# Partnering With Nature: Establishing the Role of Conservation Agriculture for Ecological Resilience and Adaptable Food Systems in the U.S. Southwest

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## Abstract 2 – Poster/In-person

As data show rising temperatures and water insecurity across the Intermountain West, adaptations can ensure increased resilience of food production systems. While trying to operate during fluctuating drought years, agricultural producers may be understandably hesitant to try new techniques. However, lack of acclimatization or overly intensive production can have severe consequences, including soil degradation leading to the desertification of arable land. By implementing ecological solutions to agricultural production, watersheds and ecosystems can benefit from reduced fertilizer and pesticide runoff, mitigated soil erosion, and water resource stewardship.

Conservation agriculture, as used in this study, refers to implementation of Nature-based Solutions (NbS) by agricultural producers for production. Examples of NbS include agroforestry, cover cropping, and development of healthier soil. This project seeks to understand attitudes and perceptions of NbS in Southwest Colorado's Montezuma County based on a survey of agricultural producers. This project is designed to help inform conservation districts and researchers about best modalities for NbS implementation based on input from current producers and consideration of greatest benefit to ecosystem wellbeing and food system resistance to disruption. The survey is a collaboration with Montezuma County's High Desert and Mancos Conservation Districts, Northern Arizona University, and the NSF-funded Transformation Network. It is scheduled for distribution in late Spring 2023 through Fall 2023. The poster will outline the process of collaborative survey creation, explain climatic changes and food growing trends in the region, and outline how conservation farming and ranching could benefit the watershed. Our goal is to illustrate constructive collaboration between agricultural producers, communities, and researchers toward stewardship and food system adaptation in the Four Corners. Such collaboration could help foster pathways of communication and encourage more applicable, symbiotic, and accessible conservation agriculture research based on the needs of producers, the land, and changing climate.

# High-Resolution Assessment of Critical Runoff Generation Areas in the San Juan River Basin: Implications for Water Security in the Four Corners Region

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## Abstract 3 – Poster/In-person

The San Juan River Basin (SJRB) is an essential water source for the arid southwestern United States, functioning as a vital tributary for the Colorado River. The river basin holds vital importance for the entire Colorado River Basin, particularly for the downstream city of Farmington, NM. Prior studies have found that watershed basin headwaters are disproportionately generating runoff flows compared to their downstream counterparts. Given the mounting pressure on western water resources from climate change, population growth, water use demands, land use change, and pollution, there is a critical need to understand the dependency of downstream communities on upstream areas generating freshwater resources. This study aims to identify and characterize the critical runoff generation areas in the SJRB using a high-resolution version of the relative water yield (RWY) equation developed by Viviroli et al. (2007). By pinpointing critical runoff generation areas in the basin, we can target vital land areas for conservation and preservation efforts, ensuring the long-term sustainability of Farmington's freshwater supply. This study expands beyond the RWY by incorporating groundwater and snowmelt versions of the RWY equation, allowing for a comprehensive analysis of three major aspects of water resources and providing a holistic assessment of inter-basin water security for the Four Corners region. While mountainous runoff and lowland dependency have been studied on coarser spatial scales, detailed basin-scale analyses of this system dynamic remain limited. Addressing this need for basin-scale water resource management and decision-making, we present a high-resolution analysis for the Four Corners region. Our findings will aid in guiding decision-makers in developing effective strategies for water resource management, including water allocation, infrastructure planning, and ecosystem restoration efforts.

**Key Words**: San Juan River Basin, Four Corners Region, Water Security, Relative Water Yield, Water Resource Management

# Fifty-four Years of Climatological Data (1969-2022): NMSU Agricultural Science Center at Farmington

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## Abstract 4 – Poster/In-person

Surface water in the semi-arid climate of the Four Corners Region of New Mexico is a crucial life resource. Vigilant monitoring of weather conditions and efficient water-use is necessary for productive life in this water-deficit region, which averages 7.90 inches (200 mm) of precipitation per year (54 year average). Meteorological data are collected at two weather stations located at the New Mexico State University Agricultural Science Center near Farmington (ASCF).

The National Weather Service (NWS) Station (Latitude 36.68972, Longitude -108.30861, (Elevation 5625.0 ft. (1715 m)) is a manual data collection station in service since 1969. The data are collected and reported daily to the NWS in Albuquerque, NM: https://www.weather.gov/abq/. Weather data components include air, soil, and water temperatures, precipitation, pan evaporation, and wind movement.

The New Mexico Climate Center (NMCC) weather station (Latitude 36.69, Longitude -108.31, Elevation 5643.0 ft., (1720 m)) is an automated station with daily and five minute frequency computer online accessible weather data: https://weather.nmsu.edu/. Weather components include air temperature and dewpoint, windchill and heat index, relative humidity, maximum and mean wind speed, mean wind direction, rainfall, and solar radiation.

