NWRRI – Nevada Water Resources Research Institute – June 2024

Nevada Water News

Written and compiled by: Nicole Damon; Designed by: Lori Fulton; Photo by: Liz Yurko Carmer/BLM Nevada

Project Spotlight: "A Storyline Approach to Assess the 1997 New Year's Flood in Western Nevada"

This project is funded through the National Institutes for Water Resources (NIWR) 104(b) grant.

Despite Nevada's arid climate, the western part of the state can still experience extreme winter storms that lead to extreme flooding. In fact, over the past seven decades, extreme flooding has greatly affected the area and resulted in fatalities and significant property damage along the Truckee River and in downtown Reno. An example of one of these events is the 1997 New Year's flood, which inundated downtown Reno, the Reno International Airport, and an industrial area of Sparks, Nevada, and caused approximately $1.6 billion in property damage (Hess and Williams, 1997). The goal of the project "A Storyline Approach to Assess the 1997 New Year's Flood in Western Nevada" is to use data from historical flooding to generate more accurate estimates of potential future extreme flooding.

Conventional climate impact studies rely on Global Climate Model (GCM) simulations downscaled to a local scale to determine current and future rainfall scenarios, but that approach has limitations. "The GCM is designed to simulate the general climate rather than a particular weather event, especially an extreme one, but it has been wrongly used to estimate the probability of future extreme events," says Dr. Guo Yu, the principal investigator of the project. "This approach also provides a limited understanding of future extreme events." Using a storyline approach, researchers can show the causes of extreme events and the effects of those events, and use data from historical events for more accurate future climate projections under climate change. "Unlike other

This Issue

If you have questions about submitting a NWRRI proposal, email Suzanne Hudson at Suzanne.Hudson@dri.edu. Visit the NWRRI website at www.dri.edu/nwrri for current RFP information.

The extreme flooding that occurred in January 1997 inundated the Reno area, causing severe damage (photo by Michael J. Nevins/ U.S. Army Corps of Engineers Sacramento District Website).

climate change projections, storyline approaches provide descriptive 'stories' of a plausible future extreme event based on what has occurred historically," Yu adds. "These stories provide a more physically consistent representation of what a future extreme weather event might look like rather than simply emphasizing the likelihood that the event will occur." In a previous study, Yu has used a storyline approach to determine the factors that generate flooding in the Las Vegas wash watershed and analyze how those factors affect future flood characteristics (Yu et al., 2023).

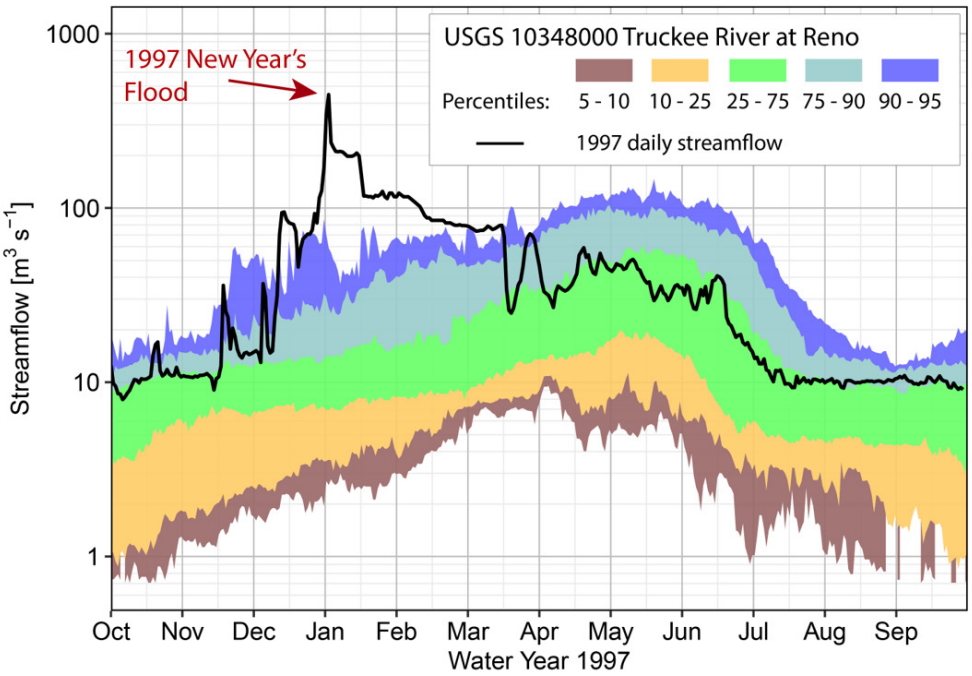
The objectives of this project are to determine the physical factors that resulted in the 1997 New Year's flood, and then use a storyline approach to simulate how climate change will affect those factors and what a similar extreme flood could look like 100 years later. Yu picked the 1997 New Year's flood for this study because it is so memorable and because there is enough data to conduct a thorough study. In his assessments so far, Yu has found that strong atmospheric rivers, high rain-on-snow runoff, and warm temperatures caused rapid snowmelt that led to the catastrophic flooding. Atmospheric rivers, which are long corridors in the atmosphere that transport water vapor, produce heavy precipitation in western Nevada and their frequency and severity are expected to increase under climate change (e.g., Galewsky and Sobel, 2005; Leung and Qian, 2009; Dettinger, 2011; and Payne and Magnusdottir, 2015). These conditions combined with growing populations and aging infrastructure could make communities in western Nevada more vulnerable flooding (Reidmiller et al., 2018).

