When Will New Mexico Run Out Of Water?

New Mexico

Supercomputing Challenge

Final Report

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Executive Summary:

New Mexico's high-desert climate, characterized by low precipitation, declining snowpack, and prolonged drought since 2000, is placing severe and increasing pressure on water resources, particularly the Rio Grande. Rising temperatures, reduced rainfall, and growing water demand from agriculture, municipalities, and industry have contributed to recurring river drying events and declining reservoir levels. Irrigation alone accounts for 87% of water use, while additional pressures from urban growth and interstate water obligations further strain limited supplies. As a result, the long-term sustainability of water in New Mexico is at significant risk. To address limitations in existing hydrological models, this project developed an autoregressive Monte Carlo simulation to improve predictions of river flow and drying events under varying climatic and water use conditions. The model, trained on historical data from 1991 to 2020, demonstrated strong predictive accuracy, successfully replicating the 2022 dry event. Simulations were conducted under three scenarios: worsening, stable, and improving climate conditions. Each run is 6,000 times to estimate the probabilities of river flow outcomes. Results indicate a critical trajectory. Under worsening and stable conditions, river flow declines over time, and the probability of the Rio Grande running dry increases rapidly, reaching near certainty within the next decade. Even under improving conditions, flow remains significantly below historical averages and frequently approaches critically low levels. Seasonal analysis shows earlier and longer dry periods, particularly in the late-summer months. At the same time, long-term projections indicate that the river fails to maintain a consistent flow in most scenarios. The study also evaluated three mitigation strategies: invasive plant removal with xeriscaping, conversion to drip irrigation, and replacing concrete channels with earthen canals. While each strategy independently improves river flow, the combined implementation of all three produces the most significant and statistically meaningful improvements across all climate scenarios. However, these benefits are gradual and do not prevent near-term drying, particularly in the next few years. Overall, the findings highlight an urgent need for immediate and large-scale intervention. Without coordinated action, the Rio Grande is projected to experience persistent and eventually irreversible drying over the next two decades. Although mitigation strategies can reduce long-term risk, they must be implemented broadly and consistently. They may need to be supplemented with additional measures, such as changes to agriculture and water policies.

Introduction

For anyone who lives in the southwest, it will come as no surprise that New Mexico is classified as a desert. New Mexico's high altitude, low rainfall, and landlocked location contribute to this designation, and it is worth noting that New Mexico is further classified as a "high desert" due to the elevation (Economic Development Department, 2026). It has three main topographic zones: the Basin and Range (western edge of the Great Plains), the Rocky Mountains, and the Colorado Plateau. These three topographic areas include seven distinct life zones, each characterized by its own endemic flora and fauna. Climatically, New Mexico has been experiencing long-term drought since 2000 due to rising global temperatures, reduced precipitation, smaller snowpacks, and increasingly extreme weather events (Cook, et. al., 2021). These events have been exacerbated by increasing water use, not only by municipalities, but also by industrial uses. In the fiscal year 2023, Los Alamos National Labs used around 300 million gallons of water (Cody, et. al., 2024), with a quarter of that being used to cool its data centers. Recent years have also seen the development and subsequent expansion of a Facebook/Meta data center in Los Lunas. The above trends have a dramatic impact on the Rio Grande. Over the last 3 years, the Rio Grande has dried up 4 times (Tashjian, 2025), most often in the 10-mile stretch in Albuquerque and the 40-mile stretch in San Acacia/Socorro. This impacts surrounding ecosystems and permanently alters the riverbed through aggradation. Aggradation occurs when sediment builds up on the river path, raising it and leading to more frequent floods. Further, a dry riverbed increases wildfire risk. The Rio Grande River isn't the only New Mexico body of water that's threatened; in 2013, Elephant Butte Lake reached its lowest recorded level at just 3% of its full capacity (NASA, 2023). While Elephant Butte draws its water from the Rio Grande, other water sources in New Mexico are experiencing the same trends.

The Rio Grande River is used for a variety of purposes. While water is frequently thought of as renewable through the hydrologic cycle, in arid areas, water use increasingly depletes finite water supplies. The single largest water consumer in New Mexico is irrigation for farms and ranches, comprising 87% of use. The Rio Grande is also a critical water source for urban areas, including the Santa Fe Aquifer, which supplies most of Albuquerque's drinking water (ABCWUA, 2025). While New Mexico's overall population is declining, urban areas have seen population increases. Albuquerque, for example, has seen a 40% increase in population but has implemented water conservation measures, successfully cutting its water use by 17% (Richter, 2025). These strategies, however, are employed at the individual or household level and include behaviors like watering early or late in the day, not washing cars, etc., and are significantly less likely to improve overall river health dramatically. The Rio Grande also plays a major role in the ecology of the bosque, supporting plants and animals that aren't found anywhere else in the world, both terrestrial and aquatic. Lastly, the Rio Grande is under pressure from other states and countries, including Texas and Mexico, as all three are part of the 1944 Water Treaty. In that treaty, Mexico is supposed to release 1.75 million acre-feet of water to the Rio Grande River. In contrast, the U.S., in return, releases 1.5 million acre-feet of water from the Colorado River to Mexico (USDA, accessed 2026).

The Rio Grande is replenished in several ways. Snowmelt runoff from Colorado and Northern New Mexico is an important contributor. Over the last 3 decades, snowmelt runoff has decreased by 17% in the Rio Grande Basin. As of March 9th, 2026, Colorado has received record-low snowfall, with only 52% of the median amount present (University of Denver, 2026). Not only is snowpack at an all time low from 2020 to the present, but only 2022 has experienced near normal monsoonal rainfall, with all other years drier than average (National

Weather Service, accessed 2026). This implies that water that would normally be replenished during a normal year is not, and already limited water supplies become increasingly depleted.

