAL FIRE Forest Health grants, riparian restoration initiatives, and the Ventura River Watershed Riparian Resilience Program. Coordination and collaboration with programs associated with the Matilija Dam removal effort has also helped efforts.

Fish-passage and aquatic-connectivity improvements have also advanced in recent years. Projects such as the City of Ventura's 2022 Foster Park Fish Passage Project - Phase 1, the 2025 Wheeler Gorge Fish Passage Project on North Fork Matilija Creek, and the fish-passage work via the Santa Ana Boulevard Bridge Replacement Project, which is the first essential implementation component of the MDERP. These projects are improving access to spawning and rearing habitat for sensitive aquatic species and rebuilding ecological connectivity across the watershed.

Technical advancements in understanding groundwater–surface water interactions have emerged through the State Water Resources Control Board's development of an integrated model of watershed hydrology. This work provides a more complete scientific foundation for adaptive water-management decisions and for understanding climate-driven changes in flow, recharge, and ecological conditions.

A watershed-wide water-rights adjudication (Ventura River Watershed Adjudication) is underway to clarify groundwater and surface-water rights and establish a coordinated management framework across the Ventura River watershed basins. While independent from the VRWRP, the adjudication is expected to influence long-term coordination among water users and may affect future governance structures. Its outcomes may influence future water management and operating rules, with implications for instream flows, and habitat conditions. The VRWRP should therefore remain flexible to a range of potential outcomes and future management conditions.

Collectively, these efforts reflect a rapidly evolving watershed context in which climate change, regulatory requirements, restoration actions, and collaborative initiatives intersect. They also highlight the scale of ongoing work already underway to restore watershed processes, improve ecological resilience, and support long-term water-resource sustainability.

Communities and Land Use

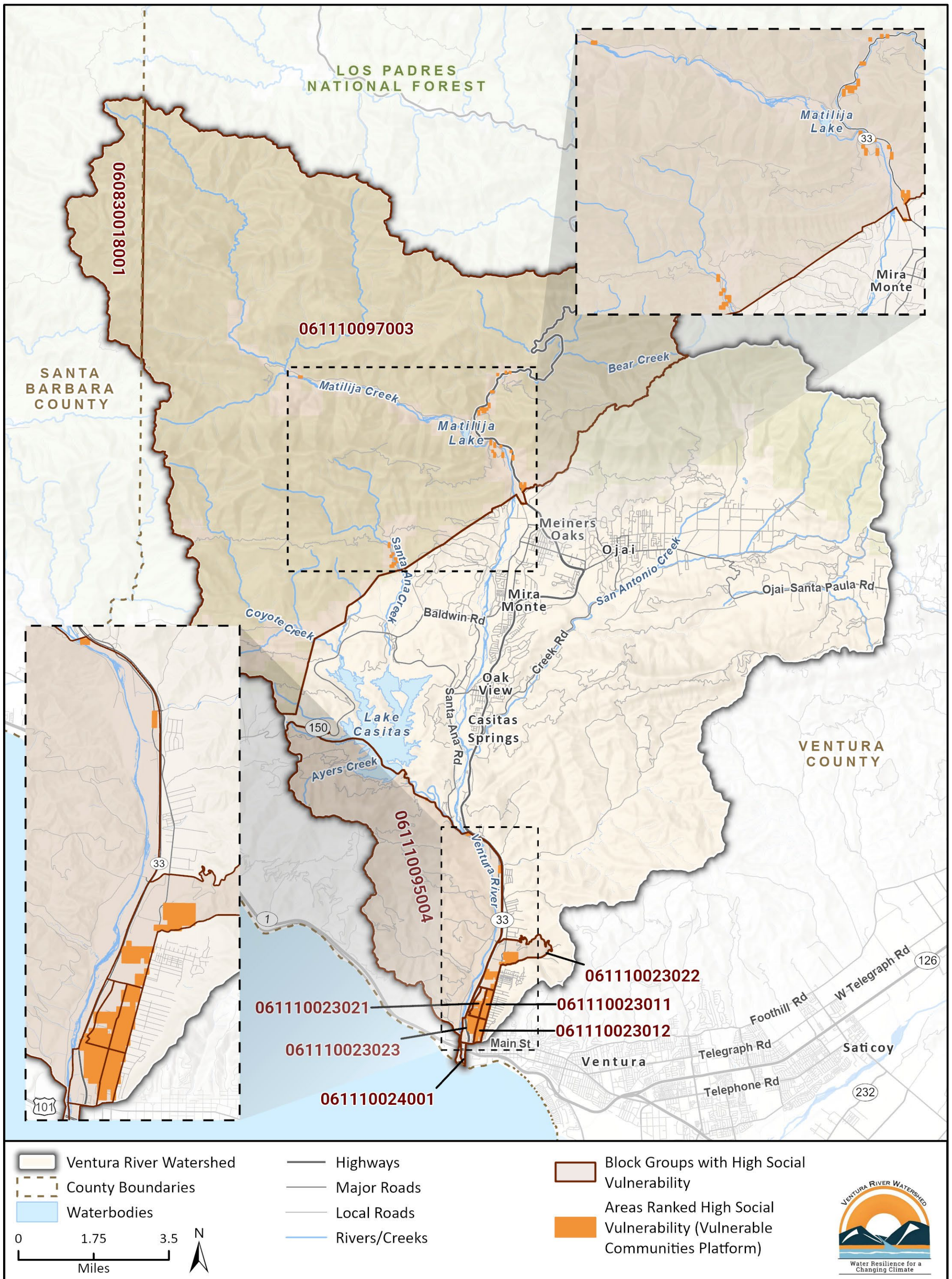
The watershed includes a mix of urban, suburban, rural, and Tribal communities, including the cities of Ojai and Ventura; the unincorporated communities of Meiners Oaks, Mira Monte, Oak View, and Casitas Springs; and Tribal homelands historically stewarded by the Barbareño/Ventureño Band of Mission Indians, as well as the Santa Ynez Band of Chumash Indians and the Coastal Band of the Chumash Nation (Chumash). According to 2020 U.S. Census data, approximately 44,000 residents live within the watershed, with a demographic composition of roughly 58 percent White, 37 percent Hispanic or Latino, 2 percent Asian, and 3 percent other races.

Updated mapping using the California Governor's Office of Land Use and Climate Innovation Vulnerable Communities Platform (VCP) identifies several block groups within the watershed as having high social vulnerability to climate change (Figure 15). Approximately 17 percent of the watershed's population resides in these highly vulnerable block groups, which include neighborhoods along Matilija Creek and portions of the West Ventura Avenue area. These areas are characterized by factors that reduce a community's ability to prepare for, respond to, and recover from climate-related events, increasing risks of health impacts, property damage, displacement, and long-term economic hardship.

The VCP highlights where climate hazards (including extreme heat, flooding, drought, wildfire, and sea level rise-related impacts) are expected to be most severe and where social conditions may heighten community exposure. These insights support the identification of overburdened communities within the watershed and clarify where targeted resilience investments are needed most.

These vulnerabilities are especially acute in neighborhoods served by small mutual water companies, which often have limited technical and financial capacity to upgrade aging infrastructure. Unlike larger utilities, these systems typically lack redundant wells, backup power, or advanced treatment, making them more susceptible to contamination and service disruptions during climate-driven droughts or flood events.

Figure 15 Areas in the watershed facing high social vulnerability to climate change



Basemap provided by Esri and its licensors © 2026.
Additional data provided by CPAD, 2025; NHD, 2024; US EPA, 2022; Vulnerable Communities Platform, 2026.

24-16486 WRP Climate Modeling
High Social Vulnerability Areas

Urban development comprises only about 3 percent of the watershed's land area, while agriculture, including citrus and avocado orchards and cattle grazing, accounts for over 18 percent. Large portions of the watershed, totaling to over 57 percent, remain protected open space or national forest, while approximately 22 percent consists primarily of rural unincorporated land and undeveloped open space. Local land use policies have limited urban sprawl and preserved agricultural and open space lands (Walter 2015).

Community Insight: Agriculture and Climate Hazards in Ventura County

During the special forum in July 2025, the importance of agriculture emerged as a key priority in the region that is facing a host of vulnerabilities. Agriculture is a cornerstone of Ventura County's economy, generating $2.31 billion in gross value in 2024, with strawberries, avocados, and lemons among its leading crops. The county ranks within California's top tier for agricultural production and recently reported $9 million in crop losses from the Mountain Fire, illustrating the economic vulnerability of this sector to climate-driven hazards (County of Ventura).

Community members emphasized that climate change is reshaping working lands. Extreme heat is causing fruit burn and bleaching, reducing yields and increasing heat stress for farmworkers. Wildfire smoke is damaging harvested produce and disrupts labor availability, while pollinator decline and rising disease pressure under warmer conditions is threatening crop viability. Loss of chilling hours and high-wind events further compromise perennial crops.

Farmland in low-lying areas are vulnerable to future flooding, which could undermine irrigation quality and long-term productivity. Pollinator-dependent crops such as berries and orchard fruits are also at risk as native pollinators, including monarchs, decline under habitat loss and climate stress. Extreme precipitation events compound these challenges by causing soil erosion, nutrient depletion, and pesticide runoff, degrading soil health and increasing recovery costs. Farmworkers reported that storms halt harvest operations, creating economic strain for families reliant on seasonal work.

Hydrologic and Ecological Degradation

Displacement of Indigenous Chumash people and communities, and decades of infrastructure development, land use change, and climactic conditions such as drought and extreme heat have fundamentally altered the watershed's hydrologic and ecological systems. Dams, surface water diversions, groundwater pumping, channelization, and long-term fire suppression practices that have altered natural disturbance and sediment processes have disrupted and constrained natural flow regimes and reduced sediment delivery. Land uses and practices such as irrigated agriculture, urban runoff from developed areas, on-site septic systems, roadway drainage, livestock and manure facilities, and post-wildfire erosion contribute to water quality impairments by increasing sediment, nutrient, legacy pesticide, and pathogen loading to streams and groundwater. Existing water infrastructure and management actions, such as the large storage capacity of Lake Casitas and the local Groundwater Sustainability Plans, have increased the region's ability to manage drought and climate variability for community water supply. This investment represents an important source of adaptive capacity and has enabled agencies to respond to climate challenges.

