

River Forecasting and 2017 Flood

By Tim Bardsley, National Oceanic and Atmospheric Administration



Now that flood season is upon us, it's fitting to illustrate how the National Weather Service (NWS) in Reno collaborates with the California Nevada River Forecast Center (CNRFC) to produce predictive models for river forecasting and seasonal outlook for the Carson River Watershed.

Hydrologists at the [CNRFC](#) use well-calibrated, lumped models to simulate watershed runoff. These models generate short-term 5-day river flow and stage forecasts and 365-day water volume forecasts, the latter being most useful for spring snowmelt runoff. Both short-term and long-term forecasts are updated at least once per day. Short-term "flood" models use rain-snow elevation, precipitation, temperature, and planned reservoir releases. Long-term forecasts blend weather and climatology 6 to 15 days out, followed by 59 years of historical precipitation and temperature data. This produces 59 different runoff scenarios allowing for probabilistic forecasts.

The winter of 2016/2017 was a good reminder of our region's flood potential and a good test for the National Weather Service (NWS) River Forecast system. After 12 years without major

Inside this Issue:

Carson River Work Days.....	2
STEAM Nights.....	3
Amorous Mistletoe?.....	3
Carson Flood Chronology.....	4
New Watershed Faces.....	6
River Forecasting Cntd.....	7
Americorner.....	8

flooding in the eastern Sierra and western Nevada, a series of mainly beneficial storms in October and December 2016 primed the pump for flooding in the central Sierra and western Nevada.

By early January 2017 significant snow began accumulating in the Sierra. Meteorologists at the Reno NWS office and the Sacramento-based CNRFC noticed their models were both predicting a very warm and wet [atmospheric river](#) event around January 8th and 9th. Public safety partners were informed January 3rd despite considerable uncertainty on the precise timing, magnitude and impacts of the event.



Rising flood waters upstream of Highway 395 on 1/8/17. Cresting flows later closed the highway in both directions. Photo by Scott McGuire.

Continued on page 7



Carson River Work Days

By Darcy Phillips, River Wranglers



Living in the Carson River Watershed allows us to experience nature in a wonderful way, and connecting students to the value of their watershed benefits everyone. River Wranglers brings hundreds of students to the river each fall to give them the chance to explore their environment while educating them about the importance of protecting their watershed.

This fall, River Wranglers worked with Carson City, Dayton, and Douglas County Schools to bring the watershed to the classroom, as well as the classroom to the watershed.

We train high school students to teach elementary students about the water cycle, local geography, non-point source pollution, water quality, and beaver adaptations. Our goal is to not only educate, but also to involve students in projects where they make a difference in their community.



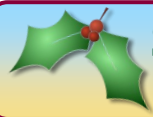
*Dayton HS and Sutro ES students
learning about the
Carson River Watershed.
Photo by Shauna Langan.*

We partner with local conservation districts; county departments; private businesses; and other nonprofits to complete the “work” part of the workday. These projects include wrapping cottonwood trees to protect them from beaver damage and labeling neighborhood storm drains to inform the public they often lead directly to the river.

We love to see the kids being adventurous, caring, and engaged inside and outside of the classroom. River Wranglers wants to inspire youth with hands-on learning, giving them the opportunity to explore, conserve, and understand our local rivers and watershed.

With the information the students gained from this amazing experience, the hope is for them to educate others to care for the watershed we all share. For more information, visit RiverWranglers.org or contact Darcy Phillips at (775) 856-9268 or dphillips@riverwranglers.org.





Sierra Nevada Journeys STEAM Nights

By Sean Hill, Sierra Nevada Journeys



Sierra Nevada Journeys (SNJ), in partnership with the Carson Water Subconservancy District (CWSD), engages families in the Carson River Watershed through an exciting Family Watershed STEAM (Science, Technology, Engineering, Arts, Math) program. These evening events take place at local schools, for the children, families and teachers in those school communities. The goals of the program are to support schools with family engagement, and to bring fun, hands-on STEAM and watershed education to the community. Families participate in 12-15 STEAM “mini-challenges”, followed by the Family Engineering & Design Challenge. Mini challenges include a hands-on watershed station, a water cycle matching activity, and stations about water and air quality. This exciting main event of the evening is designed for families to work as a team to solve an engineering problem. Examples of the design challenge include tallest tower, fastest wind-propelled vehicle, marble roller coasters, lunar landers and strongest bridges. CWSD’s sponsorship of these events help to cover the costs of this great program! For more info, contact Sean Hill at Sean@sierranevadajourneys.org.