When all of these trends are considered in tandem, the long-term sustainability of water in New Mexico is bleak. In the past month alone, multiple news sources have reported on the extremely low water levels in the Rio Grande (krwg.com 2026, USDA.gov 2026, kob.com 2026). This raises the question that inspired our project: when will New Mexico run out of water? Unfortunately, things don't look good. The answer to this question may be soon, very soon.

Methods

Hydrological models have been used for decades to predict the effects of rainfall, snowmelt, and other ecological factors on our water table in New Mexico (Dunbar et al., 2022). These hydrological models perform well at predicting water levels, river flows, and related factors, but often fall short in assessing how worsening climate change and increasing water use will specifically affect the Rio Grande and how we can manage it. Current models are overly localized and rely on historical weather data and water-use data to predict water levels in the Rio Grande Valley and its connected rivers (Abraham et al., 2024). "Use less water" has been a common response to repeated concerns, and even when followed, it doesn't give the desired result. Existing models often struggle to identify which factors significantly affect the river, and it is difficult to predict with certainty when the river will run dry. Our state needs detailed data to create an effective plan for future water management.

Existing models of the impact of precipitation on water flow use variables such as hydraulic travel times, seepage, reservoir evaporation, and deep percolation losses to predict downstream water levels (URGWOM Summary, 2025). All of these factors help make an accurate representation of New Mexico's waterways. While URGWOM (Upper Rio Grande Water Operations Model, Hanson et al., 2019) is not a water supply model, it can offer valuable insight into what is needed to measure and predict water supply. The primary function of URGWOM is to track river levels, which is known as water accounting. This aids in identifying the most efficient responses to water demands and in creating an accurate representation of the river. Still, rapid urbanization and intensifying climate change have introduced new challenges. URGWOM's detailed, automatic updates ensure that water is allocated to eligible users at the correct times.

Our project seeks to add a critical component to existing hydrological models - the effects of adopting a small number of statewide mitigation measures with fidelity to improve the long-term sustainability of water resources in New Mexico. As such, our model, once validated with historical data, aims to use Python simulations to assess which of three pre-specified mitigation strategies has the greatest impact on river flow in the Rio Grande.

Simulation Plan

We built our river model in Python, using an Autoregressive Monte Carlo simulation. The AR component captures seasonal patterns and persistence in river flow from historical data, while the Monte Carlo simulation introduces variability through random runs. This allows us to estimate the probability of outcomes, rather than relying on a single prediction. The model was trained on data from 1991 to 2020, using statistics from multiple USGS water gauges in Albuquerque and one in Otowi, Santa Fe County. We began with a validation and verification process, using data from a single gauge, USGS Gauge 08330000 in Albuquerque, because the simulation scale and time horizon reduced the amount of data needed. Drought severity and river flow percentage were determined using the NM PDSI, based on data from 1895 to 2020, to indicate how often and how severe drought conditions are met in the model. To validate the model, we compared its outputs to historical data and tested whether it reproduced known dry events. The updated model successfully reproduced the 2022 dry event 98% of the time.

Our model aims to predict river flow, specifically focusing on when the river is likely to run dry. We use multiple input and output variables. Input variables include precipitation (rainfall, monsoonal, and other), snowmelt, reservoir releases, tributary rivers, and urban runoff. Precipitation was allowed to vary between 10 and 40 inches; 1 acre-inch per hour of rain is equivalent to roughly 1 CFS of flow added to the river. With heavy rainfall, localized flash flooding may occur in arroyos draining to the river, and there is also an increase in silt washed into the watershed. Precipitation is set in each simulation by the AR trained on 1991-2020 USGS Gauge Data and drawn as a random monthly value. Precipitation is also adjusted for the current drought conditions, based on the NM PDSI data from 1895 to 2020.

Additionally, precipitation in our model varied with the seasonal cycle of the monsoon. Snowpack was allowed to vary between 14 and 18 inches, which represents the average snowpack in the

San Juan Mountains, where most of the snow melt water originates. Snowpack is set in each simulation to match precipitation and is also affected by drought conditions. The model also accounted for water output, including evaporation, aquifer/groundwater recharge, agricultural water use, municipal water use, irrigation structures, and cross-state/country water allocation. As the agricultural withdrawals are the single largest water user, the EWLP was allowed to vary between 15 and 200% of the 75.6 CFS per day baseline and is set for each simulation by the scenarios affecting the start value and trend, and is then applied across months using average water use. We ran our model with 3 different climatic scenarios, each with 6000 simulations: improving, stable, and worsening. Improving conditions were defined as having lower temperatures, greater precipitation and snowpack, and higher conservation efficiency. Worsening conditions included higher temperatures, causing lower precipitation and snowpack, higher water demands, and lower conservation efforts. Stable conditions, where temperature and precipitation levels are similar to those in the data trained from the USGS from 1991 to 2020

In our first iteration of the model, all variables (rainfall, temperature, snowmelt, and water use) directly influenced river flow in a single step. This approach was overly simplified and did not reflect how these factors interact in real-world systems. While this initial model showed some promise, our second iteration allowed our ecological variables to first interact through climate processes and water demand systems before affecting river flow. Natural river flow was generated through the AR model, then modified by climatic conditions and variability. At a second level, water consumption needs (such as agricultural withdrawals) and conservation strategies were applied, which then generated our predicted river flow. This layered structure more accurately represents real-world dynamics, in which climate, water use, and policy decisions interact to determine river conditions. These revisions improved the model's realism and reliability.