Another benefit of a storyline approach is that it can provide a better understanding of the effects of climate change on future floods and by extension, the risks a potential extreme event could pose to communities. "Instead of presenting percentages of future flood magnitudes, we could show the potential impacts of the 1997 New Year's flood if it occurred 100 years

Project Spotlight Continued

later using storyline simulations," Yu explains. "This is not only a more compelling way to communicate the data to the public, but also stakeholders such as the Truckee River Flood Management Authority will have a better understanding of the vulnerabilities of the community to an event similar to the 1997 New Year's flood in a realistic, future climate setting."

Another key component of the project will be to develop an ArcGIS StoryMap to present the findings. ArcGIS StoryMaps allow researchers to present scientific results using a combination of text, interactive maps, and multimedia content. This is both an effective way to present the results and a unique opportunity to train the next generation of water scientist. "I will be hiring an undergraduate student to take the lead on creating the ArcGIS StoryMap and guide them through the process of completing this task," Yu says. "This will give the student a unique opportunity to learn GIS technologies and gain experience in data visualization. These skills will benefit them going forward in their studies and future career." Once the project is complete, he also plans to submit a manuscript to the *Journal of Hydrologic Engineering*.



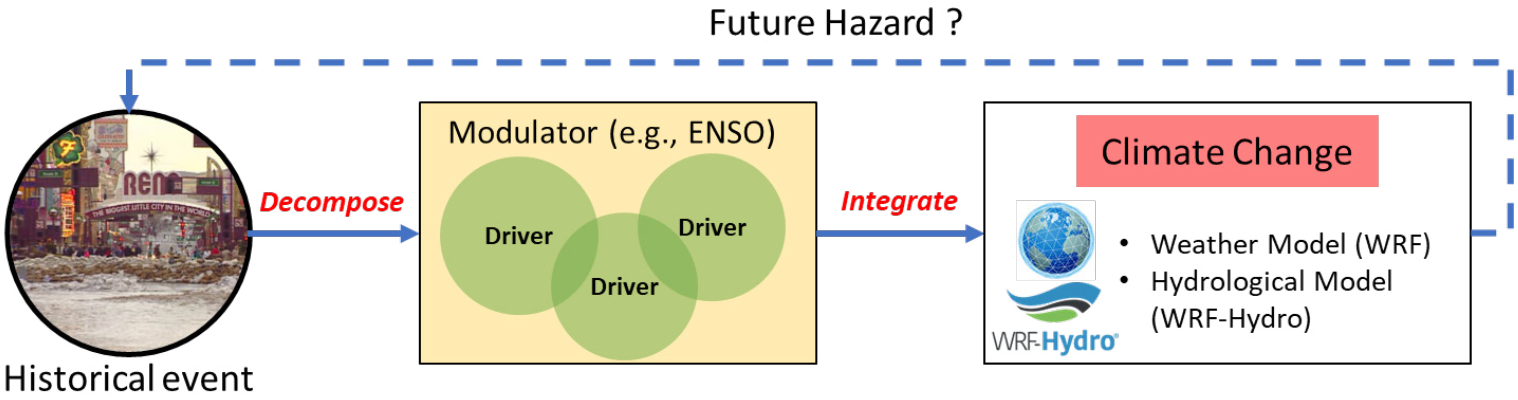
Top: A sign showing the high-water mark for the 1997 New Year's flood along the Truckee River near Wingfield Park in Reno (photo credit: City of Reno). Bottom: Daily streamflow for the Truckee River at Reno (USGS: 10348000) for water year 2017, as well as climatological streamflow percentiles based on the 1907–2022 period (graph courtesy of Guo Yu).

