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Publicizing River Source's Services and Stories

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Abstract

River Source is an organization based in Santa Fe, New Mexico that provides communities with a variety of watershed management services, including: educational programs, land assessment and restoration, and job pathways for qualified individuals. River Source works with schools to educate students on watershed science and management practices. Our goal was to help River Source publicize their story and services to New Mexico communities. We conducted educator interviews and participant observation to assess how students and teachers interact with River Source's educational programs. We provided River Source with three promotional and informational videos for the public and students and developed an educational page for River Source's website.

Executive Summary

In the United States, awareness of climate change and the effect it has is a critical topic. The issues it causes such as melting ice caps, an increase in super storm frequency, disappearance of coastline, and crippling droughts are inevitable in the global community. For the residents of the state of New Mexico, the impacts of climate change affect them consistently.

For the state of New Mexico, abnormally dry conditions and major water sources drying out are urgent issues to address. Communities must work together to maintain the health of their watershed; it is not an issue that can be remedied by any single individual. Oftentimes it can be hard for communities to take action due to the severity of the damage and limited access to resources and services. Training in watershed management strategies is not a part of the common core curriculum adopted by the state (New Mexico Public Education Department, n.d.). It is important for the younger generation to learn about these topics as climate events will keep occurring. Due to COVID-19, students and teachers have to make up for lost time with basic curriculum, leaving little opportunity for environmental and watershed education.

A way to get this information to students and educators is through environmental organizations that provide services to schools, such as River Source. Run by Rich Schrader and Carlos Herrera, River Source assists New Mexico communities with watershed management and restoration. Mr. Schrader and Mr. Herrera have dedicated their lives to improving the health of watersheds by providing educational programs, research, and community service to New Mexico (River Source, n.d.). Specifically, their education program allows students to participate in activities that teach them about watershed protection and management. To help communicate River Source's content more efficiently and effectively the team enhanced their current outreach strategies.

Goals & Objectives

The goal of our project was to develop strategies to help River Source more effectively communicate their information to students and educators. Our team had four objectives to achieve this goal.

1. Understand River Source's program and the various opportunities they provide to students and educators.
2. Identify how River Source communicates their content to students and educators.
3. Identify which delivery strategies have the highest student engagement and why.
4. Develop an effective way to communicate River Source's content to the stakeholders with whom they interact.

Methods

To accomplish our goal and objectives, we developed six different methods to help understand River Source's educational programs. We analyzed past lesson plans, documents and presentations provided by our sponsors. This allowed our team to learn about River Source's current teaching strategies and topics. We conducted field research through participant observation by accompanying River Source on field trips to see what they did and how the students interacted with the educational programs. We interviewed teachers who previously worked with River Source to better understand the program and their overall opinion of what it was like to work with the organization. From the interviews, we identified the most common responses and piece of feedback. Our team then collaborated with River Source to create a classroom survey to be administered to students at the end of River Source's educational programs. The survey allowed students to give their opinion on the program, but as well allowed us to see how much information they retained. To aid in the creation of a new promotional webpage, we researched existing climate educational websites and promotional methods to see examples of effective communication strategies for climate education programs.

Themes

From our research and analysis, we developed four main themes for discussion.

1. *Overview of River Source's Program and Organization*

From our participant observation and interview with sponsors Rich Schrader and Carlos Herrera, we were able to better understand River Source's Program and Organization. River Source works with a school for up to six days following this structure: a starting presentation, a few field days, and then ending back in the classroom. Schools typically have the option of choosing from two different programs: Watershed Watch or Outdoor Campus Assessment. Both involve ecological restoration. Watershed Watch takes the students to the river to perform tasks such as water chemistry, species indexing and taking pictures of the land. Outdoor Campus Assessment has the students conduct landscape surveys and assessments on their own school grounds, which allows the students to make meaningful decisions on land they directly interact with. These programs allow the students to participate in active field work that allows them to visualize the complex concepts that are usually taught in class.

2. *River Source's Teaching Strategies*

River Source uses various teaching strategies to communicate their information to students and teachers. The different strategies we identified are: presentations, lectures, hands-on activities, and personal stories. Presentations take place at the start and end of the program. This is where students have the most difficult time understanding the complex information that is being presented to them. Lectures were concise, used simple terminology and were often given without a presentation. This leads to the students having an easier time understanding the specific activity or topic. Students participated in hands-on activities for the field work, allowing them to put theory into practice. In these activities, students were highly engaged, and able to form a connection with the employee because of the personal stories that were incorporated into the conversations.

3. *Teaching Strategy Effectiveness*

Through field trips and interviews, we saw that the most effective teaching strategy was the outdoor education portion. In this aspect of the program, students were able to visualize the theories they learned in class and have activities in which they could participate. It was also during the outdoor learning portions of River Source's programs that students and employees were able to interact on a personal level. This led to the students having more interest in the topics that were being presented to them. Personal stories were critical to engaging students not only in the activities, but also to the technical information River Source employees taught.