With this second iteration of our model, we then ran simulations utilizing various mitigation strategies. Specifically, we addressed three mitigation strategies: invasive plant removal and xeriscaping, particularly as applied to bosque habitats bordering riverways; drip irrigation, transitioning farmers away from traditional acequia/ditch flooding of agricultural fields bordering riverways; and transitioning concrete arroyos back to earthen canals. Additionally, we allowed for all three mitigation methods to be applied. These mitigation methods were chosen due to their documented benefits related to water use. Invasive plant removal, particularly of phreatophytes (deep-rooted plants that draw water from the water table) like tamarisk or salt cedar, can return water to the water table, as these invasive species can have up to 189% higher sap flow rates as compared to native dominated systems (Hernandez, 2022). Given our previous work focused on coupling native planting with mycorrhizal fungal inoculations, this mitigation strategy should utilize fungal inoculations to support native populations. The reasoning behind shifting acequias towards drip irrigation is mixed. While acequias have a long history in New Mexico, and offer a way to temporarily recharge shallow aquifers for underground storage, allowing for later release back into the river (“Empowering High Desert Communities Built for Change”, 2018). While this is true in normal climatic conditions, the benefit of drip irrigation truly comes into play when water becomes increasingly scarce, improving watering efficiency from roughly 50% to 90-95%. As such, there is some benefit to considering the water savings of this switch. Lastly, while concrete lined arroyos help to prevent seepage and more efficiently deliver water from the mountains down to the river, shifting to earth canals offers benefits in terms of replenishing underground aquifers as well as helping to filter pollutants out of the water ("Empowering High Desert Communities Built for Change", 2018).

Statistical Analysis

Our results were analyzed utilizing SPSS available from IBM. SPSS is a user-friendly software platform for analyzing complex data and is widely used in a variety of subject areas. The benefit of SPSS for students who are relatively new to statistical analysis is that it offers a point-and-click interface and does not require detailed knowledge of the calculations that underpin these analyses. For our project, we utilized two features - means comparisons through analysis of variance (ANOVA), and regression analyses (linear and non-linear). ANOVA examines variation both between and within groups to determine whether there are significant differences in group means. In our project, with our baseline model, we utilized ANOVA to compare across the three scenarios - worsening, stable, and improving climatic conditions. Using our predictive simulations, we compared mitigation strategies across climatic scenarios. Regression analysis allows you to predict variation in your dependent variable as you vary one or more independent variables. While linear regression forces a line of best fit to the data, non-parametric regression allows for various curvilinear relationships as well. We have used both ANOVA and regression in our past projects.

Results

Our results demonstrate the critical importance of addressing water use patterns immediately.

To begin, we utilized our baseline model to generate predictions of future river levels before introducing mitigation strategies. Table 1 below shows the results of our verification and validation process. We used historical data from 1991 to 2020 and then tested our model's ability to predict the 2022 dry episode. As the table shows, the model is very successful at predicting river drying, accounting for 94.26% of the variance.

Verification and Validation		
Training Data	1991-2020	360 months
R-square	0.9426	
Significance	p<0.001	

Table 1. The verification and validation process, utilizing our model to predict the 2022 dry episode.

Table 2 below summarizes the overall trends across our baseline model, specifically comparing the three climatic scenarios: worsening, stable, and improving. As the table shows, in worsening scenarios, river flow, measured in cubic feet per second, and precipitation decrease. In stable scenarios, river flow increases slightly while precipitation decreases. In improving scenarios, river flow increases and precipitation decreases, with a value very close to zero. Lastly, while the minimum stage depth is similar across all scenarios, the average and maximum depths are lower in worsening scenarios and higher in improving scenarios.

Simulation Summaries n = 6000					
Condition	**Cubic Feet per Second**	**Precipitation Trends (%)**	**Stage Minimum (ft)**	**Stage Average (ft)**	**Stage Maximum (ft)**

	Trend				
Worsening	-1.588	-2.4	3.00	3.04	3.73
Stable	0.2	-2	3.00	3.06	3.85
Improving	1.134	-0.5	3.01	3.14	3.93

Table 2. Summary information from 6000 simulations of our baseline model. River flow declines in worsening scenarios, precipitation decreases in all three conditions, and average and maximum stage depths are highest in improving scenarios.

Table 3 summarizes the probability of the Rio Grande running dry in Albuquerque over the next 10 years. In both worsening and stable climatic conditions, the risk of the river running dry each year increases dramatically. Our model shows that once the risk begins to rise, the inevitability of continued drying in subsequent years becomes clear.

Probability of Running Dry Per Year											
Year	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**
Worsening	29.9	34.4	38.7	56.7	85	98	100	100	100	100	100
Stable	12.8	19.8	27.1	34	45.1	70.5	93.4	99.5	100	100	100
Improving	10.7	13.8	16.1	17.9	21.5	24	28.7	33.8	41.5	47.8	61

Table 3. The probability that the river will run dry over the next 10 years. Once the risk of drying increases, the river becomes more likely to run dry in subsequent years.

When we view river flow level across the months of the year, we notice a few trends. May is traditionally the highest-flow month, with an historical average of 1406 CFS. In narrow rivers, 100 CFS can support a steady flow, but in a river as wide as the Rio Grande, flows below 100 CFS are considered critically low and can cause dry banks and stagnant water; in some cases, the flow stops completely. In recent years, the river has ranged from 300 to 1000 CFS depending on monsoons and snowmelt. Figure 1 depicts the monthly flow in worsening conditions. As the graph shows, the predicted flow in May averages around 515 CFS at the 90th percentile and 72 CFS at the 75th percentiles. Water levels then drop in July, and in the 75th percentile and below, the river runs completely dry from July to September. When water does return, as occurs when the monsoons begin,it’s far below normal. In the 50th percentile and below, the river runs dry far sooner, and does not recover when monsoons set in.