A SNJ educator working with a family.
Photo courtesy SNJ.



Mistletoe: An Amorous Tradition?

By Shane Fryer, CWSD



Like many Grimm Fairytales, our romantic vision of Mistletoe has a much darker, bloodier origin. The story of mistletoe originates in Norse myths, recorded in 13th century Icelandic manuscripts (Prose Edda). The tale of mistletoe is one of Odin, his powerful wife Frigga (celebrated for her premonitions), and the devious god Loki. In a vision, Frigga foresaw the death of their son Baldur. Not knowing how he was to perish, Frigga sought a vow from everyone that none would harm Baldur.

“Frigga raced to the forest, sat at the foot of the trees and begged. “Protect my son,” she cried, and the trees promised. She ran to the rivers and demanded their protection, and they too promised. She looked to the sky, to fire and iron, to every other metal to give its oath. “Promise none of you will harm my son,” she cried, and everyone so vowed (Adapted by Amy Friedman).

However, Frigga in her arrogance neglected to ask the small, innocent and weak plant mistletoe. Loki fashioned a projectile from the plant, and as you might guess, things did not go well for Baldur. Frigga’s tears would become the white berries. Rather than punish mistletoe, Frigga in her grief asserted, the plant would become a symbol of peace and friendship evermore.



Dwarf mistletoe

Mistletoe comes from the Anglo-Saxon word *mistiltan*. Mistil means “dung”, while tan means “stick”. It literally translates to poop on a stick, referring to its dispersal by bird poop containing the berries.

The iconic Christmas-green and white berried mistletoe or *Viscum album* is a European species. Our native Dwarf Mistletoe (*Arceuthobium* spp.) can become a serious arboreal disease in drought stressed forests. It’s a hemiparasitic plant which gets most of its energy by sucking its nutrition from the tree.



European mistletoe berries.



Carson River Flood Chronology

By Justin Bedocs, CWSD, Americorps



Main Stem river flooding occurs primarily during the winter months in the Carson River Watershed. During this event, the main channel of the river flows out over the bank and onto the adjacent floodplain. These floods are influenced by the unique climate and topography of the region.

Nevada has the lowest annual average precipitation in the United States. In this arid climate, it can be easy to overlook flood dangers. It is also one of the fastest growing populations. Limited flood awareness, short-term flood memory, and increased development near the floodplain all contribute to a tendency to underestimate floods.

1862: The Great Flood

Known as the Great Flood of 1862, heavy snowfall in December 1861 carried over into 1862 for 43 days with more snowpack and rainfall. This is the only recorded megaflood to hit the west in recent history and was likely caused by an atmospheric river event; narrow bands of water vapor that lie about a mile above the ocean and extend for thousands of kilometers. One quarter of California's economy was destroyed, bankrupting the state.

1907

Empire Ranch Flood

Known as the Empire Ranch Flood, storms started as snow, then turned to rain for two more days. Snow covered the valley floor and it rained over the entire watershed. All bridges over the East Fork, West Fork and main stem of the Carson River were destroyed or damaged as well as irrigation structures and dams. Areas near the river were inundated, forcing residents to higher ground.

1955: The Christmas Flood

Known as the Christmas Flood of 1955, an unseasonably warm period and several days of intense rainstorms melted snowpack. A flow rate of 30,000 cubic feet per second (CFS) was recorded in the Carson River near Carson City. Flood damage was severe, damaging bridges, roads, diversion structures, agricultural land, residences and causing loss of livestock. More than 16,000 acres were flooded in the Carson Valley, almost the same amount as the 1997 flood.