Continued on page 4

"Unlike other climate change projections, storyline approaches provide descriptive 'stories' of a plausible future extreme event based on what has occurred historically. These stories provide a more physically consistent representation of what a future extreme weather event might look like rather than simply emphasizing the likelihood that the event will occur."

—GUO YU

Project Spotlight Continued



A conceptual schematic showing the event-based storyline approach used in the project, which attributes historical extreme weather events to physical drivers and incorporates the effects of climate change to simulate the potential impacts of those changes on future extreme events (figure courtesy of Guo Yu).

One of the interesting things that Yu has discovered so far in his research is the connection between his project and another ongoing DRI project, ARkStorm@SierraFront 2.0, led by Drs. Maureen McCarthey and Chrisine Albano (www.dri.edu/project/arkstormsierrafront-2-0). "Their group is investigating a series of prospective future atmospheric storms that could hit the western coastline of the United States over approximately one month," he says. "Although Dr. Albano isn't directly working on this project, we regularly discuss our research and I get great suggestions from her. Additionally, there are certain skills that I've developed from this project that could also help them with some tasks related to their project."

References

Dettinger, M., 2011. Climate Change, Atmospheric Rivers, and Floods in California – A Multimodel Analysis of Storm Frequency and Magnitude Changes1. *Journal of the American Water Resources Association*, 47(3), 514–523.

Galewsky, J., and A. Sobel, 2005. Moist dynamics and orographic precipitation in northern and central California during the New Year's flood of 1997. *Monthly Weather Review*, 133(6), 1594–1612.

Hess, G.W., and R.P. Williams, 1997. *Flood of January 1997 in Truckee River Basin, Western Nevada*. U.S. Geological Survey.

Leung, L.R., and Y. Qian, 2009. Atmospheric rivers induced heavy precipitation and flooding in the western US simulated by the WRF regional climate model. *Geophysical Research Letters*, 36(3).

Payne, A.E., and G. Magnusdottir, 2015. An evaluation of atmospheric rivers over the North Pacific in CMIP5 and their response to warming under RCP 8.5. *Journal of Geophysical Research: Atmospheres*, 120(21), 11,173-11,190.

Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M Lewis, T.K. Maycock, and B.C. Stewart, 2018. Fourth national climate assessment. *Volume II: Impacts, Risks, and Adaptation in the United States*, 440.

Yu, G., J.J. Miller, B.J. Hatchett, M. Berli, D.B. Wright, C. McDougall, and Z. Zhu, 2023. The Nonstationary Flood Hydrology of an Urbanizing Arid Watershed. *Journal of Hydrometeorology*, 24(1), 87–104.

Aerial view of downtown Reno.

NWRRI Undergrad Internship Interview: Adonis Gonzalez

Adonis Gonzalez participated in the NWRRI Undergraduate Internship Immersion Program in the spring of 2023. He worked on the project "Novel Adsorptive Materials for Water Treatment" and was mentored by Dr. Erick Bandala of DRI. The focus of the project was to evaluate the adsorptive capabilities of novel materials and assess their potential use in water treatment processes. We asked Adonis about his experience during the internship, current research, and plans for the future. Here's what he had to say:

1) What are you currently studying and how did you find out about the internship?

I'm currently studying Environmental Resource Science and Biology at Nevada State University (NSU) and I found out about the internship from a newsletter provided by staff at the university.

2) The project you worked on was "Novel Adsorptive Materials for Water Treatment." What did this project entail and in what ways did you participate?

Adsorption is a technique used in water treatment to remove impurities. Because of the adsorbent material's large surface area, contaminants can adhere to it and be drawn out of the water. Particles or granules are the typical forms of adsorbent materials. The project I worked on involved observing and evaluating the capability of a variety of materials to adsorb particular contaminants to determine their percentage of contaminant removal within a water resource.

3) What did you learn about using novel adsorptive materials during water treatment processes? In what ways might these materials help with water resources management?