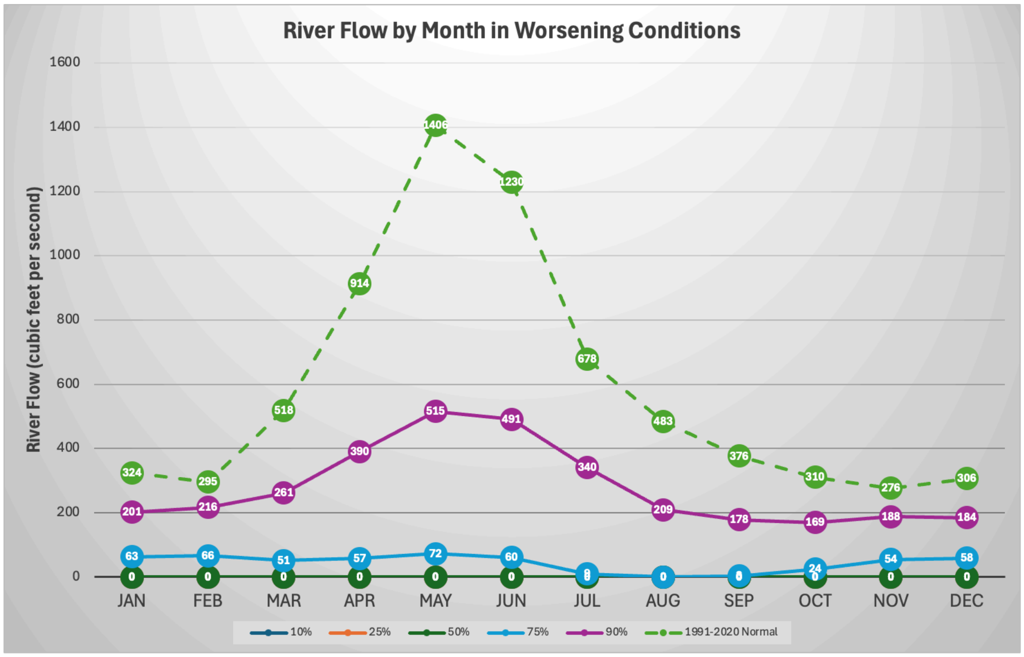

Figure 1. Rivers flow across months of the year. The green line represents the historical average, the purple line at the 90th percentile, and the blue line at the 75th percentile. At the 50th percentile and below, the river runs dry sooner, and that pattern persists.

Figure 2 below shows the same information, but for stable conditions. While the river maintains flow year-round in the 90th and 75th percentiles, it consistently runs dry in the 10th, 25th, and 50th percentiles.

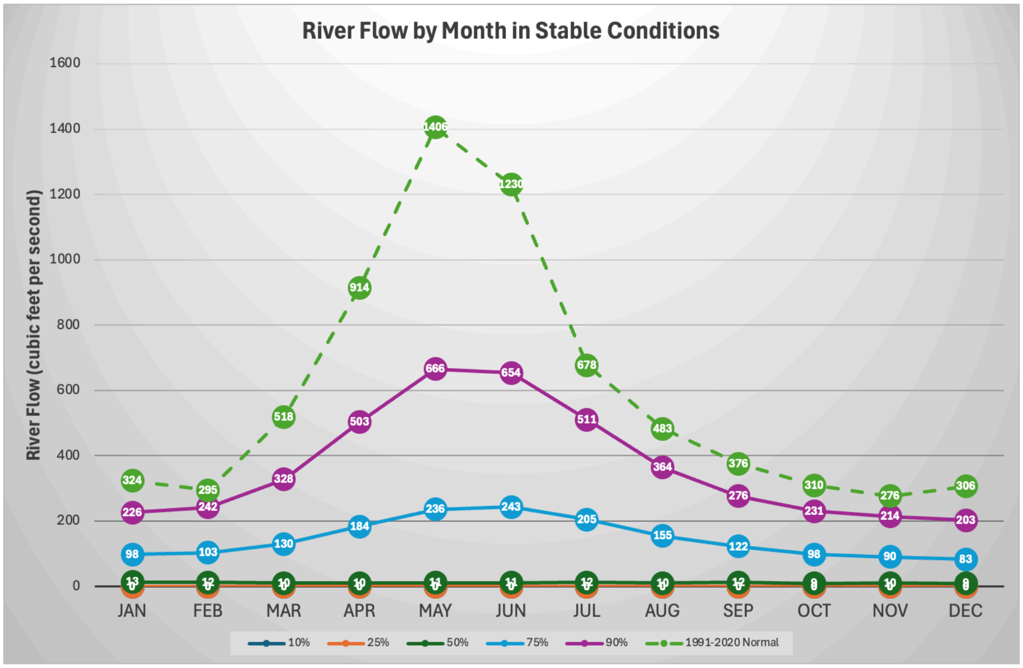

Figure 2. The river flows throughout the year. The green line represents the historical average, the purple line at the 90th percentile, and the blue line at the 75th percentile. At the 50th percentile and below, the river runs dry sooner, and that pattern persists.

Figure 3 below depicts the same information under improved conditions. Here, the river does not run completely dry, but the 25th and 10th percentiles are consistently below 100 CFS, which is critically low flow, especially for the Rio Grande. Only in the 90th percentile does water return to normal levels, shown by crossing the historical green line, but only during the drier months, August to February. In high-flow months, the river still falls below historical averages.