1963

An unseasonably warm and intense rainstorm in February led to seven inches of precipitation at Woodfords. The Carson River had a flow rate of 21,900 CFS near Carson City. After this flood, the Army Corps of Engineers straightened sections of the river to move water through the channel faster during floods. This exacerbated the problem as the river incised and eroded downstream from the straightened sections.



Massive flooding in Sacramento during the Great Flood of 1862.
Print by A. Rosenfield, 1862.



Fallon is inundated during the 1907 Empire Ranch Flood.
Photo courtesy Nevada Historical Society.

The Sierra headwaters of the Carson River Watershed often receive heavy snowfall. [Ebbett's Pass](#) receives an average seasonal [snowpack](#) of 51 inches and can even reach a depth of up to 169 inches! Much of the water in the Carson River comes from melted snowpack. Rapid snowmelt, facilitated by warm rainfall, has led to catastrophic main stem flooding along the Carson River throughout history. The timeline below is based on the [USGS Carson River Flood Chronology](#) and illustrates some of the most disastrous floods occurring throughout history in the area.

Open floodplains offer natural flood protection during floods. When the river accesses the floodplain the water slows down, spreads out, and sinks in, limiting downstream impacts. Promoting open floodplains through compatible land uses like open space and agriculture, keeps people out of harm's way and limits costly damages to property and infrastructure. As one of the fastest growing populations in the United States, it is ever-important to ensure public safety by preserving the floodplain and raising awareness in vulnerable communities. Floods happen in Nevada, so visit [NevadaFloods.org](#) and be prepared!



*Carson Valley flooded during the 1997 flood.
Full rights remain the property of Wolf Products, Inc.
www.wolf-products.com.*



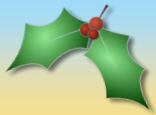
*Destroyed during the 1997 flood, a home hangs over the
Carson River. The renters nearly lost everything
Photo by Lisa J. Tolda.*

1986

Light rain began on February 12th and increased in strength for nine days. Five inches of rain was recorded in Minden along with a flow rate of 13,200 CFS near Carson City, resulting in a flooded Carson Valley. One bridge was closed on Highway 395 and a tributary dam near Dayton was destroyed, prompting the evacuation of 200 residents. Weeks Bridge on Hwy 95 was washed away.

1997: Flood of Record

One of the biggest floods in recent memory, 53.2 square miles of the Carson River Basin were flooded during the 1997 flood. A flow rate of [30,500 CFS](#) was recorded near Carson City to make this the Flood of Record for the Carson River Watershed. As a result, the Carson River Coalition was formed to address flooding and integrated watershed concerns. The flood created a 2-3 foot deep lake across the Carson Valley floor. A 6-mile stretch of the Carson River through the Carson Plains flooded an average width of half a mile parallel to the River on either side. The flood caused damage to homes and businesses.



CWSD Welcomes New Watershed Professionals



Lori Leonard - River Fork Ranch, Preserve Manager

Hello! I've been working for The Nature Conservancy for nearly four years as a Restoration Technician at the McCarran Ranch Preserve on the Truckee River. I'm originally from Wisconsin, where I grew up on a fourth-generation dairy and beef farm, which my dad and brother still run. I got my bachelor's Degree in Horticulture from the University of Wisconsin-Madison. My early conservation efforts began at The Aldo Leopold Foundation doing prairie restoration. From there, I headed West and worked in Utah, Alaska, and California doing habitat restoration and vegetation surveys. Before moving to Nevada in 2012, I was a Farm Bill Biologist for five years in a Natural Resources Conservation Service (NRCS) office, helping enroll private landowners in USDA conservation programs. I am looking forward to working in the beautiful Carson Valley! Please call or email Lori anytime regarding meetings or ideas for River Fork Ranch at lori.leonard@tnc.org or (702) 533-3255.



Lori Leonard

Shauna Langan - AmeriCorps, AWG & River Wranglers, Education & Outreach Coordinator



Shauna Langan

Shauna grew up in San Diego, where she spent most of her time exploring the beach and hiking outdoors. In high school, Shauna was an avid member of her Future Farmers of America chapter. Shauna graduated from Sonoma State University with a B.S. in Environmental Studies and Planning with a concentration in Energy Management and Design. In college, she had the opportunity to work as an intern with the Center for Climate Protection's Clean Power Exchange Program. Shauna's love for enriching the minds of students stems from being around educators and students all her life. Shauna believes youth are the key to the future. With her position as Education and Outreach Coordinator, she hopes to continue to learn and teach students and the surrounding community. In her free time, Shauna loves baking, reading, and exploring outdoors. For more info, contact Shauna at shauna@riverwranglers.org.