However, while infrastructure has strengthened water supply resilience, some modifications have weakened habitat connectivity, diminished riparian and aquatic ecosystem function. Some riverine and ecological systems within the Watershed remain sensitive to extended drought, elevated temperatures, and altered flow regimes, particularly during dry years. These conditions highlight the importance of considering ecosystem-specific vulnerabilities alongside existing infrastructure and management actions when assessing watershed resilience.

These modifications have reduced the watershed's ability to absorb and recover from climate-driven stressors, including invasive species spread such as Arundo which can further degrade riparian zones by consuming large volumes of water, increasing wildfire risk, and exacerbating erosion during storms. For additional detail, see **Appendix K**: Hydrologic and Ecological Degradation.

Relationship to Sustainable Groundwater Management Act and Groundwater Management

Groundwater basins within the watershed are managed under the Sustainable Groundwater Management Act (SGMA) and basin prioritization appropriately reflects groundwater's role in regional water supply. The VRWRP is not intended to and does not evaluate SGMA compliance, revisit groundwater sustainability determinations, or assess the adequacy of adopted Groundwater Sustainability Plans (GSPs) developed by the associated Groundwater Sustainability Agencies (GSAs). Under SGMA, the Sustainable Management Criteria and associated Minimum Thresholds establish regulatory triggers that prompt management actions or projects to avoid significant and unreasonable undesirable results from groundwater pumping. These thresholds serve as an essential backstop to protect basin sustainability. The VRWRP offers a complementary framework that looks beyond minimum compliance to identify strategies that can achieve a higher standard of watershed health and long-term climate resilience, considering the entire watershed beyond the groundwater basin boundaries.

The VRWRP considers watershed-scale conditions and climate-related stressors, such as drought, climate variability, and interconnected surface water–groundwater dynamics, that may result in periods of low groundwater levels or reduced surface flows even in sustainably managed basins. The watershed-scale perspective discussed in the VRWRP is intended to complement existing groundwater management programs by providing broader context for climate resilience planning, while recognizing that formal groundwater management remains the responsibility of the applicable GSAs.

Watershed Recreation

Although recreation is not formally defined as a water resource system within the VRWRP framework, recreational uses are deeply connected to watershed health and community well-being. Community members take advantage of boating at Lake Casitas, and swimming at and accessing the Ventura River, and enjoyment of riparian trails and open space. These activities depend on reliable water supplies, adequate streamflows, good water quality, and resilient ecosystems, all of which are directly influenced by watershed management decisions. Recreation was not included as a standalone resource category in order to maintain focus on core water supply, water quality, flood management, and ecosystem functions. By advancing strategies that sustain streamflow, improve water quality, and enhance habitat conditions, the VRWRP indirectly safeguards the recreational values that contribute to local identity, public health, and economic vitality in the watershed.

Project Spotlight: The Matilija Dam Ecosystem Restoration Project

The Matilija Dam Ecosystem Restoration Project (MDERP) represents a multi-agency partnership effort to restore natural watershed function in the Ventura River Watershed by addressing one of its most significant legacy barriers. Originally constructed in 1947, Matilija Dam has outlived its intended purpose, may be subject to significant damage in an earthquake of magnitude 7.5, and presents a safety hazard for downstream communities. Its reservoir is now filled with sediment and no longer provides the originally intended recreational or water storage uses. Matilija Dam blocks natural sediment from being transported downstream, impacting coastal beaches and estuaries, and prevents Federally and State endangered southern steelhead from accessing critical upstream spawning and rearing habitat within Matilija Creek.

The MDERP is the most significant and widely supported watershed restoration efforts underway in the Ventura River Watershed. Led through coordination among federal, state, Tribal, and local partners, the project reflects decades of coordination to address the structural, ecological, and public safety challenges associated with Matilija Dam. This effort advances a suite of interrelated actions including downstream infrastructure modernization (e.g., bridges, water supply protection, levees, and flood protection), invasive species removal, habitat improvements, and ultimately the full removal of the dam to re-establish more natural hydrologic and sediment regimes that will be more resilient to climate change. The early phases of the effort that are already underway are already improving conditions for natural processes to return, strengthening flood safety, and supporting community and ecosystem function and resiliency before complete dam removal occurs.

The MDERP exemplifies climate resilience in practice by sequencing land-use adjustments and engineering improvements that both protect people and restore important habitat under threat of bigger peak flows, post-fire debris flows, sea level rise influences, and increasing drought and erosion. Upgrades like the widened Santa Ana Boulevard Bridge have already enhanced sediment transport capacity and fish passage while reducing flood risk. Levee reconstructions are bringing critical downstream infrastructure up to current safety standards and the design plans at the Robles Diversion are addressing aquatic habitat concerns. Expansive habitat restoration efforts and invasive species management are increasing ecological health across the watershed. The MDERP proposes a long-term reshaping of the Ventura River watershed’s physical and biological systems, reconnecting headwaters within Matilija Creek to the ocean, restoring the seasonal pulse of sediment essential for beaches and estuarine environments, and re-embedding natural processes that support biodiversity in a changing climate.

This critical restoration and resiliency effort will reconnect headwaters within Matilija Creek to the ocean, restore the seasonal sediment pulses that sustain beaches and estuaries threatened by sea level rise, and re-establish natural processes that support biodiversity in a changing climate. Supporting this project will help reduce the impacts of future climate hazards and re-establish the Ventura River as a functional and thriving system for generations to come.

Water Resource Systems

Water resource systems are defined as the connected hydrological, infrastructure, ecologic, and human processes that involve water utilized for a specific purpose. For this plan, water resource systems are the organizing units around which climate resilience is analyzed. Each defined water resource system consists of individual features and components that either naturally evolved or were designed to the existing conditions of the watershed, and are at risk of future degradation, impairment, or disfunction due to climate change.

The major water resource systems of the watershed include water supply, flood management, groundwater management, ecosystems, water quality, and cultural resources (see Table 2). The following sections describe these systems in more detail.

Table 2 Defined Water Resource Systems

Water Resource System	Definition
Water Supply	The sources of local water and the network of infrastructure that collects, treats, stores, and distributes water to meet water demand.
Flood Management	The network of natural and engineered structures that convey high flows or prevents inundation of land with the intent of reducing the impacts of flooding on communities, infrastructure, and the environment.
Groundwater Management	The strategic, sustainable supervision of underground aquifers (i.e., groundwater basins or subbasins) to balance supply and demand, ensuring long-term availability and resilience for future generations.
Ecosystems	A complex network of interconnected and interdependent systems, which includes physical (e.g., soil, air, water, climate, topography) and biological (e.g., plants, animals, fungus, algae, bacteria) components.
Water Quality	The set of parameters and properties measurable in natural and human-made water bodies, aquifers, and associated built infrastructure.
Cultural Resources	Indigenous practices, such as subsistence fishing, and historical sites, ethnobiologically significant natural resources, and culturally important landscape elements.

Though the water resource systems of the watershed are defined individually, the systems are complex and interdependent. The subsequent descriptions focus on individual water resource systems, but their interdependencies are identified and discussed whenever possible. This section defines the current condition of these systems, offering a snapshot of the integrated water resource systems as they exist today.

Water Supply

The water supply system is defined as the sources of local and imported water and the network of infrastructure that collects, treats, stores, and distributes water to meet water demand. The watershed is often described as being largely dependent on local water supplies, including surface water from the Ventura River and its tributaries, storage in Lake Casitas, and groundwater from the Ojai and Ventura River basins. Unlike many Southern California regions, it does not rely on the State Water Project or Colorado River imports for its core municipal supply. The City of Ventura is developing an emergency interconnection with Calleguas Municipal Water District, which will deliver imported State Water Project supplies during severe shortages in the future. Additionally, CMWD is constructing a bidirectional potable water intertie with the Carpinteria Valley Water District, which will enhance regional emergency preparedness and enable the regional transfer of water supplies, including State Water Project allotments, across county lines to enhance long-term drought resilience.

Though the watershed does not currently rely on imported water, future plans and infrastructure to support imported water supply are being pursued. Future potential water supply sources within the watershed and adjacent areas include increased recycled water for potable reuse, imported water, and potentially desalination. Regulatory processes such as Biological Opinions (issued by National Oceanic and Atmospheric Administration), Sustainable Management Criteria (required by SGMA), various water quality regulations, and active litigation significantly influence water supply management within the watershed, in addition to considerations for the water demand of agricultural, industrial and municipal sectors.

Water Supply System Overview

Casitas Municipal Water District (Casitas MWD) is the primary water supplier in the watershed. Additional water suppliers include the City of Ventura (Ventura Water is the water and wastewater department), Ventura River Water District (VRWD), Meiners Oaks Water District, and 11 small mutual water companies. Mutual water companies are corporations formed to sell, distribute, supply, or deliver water to their shareholder-members, with the authority to levy assessments and withhold water from members who fail to pay. Unlike public water agencies, which are governmental entities governed by publicly elected or appointed boards and subject to broader public transparency, rate-setting, and service obligations, mutual water companies are private entities that serve only their shareholders and operate under corporate law rather than as public districts.

The largest water suppliers in the watershed purchase wholesale water from Casitas MWD, and supply water to customers directly through groundwater wells. Groundwater wells and small water systems play a central role in the Ventura River Watershed, supplying approximately 46 percent of average annual water use. Because of the highly porous alluvial soils, groundwater and surface water are closely interconnected, meaning pumping can directly influence streamflow and river health. The majority of groundwater extraction occurs in the Upper Ventura River and Ojai Valley Basins, where municipal providers such as City of Ventura – Ventura Water, VRWD, Meiners Oaks Water District, and the Ojai Water System (operated by Casitas MWD) serve thousands of connections.

In addition to these larger agencies, numerous small mutual water companies and private domestic and agricultural wells operate throughout the watershed, often serving small clusters of homes or farms. While the Lower Ventura River and Upper Ojai Valley Basins are smaller and classified as very low priority under SGMA, they still support important localized water uses through privately owned wells and small systems. Together, these diverse groundwater users form a decentralized network that is essential to community water supply but also closely tied to watershed hydrology and resilience. Table 3 shows the estimated number of connections associated with each groundwater supplier.

Table 3 Key Public Groundwater Providers and Connections

Water Supplier	Estimated Connections
City of Ventura – Ventura Water	31,000 *
Ventura River Water District	2,190
Meiners Oaks Water District	1,280
Casitas Municipal Water District	6,165

* Not all connections are located within or supplied by the Ventura River Watershed.