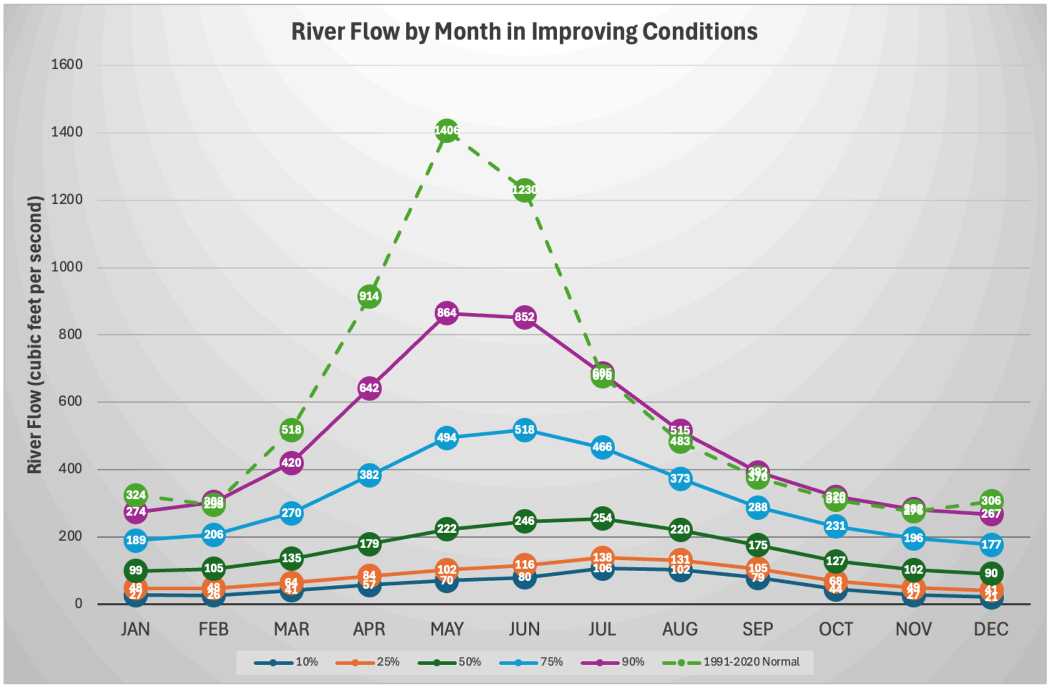

Figure 3. The river flows throughout the year. The green line represents the historical average, the purple line at the 90th percentile, and the blue line at the 75th percentile. At the 50th percentile and below, the river runs dry sooner, and that pattern persists.

Next, we used our model to predict the river flow annually over the next two decades. Figure 4, below, depicts these predictions. Critically, across all simulations of worsening and stable scenarios, the river completely dries up within the next 10 years. While these predictions are aggregated across the entire year, in contrast to the monthly flow in figures 1-3, there are no simulations that avoid this fate. Only with improving climatic conditions do we see the Rio Grande still have water; even in these best-case scenarios, river flow declines.

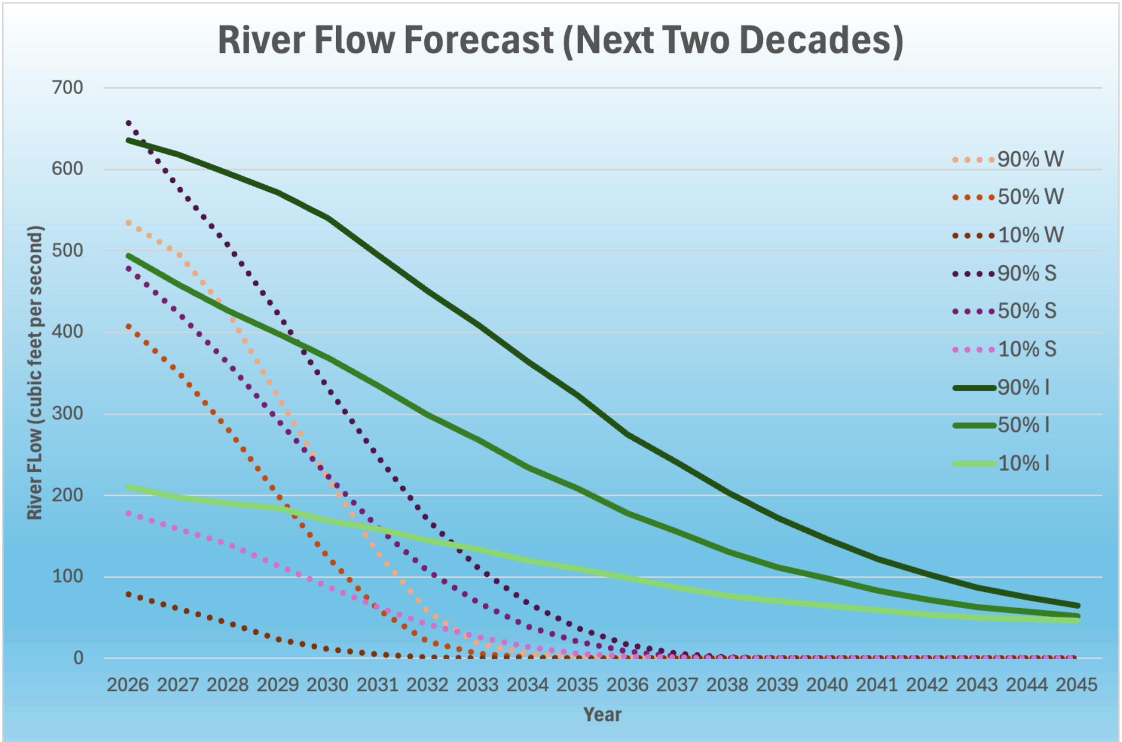

Figure 4. River flow forecast over the next two decades. The lines in shades of brown are under worsening conditions, purple are stable, and greens are improving. Critically, the river maintains flow only under improving climatic conditions, a scenario that is increasingly unlikely under climate change.

The final phase of our project looked at the effects of three mitigation strategies on river flow over the next decade. Figures 5, 6, and 7 below show the percent likelihood of the river running dry in 2026, 2030, and 2036, respectively, for each mitigation strategy implemented independently and for all three combined. It is clear from these data that there is an exceedingly high risk of the Rio Grande running dry this summer, even if we implemented these mitigation measures tomorrow. These strategies are long game strategies - the net positive effects will become stronger over the years, rather than months. As we predict further in the future, these mitigation measures positively impact the river even under worsening conditions.