Adsorbent materials act sort of like sponges in that they attract and hold on to contaminants, removing them from a water source. They are used to improve drinking water quality by taking out things such as chemicals and bad smells. These materials also help treat contaminated water from factories before it goes back into the environment. If groundwater is contaminated, these materials can clean it up by grabbing onto bad stuff such as metals and pollutants. When we use them in home filters, they make sure the water we drink is safe by catching things such as lead and germs. Using these special materials is important for keeping our water clean and safe for everyone.

4) What did you learn from your experience on the project? Was there anything you found particularly interesting or surprising?

My internship experience taught me that doing research is what I want to do. Working with so many incredible mentors confirmed my love of science and my desire to pursue graduate studies in hydrology to further my career. In addition, I really enjoyed

Photo by Adonis Gonzalez

using the Hach machine, as well as earning my mentor's trust to perform experiments without direct supervision.

5) Did participating in this internship give you any ideas for your future studies that you may not have thought about otherwise?

Participating in the internship confirmed my primary goal of becoming a hydrologist because prior to this experience, I wasn't sure I wanted to be one.

6) What are your goals for the next steps in your studies and what career direction are you pursuing?

My current goals are to complete my GRE, finish my degree, and find a graduate program.

"My internship experience taught me that doing research is what I want to do. Working with so many incredible mentors confirmed my love of science and my desire to pursue graduate studies in hydrology to further my career."

—ADONIS GONZALEZ

Dr. Sean McKenna

Matt Bromley

NWRRI Program Announcements

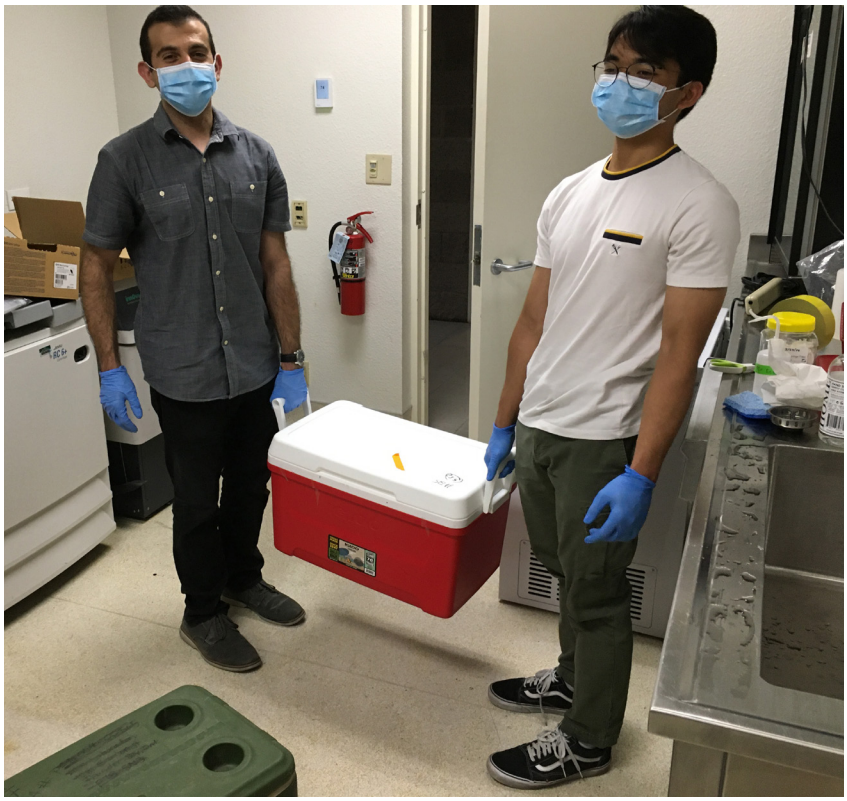
We are excited to announce Dr. Sean McKenna, Executive Director of DHS at DRI, will be serving as the new director of the NWRRI program. We are also delighted to welcome our new deputy director, Matt Bromley. Mr. Bromley is an environmental scientist at DRI and he will be assisting Dr. McKenna with his responsibilities. We want to thank our past director, Chuck Russell, for his dedication and the growth the program experienced under his directorship. The goals of NWRRI are to develop the water sciences knowledge and expertise that support Nevada's water needs, encourage our nation to manage water more responsibly, and train the next generation of water resources professionals. We know that the expertise of our new directors will continue to support these goals.