Summaries of these weather data components are presented in the ASCF Annual Progress report: https://farmingtonsc.nmsu.edu/. Summaries include precipitation, air temperatures, extreme air temperatures, freeze-free days, average and total evaporation, wind movement, soil temperatures, solar radiation, and growing degree days.

Historical weather data collected over 54 years at ASCF has been used in many applications, such as identifying plant hardiness zones, crop-management plans, ET calculations for irrigation of crops and landscapes, and weather forecast modeling. Growers, foresters, natural resource managers, municipal planners, weather forecasters and other community members utilize ASCF weather data, demonstrating the importance of long-term weather monitoring to the region.

# Examining Spatial Heterogeneity and Tourism Potential of Water Resources in New Mexico

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## Abstract 5 – Oral & Poster/In-person

Increasing outdoor tourism in New Mexico and growing demand for water-based tourism amenities requires developing innovative strategies for resource allocation and service integration among many existing and potential recreation locations. Identifying tourism potential and optimizing resource allocation has been addressed in studies using a multitude of models, methods and algorithms; however, variations between the influential factors of tourism locations are best analyzed with a Geographical Information System (GIS) based research model that can examine diverse spatial relationships in these environments. This study uses a Geographically Weighted Regression (GWR) method to illustrate that variables related to drivers of tourism are locally distinct. This tool is used to examine the spatial non-stationarity of relevant water-based tourism variables. Spatial discrepancies are shown to exist in the explanatory variables useful for developing tourism resources in rural and urban locations in the New Mexico study area. This GWR analysis can strengthen the decision process and allow policy makers to identify distinct influential factors and areas where resources for expanding water based tourism should be focused.

**Keywords**: Outdoor Tourism, Water-based Tourism, Geographic Information Systems (GIS), Geographically Weighted Regression (GWR), Rural Development

# Approach, Methods, and Challenges to Collecting Suspended Sediment and Surface Water Samples from Remote Ephemeral Channels in the San Juan River Watershed

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## Abstract 9 – Poster/In-person

Residents of Navajo Nation, and many surrounding communities in the Four Corners region, rely on the San Juan River for drinking water, irrigation, and watering stock. During routine water quality monitoring of the San Juan River, the Navajo Nation Environmental Protection Agency detected elevated concentrations of the metals aluminum, arsenic, and lead. The U.S. Geological Survey (USGS), in collaboration with the Navajo Nation Environmental Protection Agency, initiated a study to determine the sources of these and other dissolved metals in the San Juan River. Twenty-eight ephemeral channels and 5 perennial streams were sampled from Navajo Lake, in northwest NM, to Mexican Hat, UT. Due to the remote location of sampling sites, a limited budget, and the short duration of flow in the ephemeral channels, that usually occur sporadically during the summer monsoon season, this project required a new approach to collecting suspended sediment and water samples.

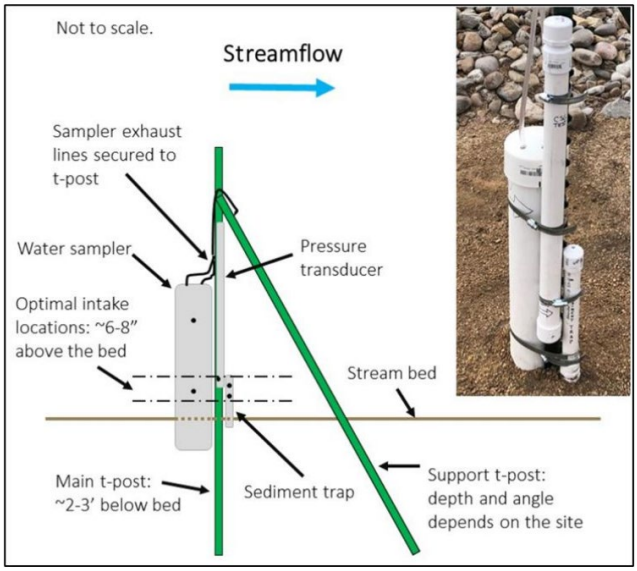



Figure 1. Concept and photograph of novel "sed-chem" monitoring gage and deployment method.

Scientists at the USGS designed and deployed 33 novel monitoring gages, referred to by the gage designers and technicians as sed-chem gages for their capacity to collect both sediment and water quality samples. The sed-chem gages were equipped with a suspended sediment settling trap, a water quality sampler that holds two 1-liter Nalgene bottles, and a pressure transducer. A conceptual model and image of the setup are shown in Figure 1. The sed-chem gages were deployed close to the channel thalweg, where possible, by mounting the individual components to a vertical t-post, anchored 2-3 feet below the channel bed and supported by an angled t-post, anchored similarly. The goal of the sed-chem gages was to collect suspended sediment, water quality samples, and stage during short duration flow events using low-cost, readily available materials. This poster presents the approach, methods, and challenges to meeting that goal.