Figure 16 illustrates major urban water suppliers and locations of key water supply infrastructure in the watershed. Refer to **Appendix L**: Water Resource Systems, and further discussed in the following subsections.

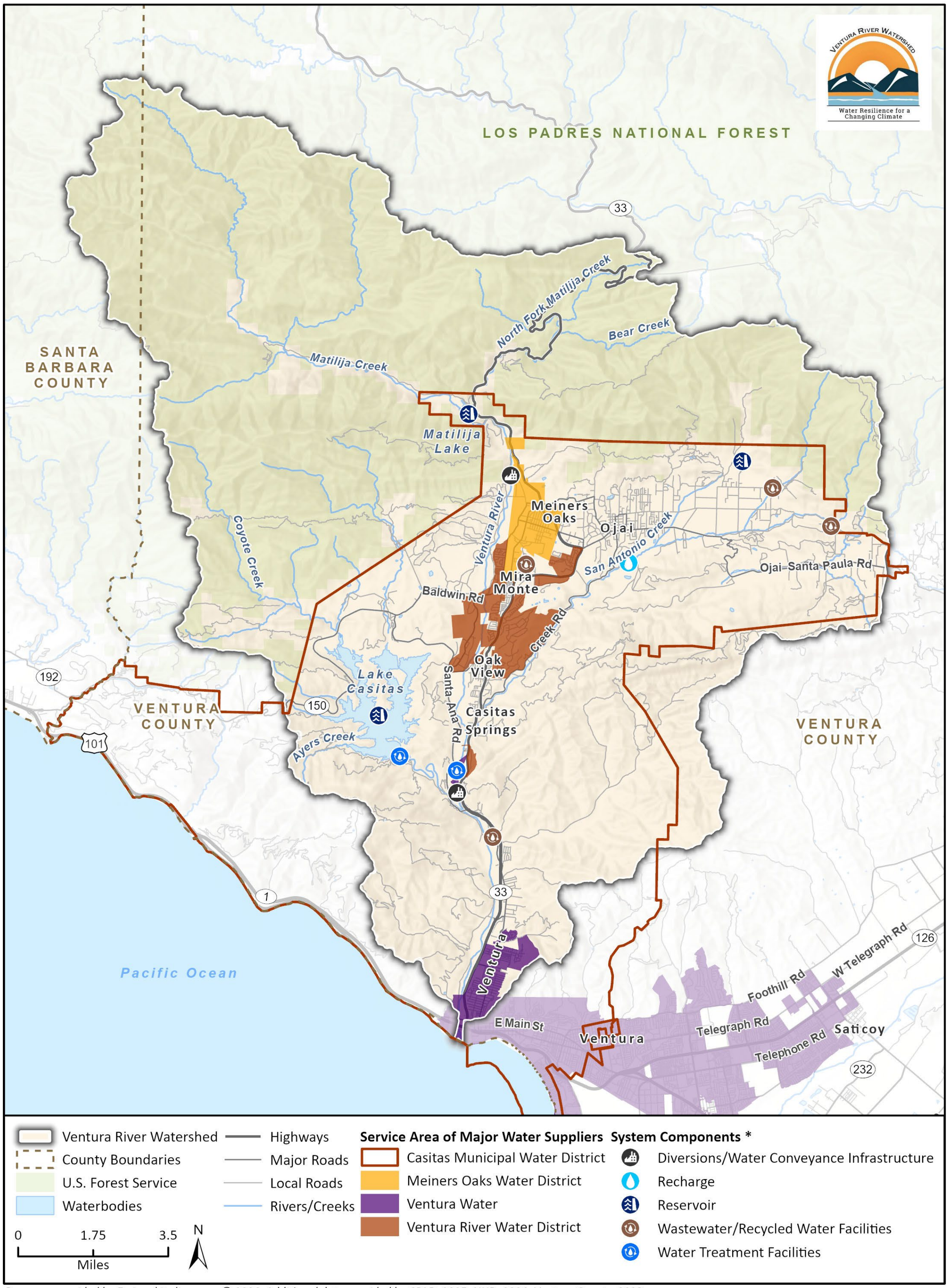
Community Insight: Climate Pressures on Water Quality and Supply

During the July 2025 special forum, community members underscored growing concerns about both water quality degradation and supply reliability under shifting climate conditions. Some participants pointed to the dramatic decline of Lake Casitas during the 2018–2022 drought, when water levels fell to historic lows of below 30 percent capacity, the lowest since the 1970s (National Aeronautics and Space Administration [NASA] 2024). Residents described how this decline triggered worries about drinking water scarcity, agricultural irrigation restrictions, and increased competition for limited water resources.

Forum input in July 2025 also highlighted the threat of post-fire sediment and debris mobilization during subsequent storm events, which can clog reservoir infrastructure and degrade water storage. Wildfire alters vegetation and soil conditions, increasing erosion susceptibility and leading to episodic pulses of sediment, ash, and debris during rainfall, rather than continuous sediment delivery. These post-fire sediment pulses, along with chronic erosion and ongoing sediment transport, affect diversion structures, system conveyance, and treatment plants, posing operational challenges during high-flow events.

Participants also named vulnerabilities in well systems, noting that multi-year drought reduces surface flows and groundwater recharge, while storm-driven sediment transport and post-fire debris flows can introduce fine sediments into wells and intakes, increasing the risk of sediment infiltration and reduced yield for both private and municipal wells. These community insights reflect a dual and multi-timescale challenge: water scarcity driven by prolonged drought and low reservoir levels, combined with episodic post-fire sediment pulses and longer-term erosion processes that strain water infrastructure and amplify concerns about long-term water security and system resilience.

Figure 16 Water Supply System Map



Basemap provided by Esri and its licensors © 2026. Additional data provided by CPAD, 2025; NHD, 2024; Ventura County, 2023.
System Component locations are approximate.

24-16486 WRP Climate Modeling Water Supply

Casitas MWD operates Lake Casitas, a reservoir serving as one of the watershed's primary water storage facilities and sources. Casitas MWD's system includes wholesale connections to most other retail water districts in the watershed and provides direct service to approximately 6,130 agricultural, commercial, and residential users. In addition to Lake Casitas, Casitas MWD operates wells in the Mira Monte area and in the San Antonio and Mutual well fields, with water treated at the Marion Walker and San Antonio treatment facilities. Casitas provides a supplemental water supply through existing infrastructure, allowing groundwater-reliant customers to access this backup source when primary local supplies are depleted during extended drought periods (Casitas Municipal Water District [CMWD] 2020).

City of Ventura – Ventura Water (the water and wastewater department) is another major water supplier, though most of its service area lies within the City of Ventura outside the watershed. Ventura Water uses a combination of water purchased from Casitas MWD, groundwater from wells at Foster Park, and a subsurface intake on the Ventura River. These supplies are treated at the Avenue Water Treatment Plant (City of Ventura, 2021).

Ventura River Water District and **Meiners Oaks Water District** are smaller groundwater-reliant agencies operating wells in the Upper Ventura River Groundwater Basin, with Lake Casitas serving as a supplemental source during dry periods. VRWD serves roughly 5,700 people, while Meiners Oaks County Water District serves approximately 4,000 people (Upper Ventura River Groundwater Agency [UVRGA] 2022).

Flood Management

The flood management system is the network of natural and engineered structures that conveys high flows or prevents inundation of land with the intent of reducing the impacts of flooding on communities, infrastructure, and the environment. Major components include reservoirs, levees, floodplains, wetlands, and local drainage infrastructure.

Flood Management System Overview

Flooding in the Ventura River Watershed results from a combination of various types of rainfall and erosion driven flooding and coastal processes, influenced by steep terrain, highly variable rainfall, wildfire burn-scar hydrology, and rapid runoff. Moderate to major floods occur frequently, and many neighborhoods, roads, and facilities lie within Federal Emergency Management Agency-designated flood hazard zones. While existing infrastructure (including the Ventura River Levee, Stewart Canyon and San Antonio Creek debris basins, and local storm-drain networks) helps manage moderate events, the system provides limited protection during high-intensity storms or post-fire conditions (Jong-Levinger et al 2022).

Flood management responsibilities are shared among the VCWPD, local jurisdictions, and state and federal partners. VCWPD maintains regional flood-control facilities, leads watershed-scale planning and hazard mitigation, and operates critical monitoring systems such as real-time stream gauges. The cities of Ventura and Ojai and the County of Ventura manage local drainage systems and enforce floodplain regulations, while the Ventura River Watershed Council supports interagency coordination and integrated planning efforts.

Despite these investments, extreme storms can still overwhelm aging or capacity-limited infrastructure, particularly when debris or sediment obstruct channels. Recent and historic flood events, including the 1969 storms, the rapid flow spikes of 1992, the 1995 U.S. 101 highway closure, the 2005 storm-related sewer rupture, the January 2023 floods, and the 2025–2026 winter atmospheric-river events, illustrate the watershed's susceptibility to sudden rises in flow, debris impacts, and downstream inundation.

These events often disproportionately affect low-lying and overburdened communities located near river corridors. For additional detail on the flood management water resource system, please refer to **Appendix L**: Water Resource Systems.

Groundwater Management

The groundwater management system is the strategic, sustainable supervision of underground aquifers (i.e., groundwater basins or subbasins) to balance supply and demand, ensuring long-term availability and resilience for future generations. Groundwater within the watershed includes water stored in the various aquifers and the natural and engineered infrastructure, natural processes, and management practices that contribute to recharge, storage, and withdrawal within its boundaries, as discussed below.

Groundwater Management Overview

The watershed largely encompasses four different groundwater basins: the Upper Ojai, Ojai Valley, Upper Ventura River, and Lower Ventura River. The Lower Ventura River Groundwater Basin is primarily within the Watershed, although it does extend slightly into the Rincon Creek-Frontal Pacific Ocean Watershed, just to the south-east. Similarly, the Upper Ojai Groundwater Basin is primarily within the Ventura River Watershed, with a portion of it extending into the Lower Santa Clara River Watershed. The entirety of both the Ojai Valley Groundwater Basin and Upper Ventura River Groundwater Basin are located within the Ventura River Watershed (Figure 17). DWR classifies the state's 515 groundwater basins into priority levels to guide sustainable management under SGMA. Table 4 summarizes the groundwater basins in the watershed, along with their priority designation.