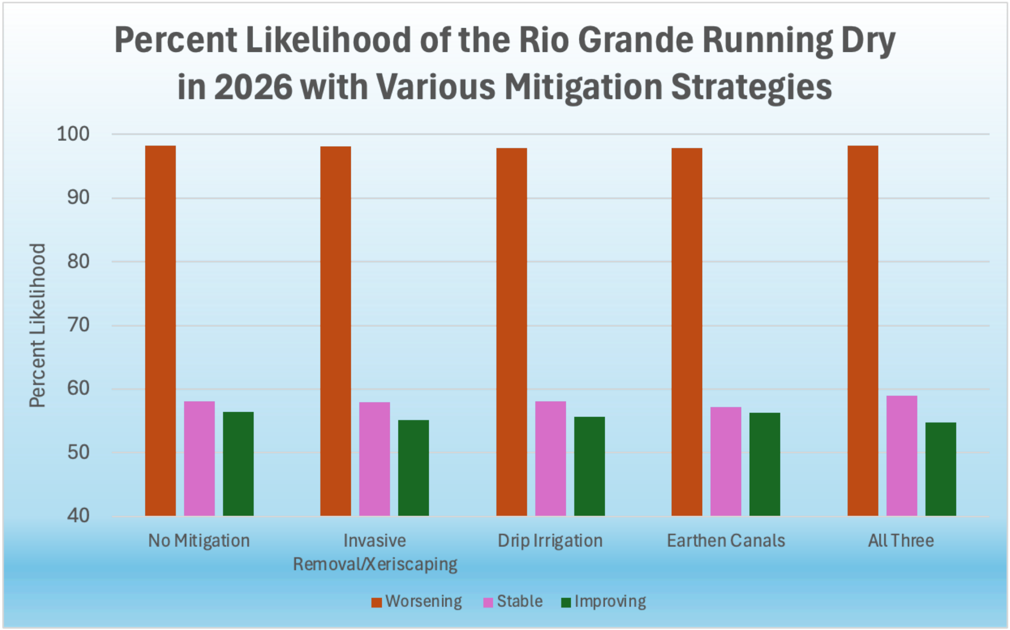

Figure 5. The percent likelihood of the Rio Grande running dry in 2026 with various mitigation strategies. Even if we were to implement large scale strategies tomorrow, the benefits will not be felt for some time.

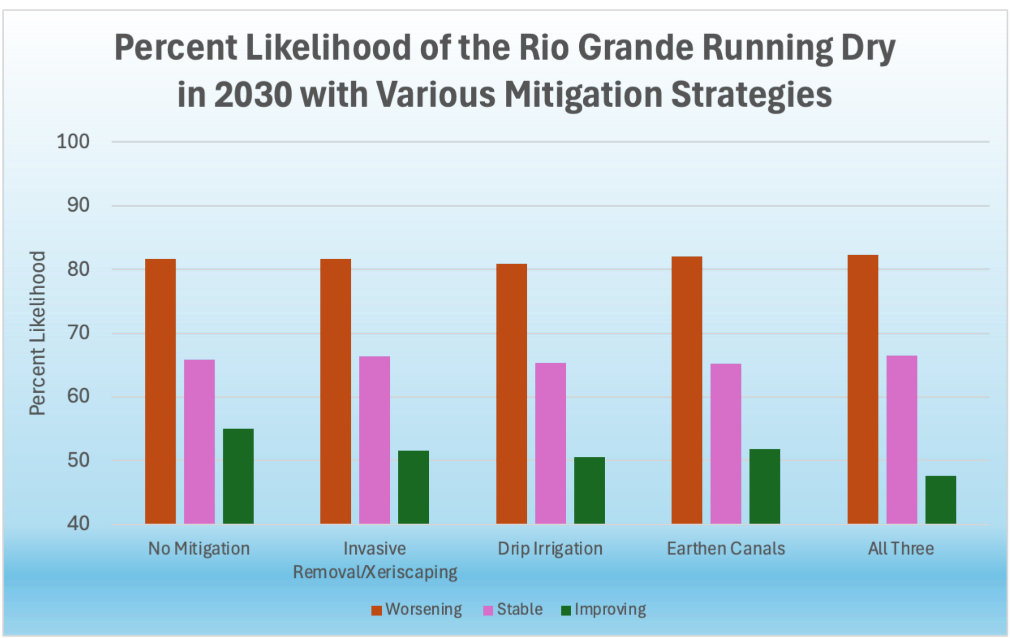

Figure 6. The percent likelihood of the Rio Grande running dry in 2030 with various mitigation strategies. While the effectiveness of large scale mitigation strategies will start to be felt, there is still a high likelihood of drying under worsening conditions.