Taylor Norton - Americorps, AWG, Restoration and Monitoring Coordinator

Born and raised in Fairfield, Connecticut, Taylor spent much of his childhood exploring the natural beauty of the northeastern United States. Annual family trips to the Green Mountains of Vermont inspired his love and curiosity for the natural world. Taylor attended the University of Vermont, graduating in the spring of 2017 with a B.S. in Geology and Geospatial Technologies. While attending the University of Vermont, Taylor studied the history of eutrophication in Lake Champlain through the analysis of lake-bottom sediments. After graduating, Taylor worked for the University of Vermont Spatial Analysis Laboratory, assisting in the creation of high-resolution land cover datasets for major cities across America. In the summer months, Taylor has worked in Jackson, Wyoming, as a wilderness guide and outdoor educator for groups of teens ages 12 to 18. Taylor is excited to serve as an AmeriCorps member for the Alpine Watershed Group and to help protect Alpine County's beautiful rivers while exploring the area. For more info, contact Taylor at awg.snap.rm@gmail.com.



Taylor Norton



Carson River Forecasting Continued

By Tim Bardsley, NOAA



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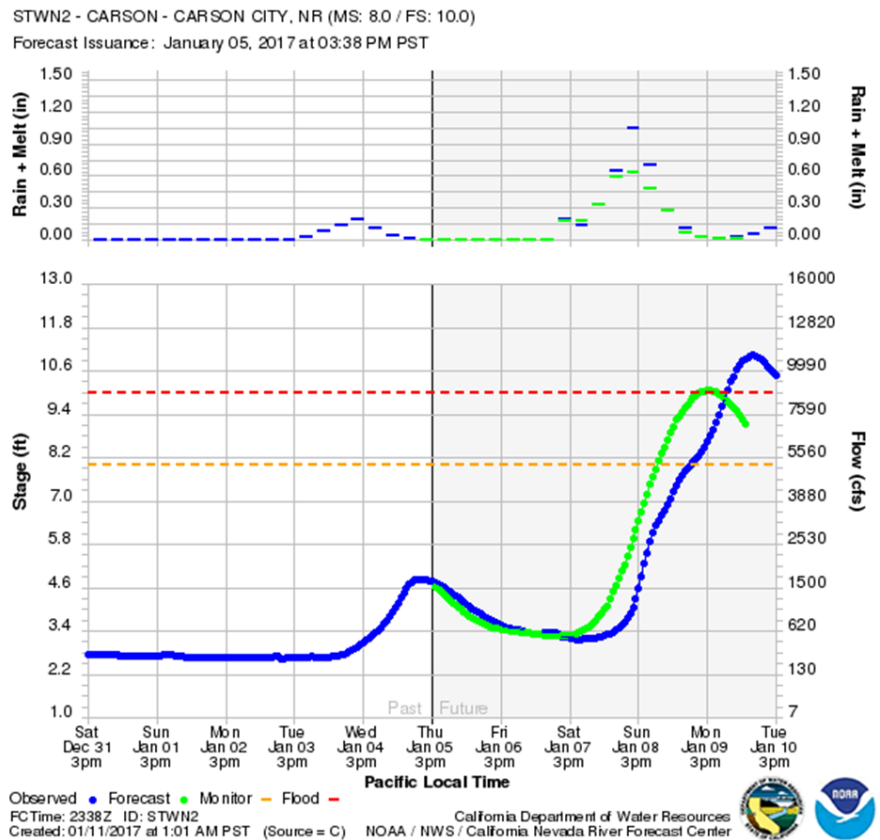
By the morning of January 4th simulations from the CNRFC were showing minor to moderate flooding throughout the region. Meteorologists and hydrologists at the Reno NWS office worked closely with the CNRFC to run various scenarios, including changes in the rain/snow line elevation and anticipated precipitation. NWS Reno used the scenario results to weigh the potential outcomes shared during partner briefings and webinars.