NWRRI Publications

Data collected during the NWRRI-funded SARS-CoV-2 wastewater monitoring project has led to a further study of the benefits of environmental surveillance for understanding the prevalence of infectious disease and community health. By testing for SARS-CoV-2 in flood control channels known to be impacted by unhoused populations, the team was able to demonstrate that this type of monitoring may be an effective tool for understanding public health conditions in vulnerable populations who are underrepresented in clinical surveillance data. You can read the paper in *Environmental Science & Technology Letters*:

Harrington, A., V. Vo, M.A. Moshi, C.-L. Chang, H. Baker, N. Ghani, J.Y. Itorralba, K. Papp, D. Gerrity, D. Moser, and E.C. Oh, 2024. Environmental Surveillance of Flood Control Infrastructure Impacted by Unsheltered Individuals Leads to the Detection of SARS-CoV-2 and Novel Mutations in the Spike Gene. *Environmental Science & Technology Letters*, doi.org/10.1021/acs.estlett.3c00938.

You can read more about the original NWRRI project in the spring 2023 issue of *Nevada Water News*.



UNLV students (left) Michael Moshi and (right) Jose Yani Itorralba picking up the weekly sample submission from DRI prior to processing and analysis at UNLV (photo courtesy of Duane Moser).

EVENTS

Please keep an eye on the event websites for changes in conference schedules.

Water Rights in Nevada Class
June 12, 2024
Reno, NV
www.nvwra.org/2024-june-water-rights-class

Advanced Water Rights in Nevada Class
June 13, 2024
Reno, NV
www.nvwra.org/2024-june-advanced-water-rights-class

Advanced Borehole Geophysics Workshop
June 12–13, 2024
Reno, NV
www.nvwra.org/advanced-borehole-geophysical-logging-workshop

SSSA Summer Conference
June 10–12, 2024
San Juan, Puerto Rico
www.sacmeetings.org

Addressing the Risks of Viruses in Managed Aquifer Recharge Webinar
June 20, 2024
www.ngwa.org/detail/event/2024/06/20/default-calendar/24jun20web

AGU WaterSciCon
June 24–27, 2024
St. Paul, MN
www.agu.org/waterscicon

2024 Sustainable Agronomy Conference (Virtual)
July 10, 17, 24, and 31, 2024
www.agronomy.org/meetings/sustainable-agronomy

2024 Floodplain Management Association Annual Conference
September 3–6, 2024
Las Vegas, NV
floodplain.org/page/AnnualConference

Tour of the Marlette Water System
September 11, 2024
Carson City, NV
www.nvwra.org/2024-marlette-lake-tour

GSA Connects 2024
September 22–25, 2024
Anaheim, CA
community.geosociety.org/gsa2024/home

Meeting the Challenges of Groundwater in Fractured Rock
September 23–24, 2024; Burlington, VT
www.ngwa.org/detail/event/2024/09/23/default-calendar/24sep5017

AWRA, UCOWR, NIWR 60th Anniversary Joint Water Resources Conference
September 30–October 2, 2024
St. Louis, MO
www.awra.org/Members/Events_and_Education/Events/2024-Joint-Conference/2024_Joint_Conference.aspx

Spring Mountain wildflowers. Photo by DRI Science.

Events
CONTINUED

2024 ASA, CSSA, SSSA International Annual Meeting
November 10–13, 2024
San Antonio, TX
www.acsmeetings.org

AGU24
December 9–13, 2024
Washington D.C.
www.agu.org/annual-meeting

Spring flowers in northeastern Nevada. Photo by Shanell Owen/BLM Nevada.

Success and dedication to quality research have established DHS at DRI as the Nevada Water Resources Research Institute (NWRRI) under the Water Resources Research Act of 1984 (as amended). The continuing goals of NWRRI are to develop the water sciences knowledge and expertise that support Nevada's water needs, encourage our nation to manage water more responsibly, and train students to become productive professionals. The work conducted through the NWRRI program is funded through the National Institutes for Water Resources (NIWR), which is supported by the U.S. Geological Survey under Grant/Cooperative Agreement No. G21AP10578. DRI administratively houses and logistically supports the operations of NWRRI.

CONTACTS

Dr. Sean McKenna
Director
Sean.McKenna@dri.edu
775.673.7305

Matt Bromley
Deputy Director
Matt.Bromley@dri.edu
775.673.7683

Suzanne Hudson
Program Administrator
Suzanne.Hudson@dri.edu
702.862.5464

Nicole Damon
Communications/Information Transfer
Nicole.Damon@dri.edu
702.862.5531