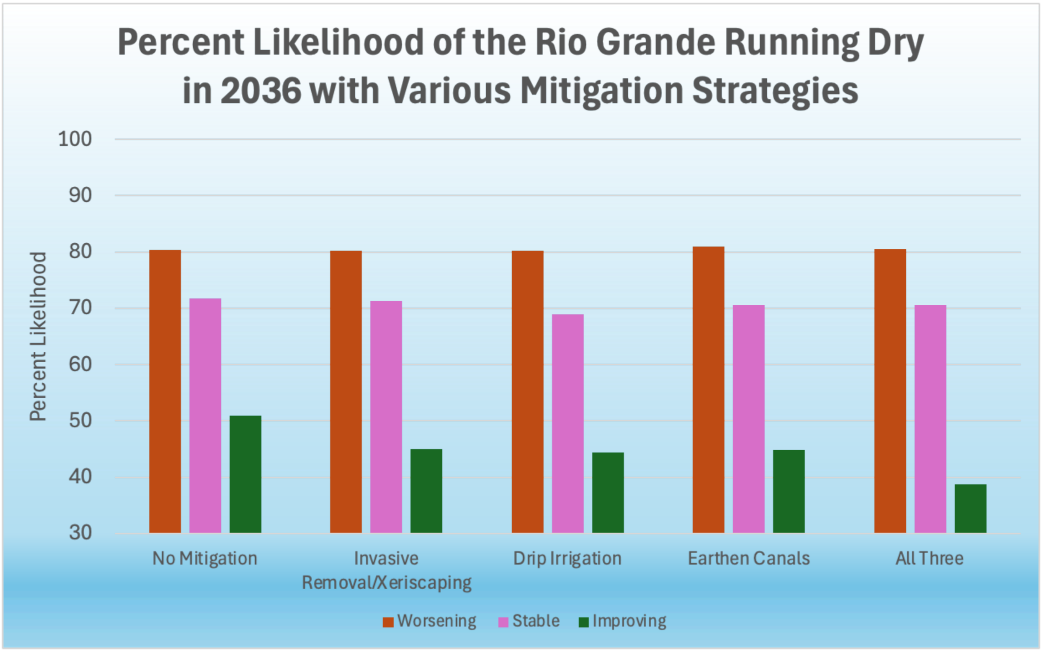

Figure 7. The percent likelihood of the Rio Grande running dry in 2036 with various mitigation strategies. It is in this time frame that the cumulative effects of large scale mitigation strategies begin to improve river flow outlooks.

With the understanding that the impacts of these mitigation strategies may have on seasonal drying out of the Rio Grande, how does implementing these strategies affect river flow predictions? Figure 8, below, shows these predicted flow rates across all three climatic scenarios and with each (and all) mitigation strategies. These predictions show that the most effective interventions, across all scenarios, is the combination of all three mitigation strategies - invasive plant removal/xeriscaping, a shift to drip irrigation, and replacing concrete arroyos with earthen canals. The prognosis for the river is, unsurprisingly, best under improving climatic conditions, but the combined effects of all three strategies enables the river to maintain flow even under stable and worsening conditions (the solid lines in the graph).

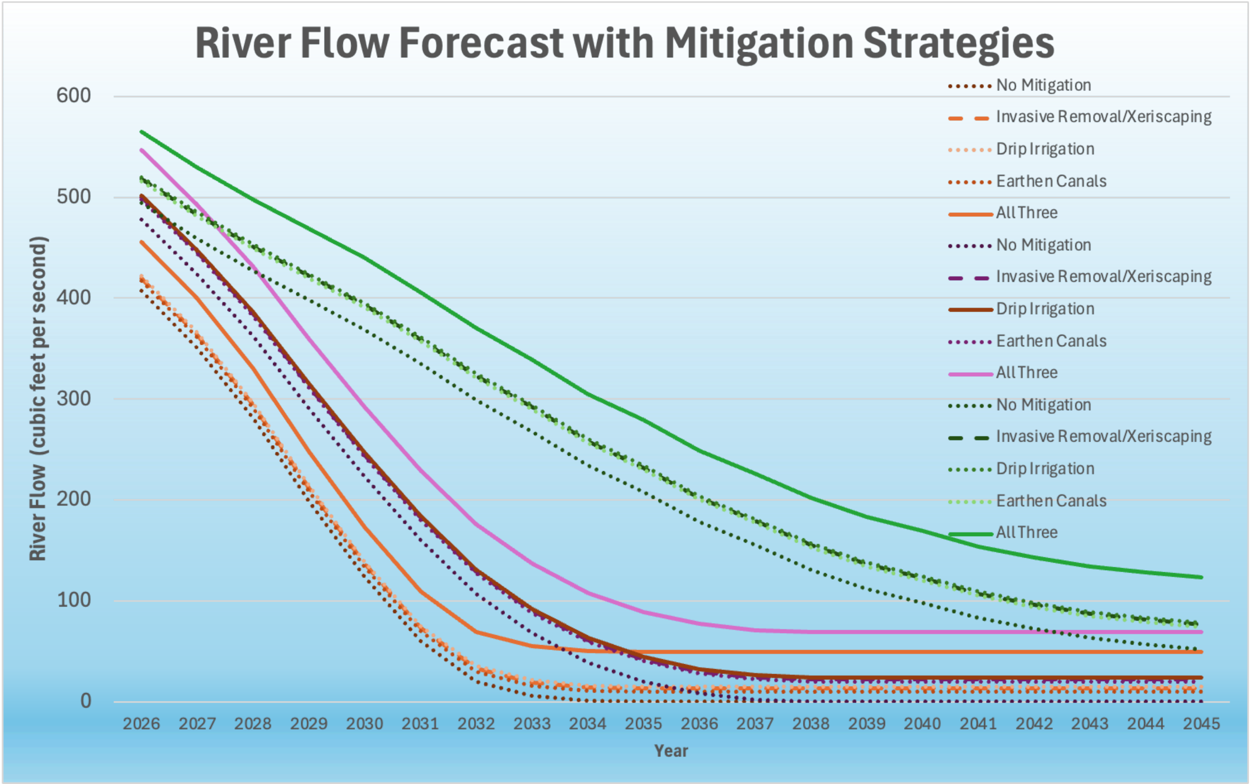

Figure 8. River flow forecast over the next two decades across each of the climatic scenarios (worsening, stable, and improving) and with each mitigation strategy independently, and all three strategies combined. Notably, the solid lines depict the combined effect of all three strategies and maintain river flow across all climatic scenarios.

While the graphs show a clear trend towards improving river health with these mitigation strategies, are these benefits significant? Table 4 below shows the ANOVA results for our mitigation strategies across each climatic scenario. All of our ANOVA analyses demonstrate measurable differences in the success of various mitigation strategies. In each climatic scenario, single mitigation strategies yielded significantly higher river flow than simulations without mitigation, and the three strategies combined yielded significantly higher river flow than any single strategy alone. These results hold for predicting river flow in 2030 and 2036.