NWS Reno issued flood watches on January 4th. As the storm arrived, flood warnings were issued and the CNRFC ramped up staffing for 24-hour operations, issuing 4 forecasts per day. During the storm, the hydro model is updated with observed precipitation and estimated rain/snow elevations, and simulations tuned to observed runoff. As Emergency Operations Centers opened, NWS Reno staff briefed them remotely and in person. Public safety partners then prepared communities for flooding.

A similar scenario played out in February 2017 with somewhat lesser impacts except for the Susan and Middle fork of the Feather Rivers, which flooded more significantly. Meanwhile, a record snowpack accumulated in the mountains. The probabilistic long-term water supply forecasts generated by the CNRFC indicated very high spring and summer runoff volumes and a high potential for snowmelt flooding, especially in the Carson and Walker River watersheds. These probabilistic forecasts aid proactive reservoir management by maximizing capacity in order to mitigate peak snowmelt flooding. These forecasts were used to inform the construction of the new emergency diversion canal below the Lahontan Reservoir, known as [“The Big Dig”](#) project.

An iterative process evolved between NWS hydrologists and reservoir managers during snowmelt events. If the CNRFC forecasts indicate significant flooding, reservoir managers often adjust their release plans to mitigate projected flooding magnitude. These changes are integrated into an updated CNRFC forecast. Later in the 2017 melt season, this iteration took place in advance of the forecast release.

The CNRFC and NWS Reno are critical partners in predicting flooding in our region. You can stay informed on water and weather issues in our area by reading the [forecast discussion](#) and checking your [local forecast](#) and following us on Facebook and Twitter @NWSReno.



An example of short-term forecast verification products for the Carson River near Carson City. The observed flow is in blue and the forecast as of 3pm January 5, 2017 is in green.



★ The AMERICORNER ★



AmeriCorps Member Manages Adopt-A-Trail Program *By Chelsea Kincheloe, AmeriCorps, CCPROS*

Carson City Parks, Recreation & Open Space (CCPROS) currently has 3 fulltime AmeriCorps VISTA (Volunteers in Service to America) members serving for their department. VISTA members serve as change-makers in communities across America for an entire year, building programs beneficial to organizations and the local community. This past year, CCPROS welcomed Chelsea as their new AmeriCorps VISTA Volunteer Coordinator.

One of the newest programs Chelsea is working on is the CCPROS Adopt-A-Trail program! Parks and Open Space trails require regular maintenance throughout the year and this program offers groups a great opportunity to learn more about Carson City's extensive 20+ mile trail system, maintain trails for the public to enjoy, and provide a sense of accomplishment.

As part of the program, groups can apply to adopt a section of trail, usually no more than a mile in length. We ask that each group commit to one year with the option to renew at the end and to complete a minimum of two clean-ups per year.

CCPROS is excited to offer this program and is looking for interested groups to participate. For more information and to apply, please visit: www.carson.org/adoptatrail or contact: Chelsea Kincheloe, Volunteer Coordinator for Carson City Parks, Recreation & Open Space at ckincheloe@carson.org or 775.283.7711.



*Newly constructed Wild Horse Trail, adopted by Carson Senators Biking Club.
Photo by Chelsea Kincheloe.*

Upcoming Events

NV State Parks Winter Events

<http://parks.nv.gov/events>

January 5, 2019 1pm-3pm

Winter Wonderland Walk!

<https://visitcarsoncity.com/event/winter-wonderland-walk/>

January 20, 2019 5:30pm-12pm

Lunar Eclipse Party! WNC Observatory

<https://m.facebook.com/westernnevadacollege/events/>

January 24-27, 2019

Eagles and Agriculture!

Celebrate the annual arrival of eagles to the Carson Valley!

<http://www.carsonvalleynv.org/events/details/>

April 2 & 3, 2019

Carson River Watershed Forum

Stay Tuned for More info @ cwsd.org



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CWSD works within existing governmental frameworks to promote cooperative action for the watershed that crosses both agency and political boundaries.

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