Table 4 Summary of Groundwater Basins within the Ventura River Watershed

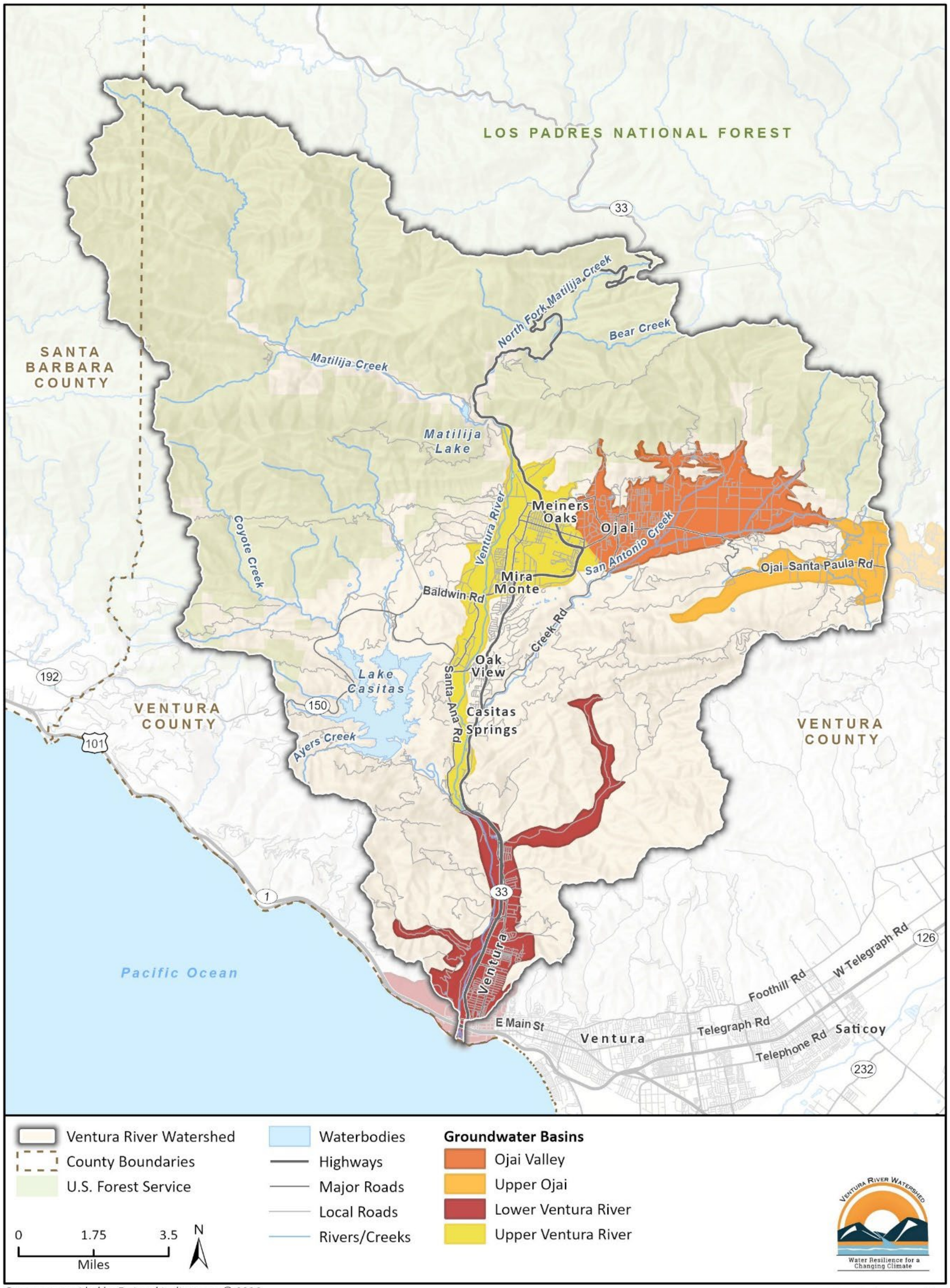
DWR Basin Number	Name	Priority Designation
4-001	Upper Ojai Groundwater Basin	Very Low
4-002	Ojai Valley Groundwater Basin	High
4-003.01	Upper Ventura River Groundwater Basin	Medium
4-003.02	Lower Ventura River Groundwater Basin	Very Low

Basins ranked high or medium must be actively managed by local GSAs, which develop and implement GSPs aimed at achieving long-term sustainability by 2042. The two GSAs within the watershed are the UVRGA, which manages the Upper Ventura River Groundwater Basin, and the Ojai Basin Groundwater Management Agency, which manages the Ojai Valley Groundwater Basin. Both GSAs developed and adopted GSPs (approved by California DWR in 2023) for their respective basins. These GSPs serve as the regulatory framework for local agencies to achieve long-term sustainability in high- and medium-priority basins over a 20-year implementation period. These plans are designed to prevent six undesirable results identified under SGMA: chronic lowering of groundwater levels, reduction of groundwater storage, land subsidence, seawater intrusion, water quality degradation, and depletion of interconnected surface water. Ultimately, DWR uses these roadmaps to ensure that aquifers are managed as a reliable, drought-resilient resource for agricultural, urban, and environmental needs.

The GSAs within the watershed manage groundwater within their respective basins in a way that supports long-term water reliability, ecosystem health, and compliance with SGMA requirements while improving monitoring and coordination across jurisdictions.

For more detail on the Groundwater Management System and Ventura River Watershed's four subbasins, please refer to **Appendix L**: Water Resource Systems.

Figure 17 Groundwater Basins in the Ventura River Watershed



Basemap provided by Esri and its licensors © 2026.
Additional data provided by CPAD, 2025; NHD, 2024; Ventura County, 2023; DWR, 2025.

24-16486 WRP Climate Modeling
Groundwater Basins

Ecosystems

An ecosystem is a complex network where biotic communities such as plants, animals, and microbes interact with abiotic factors like soil, water, and climate. These systems comprise diverse upland, riparian, and aquatic habitats where biological organisms and abiotic elements like sunlight and nutrients are deeply interdependent. Recognizing the inherent connections between these biotic and abiotic components enables watershed decision makers to foster overall system health, balance, and sustainability.

Ecosystem Overview

The Ventura River Watershed supports a diverse mosaic of upland, riparian, aquatic, and estuarine ecosystems, shaped by steep headwater terrain, dynamic sediment movement, and varied river flows ranging from ephemeral to perennial.

These habitats include chaparral, oak woodlands, and coastal sage scrub in the upland areas, extensive riparian corridors along major rivers, freshwater wetlands adjacent to riverine habitats, and a brackish estuary at the mouth of the Ventura River. Together, these biotic and abiotic ecosystem components perform critical functions such as filtering sediment, capturing bedload, and improving floodwater retention. They also support groundwater recharge, maintain water quality through nutrient cycling, provide habitat connectivity, and assist in climate regulation. Figure 18 illustrates the spatial distribution of major vegetation communities and land cover types, highlighting natural habitats as well as developed and agricultural areas within the watershed boundaries.

Riparian and aquatic habitats are especially sensitive yet adaptive to fluctuations in flow, temperature, and sediment movement. High-energy storm events periodically reshape channels, scour vegetation, and create new riparian recruitment surfaces. Perennial and intermittent reaches provide important habitat for sensitive species including southern California steelhead, southwestern willow flycatcher (*Empidonax traillii extimus*), and California red-legged frog (*Rana draytonii*) and the estuary at the mouth of the Ventura River is important habitat for tidewater goby . Each of these species are federally listed as threatened or endangered and the southern California steelhead and southwestern willow flycatcher are also state endangered . Portions of the watershed are designated critical habitat for each of the above mentioned species.

Over time, land-use changes, infrastructure, altered flow regimes, and invasive species have significantly modified these riparian and aquatic habitats . Legacy hydrologic modifications, including channelization, diversions, and long-term fire suppression, have further contributed to habitat fragmentation and altered natural disturbance processes. Among the most pervasive ecological stressors is Arundoan aggressive invasive plant species that has severe ecological impacts on physical processes, plant and animal communities, and has high rates of dispersal and establishment. Arundo has spread extensively along riparian corridors within the watershedand increases evapotranspiration, narrows channels, elevates wildfire intensity, contributes to post-fire debris loads, and displaces native vegetation, reducing habitat quality and altering natural disturbance regimes. While watershed-wide removal and riparian-restoration efforts are underway and described earlier in this chapter, Arundo continues to influence ecosystem condition and natural Ventura River condition recovery potential.

As discussed earlier in this chapter, recent progress has been made towards major fish-passage and habitat-connectivity improvement projects within the watershed. Additionally, Casitas Municipal Water District is in the planning phases of implementing seasonal flow-augmentation and habitat-enhancement measures in San Antonio Creek under interim regulatory orders to improve ecological conditions during dry periods, demonstrating the link between water management operations and habitat health.