ANOVA River Flow by Mitigation Strategies 2030						
Scenario	**Source of Variation**	**Sum of Squares**	**Degrees of freedom**	**Variance**	**F**	**p-value**
Worsening	**Between Groups**	6027.600	4	1506.900	2354.531	<0.0000
	Within Groups	19196.800	29995	0.640		
	Total	25224.400	29999			
Stable	**Between Groups**	7558.320	4	1889.580	2332.815	<0.0000
	Within Groups	24295.950	29995	0.810		
	Total	31854.270	29999			
Improving	**Between Groups**	168735.120	4	42183.780	54208.255	<0.0000
	Within Groups	23341.509	29995	0.778		
	Total	192076.629	29999			

ANOVA River Flow by Mitigation Strategies 2036						
Scenario	**Source of Variation**	**Sum of Squares**	**Degrees of freedom**	**Variance**	**F**	**p-value**
Worsening	**Between Groups**	2226.480	4	556.620	1654.637	<0.0000
	Within Groups	10090.318	29995	0.336		

	Total	12316.798	29999			
Stable	**Between Groups**	26860.800	4	6715.200	11938.133	<0.0000
	Within Groups	16872.188	29995	0.563		
	Total	43732.988	29999			
Improving	**Between Groups**	454881.600	4	113720.400	209522.44	<0.0000
	Within Groups	16280.086	29995	0.543		
	Total	471161.686	29999			

Table 4. ANOVA results examine the impact of mitigation strategies within each climatic scenario on river flow in 2030 and 2036. Each strategy alone showed significantly improved river flow when compared to no mitigation, and the three strategies combined showed significantly improved river flow when compared to the individual strategies.

Regression analyses were conducted to determine whether particular strategies more strongly predicted river flow. These analyses were not significant and are not included here.

Discussion

This project challenged our team as we transitioned from NetLogo to Python for our coding language. We used an Autoregressive Monte Carlo simulation to introduce variability across runs and estimate probabilities from many runs rather than a single one. This model was one we were less familiar with. We focused more of our time on verifying and validating our model by using a single gauge, and then began the simulations we used to predict the outcome of the Rio Grande running dry. In the future, we recognize the value in generating a flow chart or path diagram of our variables first, to streamline model creation before we actually start running the model. We did attempt this, but not before spending considerable time on our code.

Our model shows that, without intervention, the river will increasingly run dry earlier in the season and for longer periods, until it becomes functionally dead, unable to recover. Our simulations demonstrate that this is a realistic risk over the next two decades. Mitigation strategies will reduce the risk, but would need to be implemented intensively and with fidelity by all water users. Our ability to change global climate factors is limited, but we need to address this problem immediately and intensively for New Mexico to continue to have water in the long term. Utilizing all 3 strategies, the probability that the river runs dry at least once over the next 10 years is 78%. However, with mitigation strategies in place, the likelihood of the river running dry drops by 10% over the next 10 years. While it is too late to stop the river from drying up in 2026 and perhaps even 2027, acting now can help minimize future damage. Our goal needs to be long term river health, and for that, we need buy-in from all stakeholders.

Our results highlighted the effects of overall climatic conditions on river flow and the probability of the river running dry. Our best outcomes were achieved through these mitigation strategies, in tandem with improving climatic conditions. These improved conditions are very unlikely to be met, and so we need to focus on the predictions of our worsening and stable scenarios. Under these circumstances, the three mitigation strategies that we highlighted may not be enough. If we were able to extend and improve upon our model, we would include more strategies, such as intentionally planting more drought tolerant crops, changing our ranching practices, and renegotiating interstate and transnational water treaties. For example, southern New Mexico is one of the major producers of pecans. Pecan trees have significant water needs, especially during nut formation. Mature pecan trees use upwards of 250 gallons of water daily, while developing trees require 10-15 gallons of water weekly. If soil is not kept critically moist, nuts don't set or are reduced in size (NMSU, accessed 2026). Transitioning pecan orchards to drought tolerant fruits, including figs, pomegranates, pistachios, jujubes, persimmons, and olives, will minimize the water needs of many of our downstream users. Similarly, cattle and pastures require quite a bit of water, up to 30 gallons per head for drinking needs, plus associated irrigation needs for hay/grazing. Sheep and goats require only 1-3 gallons per head for drinking needs and less irrigation for grazing lands. While we acknowledge a difference in the sizes of these animals, caprines (sheep and goats) are better adapted to more arid environments. We did not include these variables in this year's model, but they would be impactful ways to further mitigate the decline in water resources.

In the future, we would love to shift our focus to a regional model, expanding to include Texas, Colorado, and northern Mexico, as we cannot address the health of the Rio Grande by focusing on New Mexico in isolation. If we continue to work individually, we will not be able to mitigate the negative consequences of climate change. We are well past the tipping point towards an ever warming, ever drying southwest, and the only way we will be able to affect change is with large scale intervention and fidelity in committing to these mitigation strategies.

Conclusion

In conclusion, the findings of this study paint a stark but actionable picture of New Mexico's water future. Prolonged drought, declining snowpack, increasing demand, and climatic instability have placed the Rio Grande - and the broader water system - on an unsustainable trajectory. Our model demonstrates that, under both worsening and even stable climatic conditions, the river is highly likely to experience frequent and eventually permanent drying within the next decade. While improving climate conditions offer some relief, they remain unlikely given current global trends.

However, this outlook is not entirely without hope. The simulation results clearly show that targeted, large-scale mitigation strategies, particularly when implemented together, can significantly improve river flow and reduce the long-term risk of complete drying. Measures such as invasive species removal, adoption of drip irrigation, and restoration of natural water channels are not quick fixes, but they represent meaningful, evidence-based pathways toward greater water resilience. Importantly, their effectiveness depends on widespread adoption and long-term commitment across all sectors of water use.

Ultimately, this study highlights the importance of coordinated action. Short-term conservation efforts alone are insufficient to reverse current trends; instead, systemic changes in water management, agricultural practices, and policy must be prioritized. While some degree of river drying in the immediate future may be unavoidable, decisive action taken now can still shape a more sustainable trajectory. The future of the Rio Grande, and the communities and ecosystems that depend on it, will depend on how quickly and collectively these solutions are embraced.

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