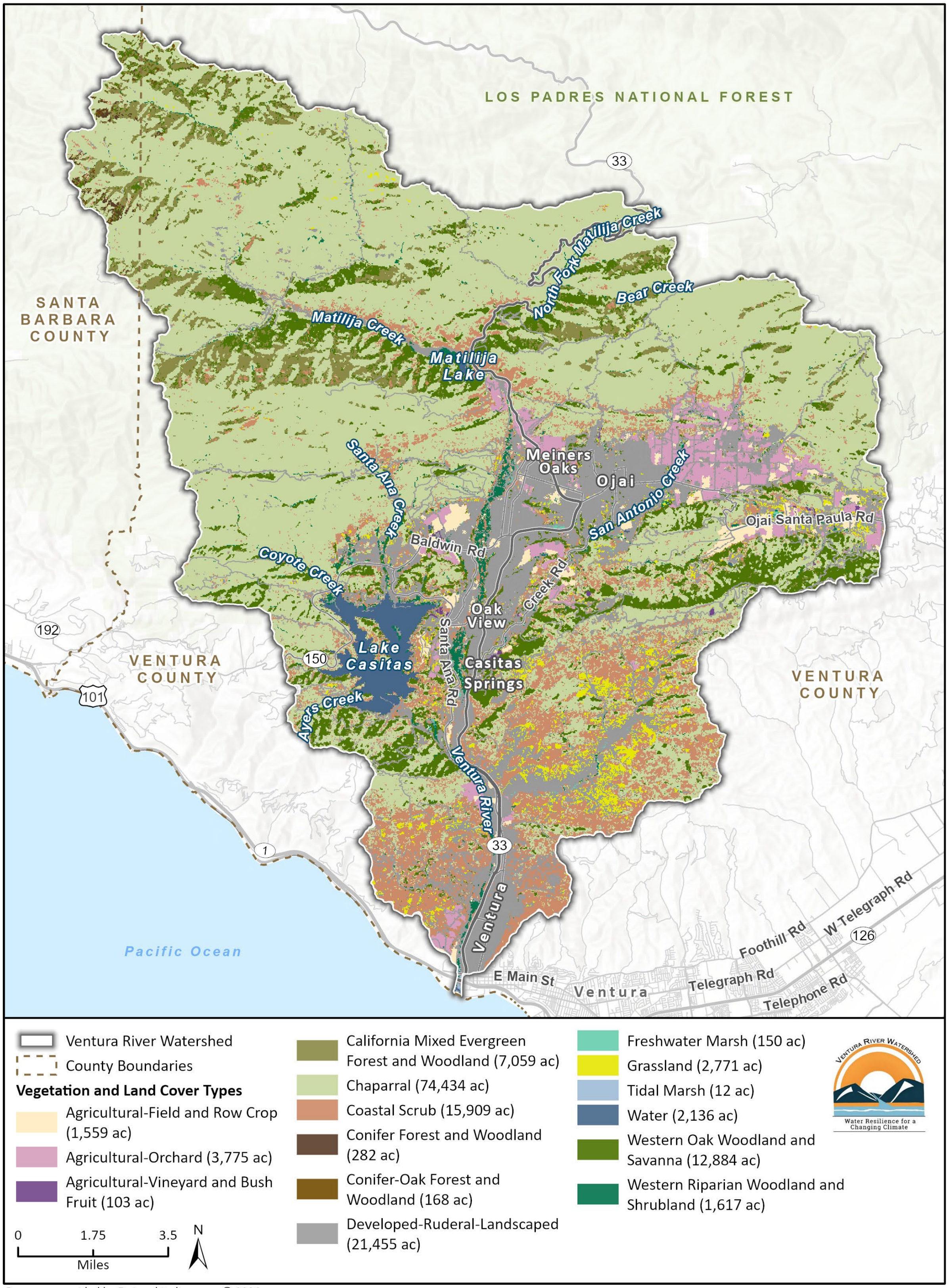
Ecosystem conditions are further influenced by climate change. More extreme heat, prolonged drought, reduced marine fog, and more intense wildfire seasons heighten stress on vegetation communities and aquatic organisms. Severe wildfires and subsequent post-fire erosion can destabilize slopes, alter channel form, increase sediment inputs, and degrade riparian and aquatic habitats. These interacting stressors, combined with invasive-species pressures and legacy hydrologic modifications, underscore the importance of ongoing restoration, collaborative management, and adaptive strategies to sustain ecosystem resilience under future climate conditions.

Detailed descriptions of vegetation communities, hydrologic processes, aquatic resources, special-status species, and regulatory frameworks are provided in **Appendix L**: Water Resource Systems.

Defining Watershed Terminology

"Take" under the Endangered Species Act of 1973 means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. This definition encompasses both direct physical injury and indirect actions, such as significant habitat modification or degradation that kills or injures wildlife by impairing essential behavioral patterns like breeding, feeding, or sheltering. In a watershed context, this can typically refer to water management activities that reduce flows, alter, destroy or appreciably diminish the value of designated critical habitat, or block access in ways that injure or kill listed species, even indirectly.

Figure 18 Vegetation and Land Cover Types of the Ventura River Watershed



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Additional data provided by CPAD, 2025; NHD, 2024; LANDFIRE, 2023.

24-16486 WRP Climate Modeling
Vegetation and Land Cover Types

Water Quality

The water quality system is the chemical, physical, and biological characteristics of water that determine its suitability for drinking, agriculture, recreation, and ecosystem health. In the Ventura River Watershed, maintaining good water quality is essential because the Ventura River and its aquifers provide nearly all local water supplies and support culturally and ecologically significant species.

Water Quality

Water quality is shaped by the interaction of land use, hydrology, climate extremes, and built infrastructure. Regulatory mandated monitoring programs track conditions in surface water, groundwater, and stormwater systems to protect beneficial uses and support treatment operations. (In California water law in Article X of the California Constitution, "beneficial use" is the foundational principle that determines whether a water right is valid and how much water may legally be used.) Despite ongoing stewardship efforts, water quality challenges persist and are expected to become more complex with climate change.

To better define water quality, this section summarizes the major water quality issues impacting surface water, groundwater, and stormwater. An overview of applicable water quality regulatory programs is provided in **Appendix L**: Water Resource Systems.

Surface Water Quality

Surface water quality in the Ventura River Watershed reflects the combined influence of point and non-point source discharges interacting with highly variable hydrologic conditions. Surface waters are shaped by nutrient inputs, algal production, indicator bacteria, sediment transport, and temperature variability, all of which respond to land use, flow regime, and climatic conditions. Runoff from agricultural and developed landscapes introduces pollutants to streams and tributaries, while prolonged dry periods reduce natural dilution and increase residence time, concentrating constituents in surface waters.

Point source discharges, particularly wastewater treatment facilities, play a more prominent role during low-flow conditions when treated effluent can represent a substantial portion of streamflow. Under these conditions, nutrients and organic matter can contribute to eutrophication, especially in slower-moving reaches and the Ventura River Estuary, where warm temperatures and limited circulation further intensify water-quality stress. During extreme storm events, wastewater and stormwater systems may be hydraulically stressed, increasing the potential for short-duration contaminant loading and downstream transport.

Non-point source discharges are primarily episodic and driven by storm events, when rainfall mobilizes nutrients, bacteria, and sediment from across the watershed. Agricultural lands, urban surfaces, eroding channels, and disturbed hillslopes all contribute to these pulses, with the magnitude of impact closely tied to storm intensity, antecedent conditions, and land management practices. Wildfire and other large-scale disturbances can further amplify these effects by increasing erosion and runoff until watershed recovery occurs.

Understanding these dynamics is supported by a broad suite of long-term surface water monitoring programs implemented by municipal stormwater agencies, wastewater treatment facilities, drinking water providers, and non-profit organizations. Together, these efforts provide a comprehensive picture of water quality across seasons, flow conditions, and land uses, indicating that overall watershed conditions are relatively good, with challenges concentrated during storm events, extended dry periods, and in sensitive receiving waters such as the estuary.

As climate change alters precipitation patterns, increases the frequency of extreme events, and lengthens dry periods, the balance between point and non-point source influences is expected to shift. Continued coordination among monitoring programs and integration of their findings will be critical for understanding evolving water-quality drivers, supporting adaptive management, and maintaining the Ventura River Watershed as a resilient and functioning water resource system.

Groundwater Quality

Groundwater is vulnerable to elevated nitrates from septic systems, fertilizers, livestock operations, and aging wastewater infrastructure. While public-supplier wells generally meet drinking water standards, elevated nitrates have been detected in some domestic wells. These conditions are being monitored and evaluated by UVRGA, the Ventura County Public Works Agency, and the State Water Resources Control Board through its Groundwater Ambient Monitoring and Assessment (GAMA) Program. The Lower Ventura River Groundwater Basin has limited groundwater pumping due to naturally high total dissolved solids and other constituents. Strong surface-groundwater connection means drought and reduced streamflow often worsen groundwater quality conditions (DWR 1959, Watershed Coalition of Ventura County 2014).

Stormwater Quality

Stormwater runoff carries pollutants accumulated during dry periods into creeks, the river, and the estuary. The regulatory framework associated with Municipal Separate Storm Sewer Systems (MS4s) manage point-source pollution by conveying stormwater separately from wastewater, but high-intensity storms can damage local drainage systems and increase erosional forces, which can increase pollutant loads. In rare cases, wastewater treatment system overflows or damaged infrastructure may discharge untreated wastewater during extreme precipitation events.

Wastewater Treatment System Overflows During Severe Rain Events

In January 2023, heavy rainfall overwhelmed the Ojai Valley Sanitary District sewer system, resulting in approximately 1.2 million gallons of untreated sewage entering San Antonio Creek near Oak View. The overflow occurred when intense storm flows exceeded system capacity and a damaged sewer main allowed sewage to discharge directly into the creek.

Untreated sewage introduced high levels of bacteria, nutrients, organic matter, and other contaminants into receiving waters. In creeks like San Antonio Creek, which provide habitat and contribute flow to the Ventura River, such discharges can degrade water quality, increase health risks for downstream communities, reduce dissolved oxygen levels, and harm aquatic life. As a result, beaches in proximity to the Ventura River mouth were closed.

Cultural Resources

The Ventura River Watershed is home to many forms of culture, identity, and lived connection. Community members hold diverse ties to this landscape through recreation, farming, stewardship, long-standing family presence, and other meaningful relationships with the watershed. The VRWRP recognizes and respects those connections. At the same time, the VRWRP intentionally centers Tribal cultural resources because Indigenous communities have stewarded these lands since time immemorial, and their voices and knowledge systems have been historically marginalized or excluded from formal water and land-use decision-making. Elevating Tribal leadership and cultural perspectives, including deep ecological knowledge and practices that strengthen watershed resilience, is essential to building an equitable and climate-resilient future for all.

In the VRWRP, cultural resources are included as a distinct water resource system to help identify climate impacts, vulnerabilities, and adaptation strategies that might otherwise be overlooked. The Ventura River Watershed has been home to Chumash peoples for at least 12,000 years, with ancestral communities relying on the region's diverse coastal, riparian, and upland environments for food, materials, and cultural practices (Jones and Ferneau 2002, Moratto 1984). Subsistence patterns historically blended hunting, inland and coastal fishing, gathering, and careful stewardship of plant communities, including the use of cultural burning to enhance food plants such as chia and maintain basketry materials (Lightfoot and Parrish 2009, McCawley 2017).

The watershed lies within traditional territories of several Chumash language groups, whose contemporary descendants include the Barbareño/Ventureño Band of Mission Indians, the Coastal Band of the Chumash Nation, the Santa Ynez Band of Chumash Indians, and others with ancestral ties to the region (Golla 2007).

While cultural resources intersect with many aspects of the watershed, elevating them as a distinct system helped the planning team identify potential climate impacts, vulnerabilities, and adaptation strategies that might otherwise be overlooked. These resources include Tribal cultural landscapes and knowledge systems and the ways communities interact with and value the river today.

Tribal Chairman Matthew Vestuto of BVBMI and respected Chumash Elder Julie Tumamait-Stenslie have played important roles in informing the VRWRP process.

Community Insight: Cultural Resources and Sacred Sites

Cultural resources across the Ventura River Watershed are experiencing intersecting pressures from wildfire, post-fire erosion, drought, extreme heat, and coastal stressors. Community input described how wildfire and subsequent debris flows can damage archaeological and sacred sites and limit access for ceremonies and teachings. Participants also noted that culturally significant plants and animals (used for food and medicine) face heightened risk when invasive species proliferate after fire and when hydrologic shifts alter stream corridors. In the lower watershed, where river meets ocean, community members emphasized that sea-level rise and storm surge can damage or permanently inundate coastal access and affect the meaning and use of beaches and estuarine areas central to cultural practice. Together, these hazards erode cultural landscapes and reduce access to key resources, underscoring the need for restoration that integrates invasive removal, riparian recovery, and culturally appropriate access agreements.

Cultural Resources Overview

The Ventura River Watershed is home to several Tribal nations with ancestral, cultural, and ongoing stewardship ties to the region, including the Barbareño/Ventureño Band of Mission Indians, the Coastal Band of the Chumash Nation, and the Santa Ynez Band of Chumash Indians . Ongoing language revitalization efforts reflect community-preferred dialect names such as mitsqanaqaṅ (San Buenaventura region) and s^{h}amala (Santa Ynez Valley). These Tribes maintain deep cultural relationships to the watershed's lands, waters, and species, and each played an important role in shaping this Plan.

Among these Tribes, the Santa Ynez Band of Chumash Indians is the sole federally recognized Tribe; the BVBMI and the Coastal Band of the Chumash Nation are not federally recognized. As a result, they may face barriers to accessing federal funding programs and set-aside grants, entering government-to-government consultation processes required under federal law, qualifying for certain Bureau of Indian Affairs technical assistance programs, and participating in formal co-management or regulatory decision-making frameworks tied to federal trust status. Regardless of recognition status, all Tribes bring essential cultural knowledge, stewardship practices, and community priorities that inform watershed resilience.

These constraints are compounded by the historical dispossession of Tribal lands. Colonial settlement beginning in 1769 disrupted Indigenous lifeways through missionization, land dispossession, forced labor, violence, and disease. Subsequent Mexican-era ranchos and American expansion further displaced Chumash communities and transformed the watershed's landscape (Santa Ynez Band of Chumash Indians 2025, Castillo 2025). More recently, reduced access to cultural and ceremonial sites, and the extensive modification of the lower watershed through urban development and major infrastructure projects, including the construction of Matilija Dam and channelization, which have altered river flows, sediment transport, habitat connectivity, and access to traditional resources central to Chumash stewardship practices.

Climate change is exacerbating these issues and impacting cultural practices across the region. Shifts in weather, extreme heat, drought, and wildfire affect access to traditional foods, medicinal plants, ceremonial areas, and culturally significant species. As a result, the VRWRP considers a broad range of cultural resources (including subsistence practices, ethnobiologically significant species, sacred landscapes, and cultural-use sites) while maintaining confidentiality regarding specific locations and sensitive information.

Despite these disruptions, Chumash people remain an active and present community in the Ventura River Watershed today, continuing cultural traditions, gathering practices, stewardship activities, and ceremonial connections that depend on healthy river flows, access to culturally important species, and protection of sacred sites. Many Tribal members in the region remain engaged in river-based subsistence, ethnobotany, and cultural restoration despite obstacles created by climate change, land-use changes, and restricted access.

These living cultural connections underscore that cultural resources in the watershed are not solely archaeological or historical; they include current Tribal communities, cultural landscapes, and the species, materials, and places that support ongoing cultural identity and practice. Understanding historical context helps frame these resources, but the VRWRP recognizes Indigenous peoples as present-day knowledge holders, land stewards, and community leaders whose continued relationship with the Ventura River is essential to watershed resilience.

Current Climate Hazards

The following section outlines how climate drivers, including changes in temperature and precipitation, are currently creating climate hazards, like extreme heat, drought, wildfire, flooding, sea level rise, and marine fog reduction. These hazards directly affect the watershed's water-resource systems, ecosystems, infrastructure, and communities. Historical examples of these events and their impacts are summarized in **Appendix M**: Historical Climate Events, and **Chapter 4**: Future Climate Conditions builds on this baseline by examining how these hazards are projected to intensify under future climate scenarios.

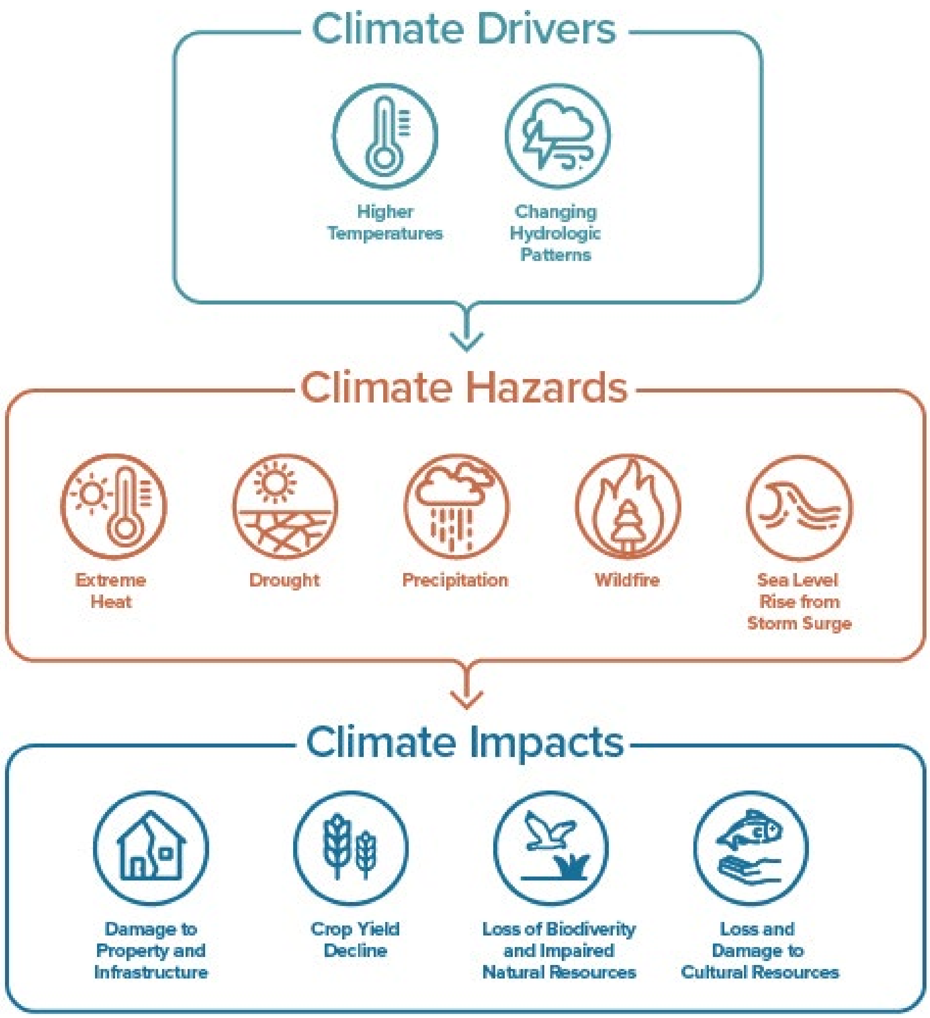
Definitions

Climate planning literature contains a vast array of terminology, often with conflicting definitions. This plan adopts the following key definitions with respect to climate drivers, climate hazards, and climate impacts:

- **Climate Drivers**: The processes, variables, and phenomena in the climate and weather domain that may span over multiple spatial and temporal scales. Key drivers include precipitation and temperature, as they influence long-term weather patterns in an area and determine the region’s climate characteristics. Changes in climate drivers can result in extreme weather events (i.e., climate hazards) that can impact people, services, infrastructure, and natural systems. Primary changes in climate drivers are caused by an increase in the proportion of greenhouse gasses in the atmosphere from human-caused sources of change to the earth’s climate (Zscheischler 2018, U.S. Global Change Research Program 2017).
- **Climate Hazard**: An occurrence of a physical event or physical trend, like an extreme heat event, extreme rain event, sea level rise or wildfire, that arises from changes in climate drivers. A climate hazard poses risk to people, services, infrastructure or natural systems in the watershed. Hazards are usually the immediate physical precursors to negative climate impacts (California Governor’s Office of Emergency Services 2020, Zscheischler 2018).
- **Climate Impact**: The effect of climate hazards on the people, services, infrastructure, and natural systems. Climate impacts could include flooding of homes, seawater intrusion in groundwater aquifers, habitat and biodiversity loss, and degraded air quality (Legislative Analyst's Office 2022).

The relationships between climate drivers, hazards, and impacts as understood for this plan are visualized in Figure 19.

Figure 19 Climate Impacts on the Ventura River Watershed



The following sections describe the specific climate hazards of concern in the Ventura River Watershed and their impacts. Climate impacts are complex and interdependent, resulting in disparate impacts to people, property, and the environment. While everyone is impacted by climate hazards, overburdened communities face greater adverse outcomes to their health, economic well-being, and neighborhoods due to systemic inequities. These inequities stem from historical and current institutional structures, such as water rights and governance, discriminatory housing and land-use practices, uneven infrastructure design, and patterns of public investment, that have concentrated risk and limited access to the resources needed for effective climate preparedness, response, and recovery.

Community Insight: Built Infrastructure and Safety Under Compounding Hazards

During the July 2025 VRWRP Forum, community members described how storm drains, culverts, and low-lying roads failed under extreme precipitation, creating transportation gridlock and delaying access to emergency services for isolated communities. Residents in the Ventura Avenue neighborhood emphasized that limited evacuation routes, poor signage, and inadequate multilingual alerts heightened risks for renters, unhoused individuals, and non-English speaking households. Flood management systems downstream of the Ventura Avenue neighborhood were flagged as vulnerable to sea-level rise and storm surge, increasing the possibility of levee and wastewater failures in the lower watershed.

The Thomas Fire of 2017 exemplifies these vulnerabilities. Widespread road closures and Public Safety Power Shutoff events during the fire disrupted access to water facilities and emergency services, while post-fire debris flows overwhelmed drainage systems and prevented emergency access to neighborhoods. Cascading impacts from the fire (power disruption, flooding, and infrastructure failure) remain central to community concerns about future multi-hazard events. Participants stressed the need for redundant and culturally appropriate communication systems, resilience hubs, and coordinated evacuation planning to protect vulnerable populations when infrastructure falters.

Extreme Heat

Extreme heat is a prolonged period of high temperature and high humidity that is much higher than expected for a region at a given time of year. Extreme heat can be an acute (short-term) hazard or a chronic (long-term) hazard (National Integrated Heat Health Information System 2025). Specifically, extreme heat days refers to the number of days per year when the daily maximum temperature reaches the 98th percentile value of historical daily maximum temperatures. In the Ventura River Watershed, extreme heat is characterized by a 98th percentile temperature threshold of 89.8 °F, meaning that based on the historic record, extreme heat refers to days hotter than 89.8 °F (Cal Adapt 2025).

Extreme heat events have increased in frequency and severity across the Ventura River Watershed, impacting public health, agricultural productivity, and sensitive riparian habitats. These thermal extremes accelerate evapotranspiration, which significantly depletes soil moisture and leads to the physical hardening of the land surface (Langridge 2018). This process reduces the infiltration capacity of the soil, effectively increasing the runoff coefficient for the watershed. Consequently, during subsequent high-intensity precipitation events, these hardened, desiccated soils act as semi-impermeable surfaces, shedding water rapidly and exacerbating the risk of flash flooding and sedimentation in both developed and natural areas.

Farmworkers are among the most vulnerable populations to extreme heat due to prolonged outdoor exposure, limited access to cooling infrastructure, substandard housing conditions, and systemic inequities resulting in barriers to healthcare and legal protections. High temperatures have led to documented increases in heat-related illnesses among agricultural workers in Ventura County, particularly during multi-day heat events. Although California requires shade, rest, and water breaks for farmworkers in temperatures above 95 °F, enforcement and access to such resources remain uneven (California Department of Industrial Relations 2024).

Since 1997, there have been six notable extreme heat events (multi-day periods of consecutive extreme heat days) throughout the watershed, including as recently as September 2024. Key features of these events include temperatures above 90 °F in coastal areas and temperatures as high as 119 °F in inland areas such as in Ojai and Meiner's Oaks (Western Regional Climate Center 2019). Extreme heat is more prevalent in the inland and urban areas of the watershed, especially near the communities of Ojai, Meiner's Oaks, and Wheeler Springs (Western Regional Climate Center 2019, Ventura Star 2024).

Drought

Drought is defined as an extended period of dryness caused by low precipitation and high temperature that negatively impacts soil moisture and water resources availability for some activity, group, or environmental sector. Both single and multi-year drought events have been a recurring hazard throughout history in the watershed, with 11 significant droughts occurring since 1898. Drought is a top concern and drives significant water supply reductions, ecological stress, agricultural and community impacts, and infrastructure issues. It represents a key climate vulnerability, particularly in a watershed that currently relies exclusively on local water supplies.

During drought years, water supply reductions occur, resulting in streamflow declines in the Ventura River and its tributaries, especially during summer and fall months. Similarly, groundwater recharge deficits occur especially in the Upper Ventura River and Ojai Groundwater Basins, causing disruptions to agricultural and urban uses (Ventura County Public Works Agency 2020).

The watershed's dependence on natural recharge, due to both its lack of imported water and geology, leaves its basins particularly vulnerable during drought. During dry years, the lack of surface flows reduces infiltration and curtails opportunities for recharge through spreading grounds. The Ojai Valley GSP includes provisions for enhancing recharge and capture opportunities for stormwater when available (Ojai Basin Groundwater Management Agency 2022).

Local water supplies provide irrigation to more than 6,000 acres of agricultural land in the watershed. These supply sources are vulnerable to drought, particularly where agricultural communities rely on wells without access to alternative surface water allocations or deliveries due to infrastructure gaps or economic barriers. While most farming operations within the watershed have dual supply (surface water and groundwater sources), agricultural lands outside the Lake Casitas distribution system, particularly in parts of the Ojai Basin and rural headwater areas, depend primarily on groundwater for irrigation and are therefore more exposed to drought-related well failures and pumping cost increases. During the 2014 drought in Ojai, when wells ran dry, most agricultural communities were unable to purchase new water allocation due to the heightened costs of water, resulting in crop die-off and large economic losses (Walter 2015).

Droughts reduce local supplies and necessitate costly operational shifts, such as increased reliance on groundwater pumping. Under the Water Efficiency and Allocation Program, the CMWD Board of Directors may implement, at their discretion, demand reduction measures including surcharges when Lake Casitas storage falls within specific ranges, such as Stage 3. While a drop below 40 percent storage indicates a potential Stage 3 condition, the implementation of penalties for exceeding allocations remains a policy decision managed by the board to effectively balance remaining supplies.

Wildfire

A wildfire is any unwanted and uncontrolled fire that burns natural or developed areas. Historically, fire in the Ventura River Watershed resulted from lightning ignitions and Indigenous cultural burning, which together shaped the watershed's natural fire return interval (Cal Fire Vegetation Treatment Program

2025). These frequent, low-intensity fires supported ecological health by promoting fire-dependent plants and maintaining open, resilient vegetation structures. After the late eighteenth century, Federal- and State-imposed restrictions on Indigenous burning and subsequent significant fire-suppression policies disrupted this regime, allowing fine fuels (small, lightweight vegetation that dries out quickly and ignites easily) to accumulate. Continued suppression over the past century has further increased fuel loads, contributing to today's high-intensity wildfires that burn larger areas at a pace that is much more difficult for wildfire responders to control, and burn at an intensity that results in more significant impacts, generating severe erosion, sedimentation, vegetation, species, and property and human loss (van Wagtendonk et al. 2018).

Approximately 95 percent of the Ventura River Watershed falls within zones capable of extreme fire behavior, with most of the region classified as Very High Fire Hazard Severity Zones. Areas extending from the City of Ventura north along SR-33 to Ojai face elevated wildfire risk due to fuel conditions, steep terrain, hazardous wind patterns, and the region's characteristic fire weather (CAL FIRE 2025).

Wildfires pose serious impacts to water resources and infrastructure. High severity fires increase sedimentation and ash loads in waterways, strain firefighting systems through high demand and infrastructure damage, and create power outages that limit pumping and treatment capacity (Walter 2015). Severe burns destabilize slopes and create hydrophobic soils, reducing infiltration and amplifying runoff. As a result, even moderate post-fire storms can trigger flash flooding, debris flows, and sediment surges that overwhelm flood-control structures (Ventura County Office of Emergency Services 2022). Sediment export in burned areas has been documented at up to two orders of magnitude above unburned conditions (Jumps et al. 2022), carrying ash, sediment, and nutrients downstream and threatening drinking water supplies, habitat, and public safety.

Wildfire impacts extend to the agricultural sector, where farmworkers face hazardous smoke conditions and respiratory exposure. In past events, such as the 2017 Thomas Fire, thousands of agricultural workers reported limited access to protective masks or sheltered conditions (English et al. 2020, CDPH 2018), while rural farmworker housing remains particularly vulnerable to fire damage. The Thomas Fire also burned thousands of acres of avocado and citrus orchards in Ventura and Ojai, destroying crops, damaging irrigation systems and farm infrastructure, and causing over $170 million in agricultural losses in Ventura County alone, severely impacting avocado and citrus industries.

Although fire has been part of the watershed for millennia, the shift toward larger, hotter, and more frequent wildfires threatens both ecological systems and cultural resources. High-severity fires destroy archaeological and cultural sites, disrupt access to culturally important plants and materials, and permanently convert native shrublands and forests into non-native, fire-prone grasslands (National Parks Service 2016).

Extreme Precipitation and Flooding

Extreme precipitation refers to rainfall that exceeds typical intensity or frequency, while flooding is the temporary inundation of normally dry land (U.S. EPA n.d.). Flooding is a long-standing feature of the Ventura River Watershed: since 1933, major or moderate floods have occurred roughly once every five years (Walter 2015). Because flooding in the watershed is closely tied to intense rainfall, this plan considers extreme precipitation and flooding together.

During extreme precipitation events, soils saturate quickly and excess runoff raises water levels in creeks, sloughs, reservoirs, and stormwater systems. Floodwaters increase depth and velocity, which can damage homes, infrastructure, crops, and natural areas. Major floods on the Ventura River, defined by a peak discharge threshold of 40,000 cubic feet per second (cfs) at the Ventura River near Ventura gage (USGS 11118500), have occurred at least 11 times since records and historical reconstructions began in 1862 (USGS 2023). These high-magnitude events are characterized by rapid rising limbs on the hydrograph, often increasing from baseflow to peak discharge in fewer than four hours. (U.S. Geological Survey, 2023)

Several significant events illustrate the watershed's exposure. The watershed experienced six peak-flow floods above 40,000 cfs after 1933, including two major events during the 1969 winter storms, which brought 43 inches of rain in nine days and produced peak flows of 58,000 cfs. These storms caused widespread infrastructure damage and more than $43 million in losses (Ventura County Public Works Agency 2025a).

Subsequent storms produced similarly rapid rises in flow. In 1992, Ventura River flows spiked from less than 100 cfs to 46,700 cfs in under three hours at Foster Park. In 1995, regional storms overtopped the Ventura River near U.S.-101, forcing a 33-hour freeway closure and inundating areas used by unhoused residents, resulting in one fatality (DWR 2003).

More recent events confirm the trend. For example, during the federally declared disaster in January 2005, extreme high-water flows and severe bank erosion along San Antonio Creek and the Ventura River exposed and ruptured sewer mainlines operated by the Ojai Valley Sanitary District, resulting in a major release of raw sewage (Ventura County 2022). In January 2023, peak flows exceeding 34,000 cfs triggered widespread flooding and months-long recovery efforts, with damages surpassing $30 million (Ventura County Public Works Agency 2025a).

Sea-level Rise and Storm Surge

Sea-level rise is the long-term increase in average ocean water levels, while storm surge is the temporary rise in water above predicted tides caused by storm events (Central Coast Wetlands Group, 2017). Together, these hazards pose growing risks to low-lying coastal areas of the Ventura River Watershed. Rising seas and more frequent high-energy storm events accelerate beach erosion, raise coastal groundwater levels, increase seawater intrusion into aquifers, inundate roads and neighborhoods, and damage wetlands and coastal infrastructure. Storm surge further intensifies these impacts by rapidly eroding unstable shorelines, damaging beachfront homes and businesses, and undermining protective structures such as seawalls and breakwaters.

Coastal areas of the watershed have long experienced these hazards. Since 1907, at least 11 major coastal flooding events have been documented, with impacts often amplified during El Niño years. Notable El Niño events (including those in 1982–83, 1997–98, 2010, and 2024) generated powerful waves, severe erosion, and significant infrastructure damage (Walter, 2015; Leonard, 2024). In 2010, a series of storms combined heavy rainfall, large surf, and elevated tides to cause widespread flooding (Ormond Beach 2018 Emergency Report, 2018). More recently, in late 2023 and early 2024, intense atmospheric river storms paired with high surf resulted in extensive coastal flooding, road closures, evacuations, and damage to neighborhoods near the Ventura River mouth (Office of the Governor, 2024; Jenkin, 2024).

The lower Ventura River Watershed is particularly exposed, especially where the river meets the Pacific Ocean near U.S.–101. Since 2011, the City of Ventura has implemented the Surfers Point Managed Retreat Project, which replaced portions of a damaged parking lot and bike path with sand dunes and a buried cobble berm to stabilize the back-beach area. These modifications addressed localized erosion and public-access issues at the site (City of Ventura, n.d.). These actions were designed for the unique conditions at this location and do not necessarily represent approaches applicable elsewhere in the watershed.

Declining Marine Fog

Marine fog forms when moist air moves over cooler ocean waters, creating low-lying clouds that moderate coastal temperatures and reduce evaporative demand. Fog occurrence is shaped by large-scale atmospheric processes, including the position of the Pacific high-pressure system and the jet stream. While persistent marine layers traditionally keep summer temperatures cooler, heat waves—driven by strong high-pressure systems and offshore winds—can punctuate or disrupt these fog cycles, intensifying drought stress, crop losses, and wildfire conditions (Kawai et al. 2018).

Historically, marine fog has played a critical ecological and hydrologic role in the Ventura River Watershed. Fog reduces plant water loss, supports coastal and riparian vegetation, lowers irrigation demand, and moderates extreme heat events (Fischer et al. 2009, Baguskas et al. 2018, Gershunov and Guirguis 2012). However, long-term observations indicate a decline in fog frequency along the southern California coast (Williams et al. 2015). Decreasing fog cover heightens evaporative stress, increases irrigation requirements, exacerbates vegetation drought stress, and intensifies heat extremes—particularly in coastal and lower-watershed zones where fog historically provided natural cooling (Torregrosa et al. 2014).

Historical Watershed-wide Water Budget

Understanding the Watershed's Historical Water Budget

A water budget is a quantitative accounting of water inflows, outflows, and changes in storage within a defined area over a specified period. They are used to evaluate how water moves through a system and to assess temporal changes in water availability. Water budgets illustrate hydrologic conditions and demonstrate how changes in water supply, demand, management actions, and climatic conditions can affect water resources. Because the Ventura River Watershed has historically relied almost entirely on local precipitation and has limited natural storage, it is highly sensitive to drought, shifting rainfall patterns, and climate extremes. Understanding the historical water budget provides critical context for water resource vulnerabilities discussed throughout this plan.

Summary

Historically, the Ventura River Watershed has relied on local precipitation, with no significant managed recharge programs or external (imported) water sources. This reliance reflects limited water supply diversity and contingency planning, a vulnerability that is expected to intensify under changing climatic conditions. Long term drought (both local and regional) poses significant risk to the watershed.

Water storage opportunities within the watershed are constrained by geologic conditions, including small and shallow aquifers, as well as topographic features that limit surface water storage capacity. These constraints result in limited groundwater and surface water storage availability, with Lake Casitas serving as the primary water storage reservoir in the watershed.

Groundwater and surface water are strongly interconnected throughout the watershed, supporting agricultural, municipal, industrial, and ecological uses. Groundwater pumping can reduce surface-water availability in interconnected reaches, while the relationship between surface-water extraction and groundwater recharge is more context-specific. In the Upper Ventura River Basin, most surface-water diversions occur only during high-flow periods when flows exceed diversion thresholds, and thus have a limited effect on recharge relative to other uses. Regardless of source, changes in either groundwater or surface-water availability can influence ecosystem health in connected reaches.

Steep terrain and geologic characteristics contribute to rapid aquifer recharge and drainage, leading to significant variability in groundwater and riverine surface water availability. Some of the river channels are ephemeral, having high infiltration rates. Recharge primarily occurs during wet years and declines during dry years. Onsite wastewater treatment system percolation provides a small amount of incidental recharge to shallow groundwater, but the watershed does not currently conduct managed aquifer recharge. Primary outflows from the watershed include evapotranspiration and surface water discharge to the ocean, particularly during wet years when runoff is elevated.

Total watershed water budget components and the annual water budget volumes for the Ventura River Watershed inflow and outflow components across the period of analysis, 1994-2017, are documented in **Appendix N**: Historical Water Budget. The dominant components of the total system water budget, which describes the water budget at a watershed scale, are: 1) precipitation, the primary inflow; 2) evapotranspiration, the main outflow; and 3) stream outflow to the ocean, a secondary but significant outflow. Water storage increases during wet years (e.g., 1995, 1998, 2005) and decreases during dry periods, particularly during the 2012–2016 drought.

Key Findings:

Key findings from the historical water budget are discussed below, along with the associated adaptation measures developed to help address these challenges. Measures referenced here have not undergone a prioritization process, and are discussed in greater detail in **Chapter 6**: Adaptation Strategies, Actions, and Implementation Roadmaps.

- The watershed relies on precipitation as its primary water source, a vulnerability that potentially increases with climate change.
  - *Adaptation measure*: Diversify water sources (Strategy 2.3)
- Water storage capacity is limited by geology and topography, with Lake Casitas as the only significant reservoir.
  - *Adaptation measure*: Expand water storage and conservation programs (Strategies 2.2 and 2.3)
- Groundwater and surface water are highly interconnected and jointly used by all many users.
  - *Adaptation measure*: Continue to improve equitable water resource management (Strategies 1.3 and 2.2)
- Natural groundwater recharge is highly variable, dependent on water-year type, and aquifers have limited storage.
  - *Adaptation measure*: Infiltrate elevated runoff, increasing recharge opportunities where feasible and where recharge enhancements are deemed beneficial (Strategies 1.2 and 4.2)
- Managed aquifer recharge is limited to supply from a wastewater treatment system.
  - *Adaptation measure*: Diversify and expand infiltration and recharge opportunities where feasible and where recharge enhancements are deemed beneficial (Strategies 1.2 and 4.2)
- Major outflows include evapotranspiration and surface water discharge to the ocean.
  - *Adaptation measure*: Reduce inefficient water use (e.g. invasive species, overwatering, water-intensive plants) (Strategies 1.4, 2.2, 6.1, 6.2, and 6.3)
  - *Adaptation measure*: Increase permeable area (e.g. expand parks, green-infrastructure, infiltration basins) where feasible and where recharge enhancements are deemed beneficial (Strategies 3.2, 4.2 and 5.1)

For a more detailed accounting of the Historical Water Budget, see **Appendix N**: Historical Water Budget.

Key Watershed Problems and Challenges

The following problem statements summarize the major challenges that communities, ecosystems, and infrastructure in the Ventura River Watershed currently face. Their purpose is to clearly identify the conditions that limit watershed resilience and to highlight where adaptation strategies are most needed. These statements draw from existing public-agency documents, watershed plans, vulnerability assessments, and input gathered through a community forum, key partner interviews, and Advisory Group review. They reflect historical events, local data, and diverse lived experience across the watershed. Problem statements are organized into five thematic areas: Infrastructure; Natural Resources; Cultural Resources; Communities and Land Use; and Operations and Community Services.

Refer to **Appendix O**: Problem Statements for full descriptions of each problem statement.

Thematic Area: Infrastructure

1. Wildfires Damage Water Infrastructure and Temporarily Interrupt Water Supply
2. Extreme Precipitation and Flooding Damage Stormwater, Water Supply, and Wastewater Systems
3. Drought and Extreme Heat Reduce Surface Water, Lower Groundwater Levels, and Strain Local Water Supplies
4. Drought, Extreme Heat, Wildfire, and Flooding Degrade Water Quality and Increase Treatment Challenges

Thematic Area: Natural Resources

5. Drought, Extreme Heat, and Wildfire Degrade Ecosystems, Reduce Habitat Quality, and Spread Invasive Species
6. Drought, Heat, and Flooding Accelerate the Spread of Invasive Species in Riparian and Coastal Areas
7. Sea Level Rise, Storm Surge, and Declining Marine Fog Impact Coastal and Estuarine Ecosystems
8. Human Infrastructure Alters River Flows and Reduces Natural Hydrologic and Habitat Functions
9. Soil Degradation and Watershed Management Practices Increase Erosion, Runoff, and Water Supply Vulnerability

Thematic Area: Cultural Resources

10. Climate Hazards Degrade Cultural Resources, Traditional Lifeways, and Access to Culturally Significant Places

Thematic Area: Communities and Land Use

11. Climate Hazards Reduce Access to Open Space and Impacts Community Health and Well-Being
12. Water Access Disruptions and Rising Water Costs Disproportionately Impact Overburdened Communities
13. Extreme Heat, Drought, and Flooding Impact Water-Dependent Agriculture and Farmworker Well-Being
14. Development in Flood and Fire Hazard Zones Increases Community Exposure to Climate Risks

Thematic Area: Operations and Community Services

15. Wildfire, Extreme Precipitation, and Flooding Disrupt Critical Services and Emergency Operations
16. Insufficient Funding and Coordination Limit Proactive, Climate-Responsive Planning Across the Watershed
17. Outdated Permitting and Infrastructure Policies Leave Communities Vulnerable to Climate-Driven Hazards