4. *Effective Methods to Communicate River Source's Content*

When interviewing with teachers, we learned that the initial connection with an education institution or community is important. The most common way River Source would reach out is either personally contacting or through word of mouth. To help effectively publicize River Source's content, many interviewees suggested more visuals and to have a more engaging website. Our team suggested a promotional video, explaining who River Source is and what they do. Many teachers agreed that this would be beneficial.

Recommendations & Deliverables

From our findings, we developed recommendations that we think could enhance River Source's communication of their content to students and educators. We recommend having more visuals integrated into presentations and lectures to help students visualize what is being taught. Another recommendation is to present any new terminology or concepts at the start before the students go out in the field. This would ensure that a disconnect will not occur once doing hands-on activities. Our final recommendation is to develop an official form to give to teachers prior to the program that establishes relevant material to cover. Having this would allow the program to completely cover the material the teachers are already teaching.

For our deliverables we created three videos to help River Source communicate their content. We have two promotional videos explaining what River Source is and why they educate. Then we have an education video explaining and demonstrating what a watershed is. From our interviews with River Source employees, we found that introduction material is where students get confused the most, particularly when introducing the concept of a watershed. To assist with this, we developed a short, animated video to help facilitate the basic information. These three videos would be placed onto the webpage that we created to help publicize their story and services.

Conclusion

The different educational programs that River Source provides allows the public to obtain more knowledge on different climate topics. With our recommendations, we hope that River Source's stories and services will be more accessible to the public creating a better outreach. Seeing how climate events are mitigated helps communities have a positive outlook while facing this daunting topic. More importantly, the students can see that while issues occur, there are ways to actively help solve and prevent them. The more students that River Source can serve, the better the chances for watershed restoration in our changing climate.

Acknowledgements

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Abstract	Vincenza Burdulis	Clayton Hanlon
Executive Summary	Vincenza Burdulis	Clayton Hanlon
Introduction	Clayton Hanlon	Vincenza Burdulis
Background		
New Mexico Residents' Connection to the Land	Clayton Hanlon	Vincenza Burdulis
Recent History of Watershed Disasters	Vincenza Burdulis	Clayton Hanlon
Effects of Different Climate Conditions	Vincenza Burdulis, Giancarlo Orlandi & Tim Rinaldi	Clayton Hanlon & Vincenza Burdulis
Surface and Groundwater	Vincenza Burdulis	Clayton Hanlon
Environmental Education in New Mexico	Clayton Hanlon	Vincenza Burdulis
Introduction Our Sponsor	Clayton Hanlon	Vincenza Burdulis
Methodology		
Objective 1	Giancarlo Orlandi	Tim Rinaldi
Objective 2	Clayton Hanlon	Tim Rinaldi
Objective 3	Vincenza Burdulis	Giancarlo Orlandi
Objective 4	Tim Rinaldi	Giancarlo Orlandi
Findings and Recommendations		
River Source's Educational Program	Giancarlo Orlandi	Vincenza Burdulis
River Source's Teaching Strategies	Clayton Hanlon	Vincenza Burdulis
Collaboration with Educators	Clayton Hanlon	Vincenza Burdulis
Engagement Gap Between Teaching Strategies	Vincenza Burdulis	Clayton Hanlon
Effective methods to communicate River Source's content	Tim Rinaldi	Giancarlo Orlandi
Recommendations	Tim Rinaldi	Whole team
Conclusion	Vincenza Burdulis	Clayton Hanlon

Table of Contents

Table of Figures

1. Introduction

What is the first thing that comes to mind when the topic of climate change is brought up in conversation? Daunting issues ranging from melting ice caps, an increase in super storm frequency, disappearance of coastline, and crippling droughts only begin to highlight the challenges that the global community is facing. It is impossible for any single individual to remedy these issues alone. Instead, largescale, communal action is needed. Although awareness of these issues is at an all-time high, the U.S. public has not acted (Armstrong et al., 2018). In many parts of the country, particularly in the wake of the COVID-19 pandemic, more immediate concerns take up individuals' time and energy.

For the residents of the state of New Mexico, the impacts of climate change are prevalent every day. Most of the state experiences abnormally dry conditions and major water sources, such as the Rio Grande, are drying out (National Drought Mitigation Center et al., 2022; Pratt, 2022). Communities must work together to combat issues of water conservation, wildfires, and land erosion. Unfortunately, taking action can often be difficult for these affected groups. Training in watershed management strategies is not a part of the common core curriculum adopted by the state (New Mexico Public Education Department, n.d.). Moreover, New Mexico's students, especially those in underserved communities, lost the equivalent of a year of learning due to school closures to combat COVID-19 (Program Evaluation Unit, 2020). Students and teachers must make up for lost time in classes that are a part of the accepted curriculum, leaving little time for environmental and watershed education. However, alongside the urgency of the COVID-19 pandemic, climate threats in New Mexico continued. Consequently, the underserved communities that had trouble addressing the climate threats before the pandemic had even fewer resources to devote while trying to stay quarantined. The question is then: how can educational resources be brought to the aid of New Mexico communities?

Rich Schrader and Carlos Herrera are the directors of River Source and our sponsors for this project. River Source is an organization that aims to assist New Mexico communities with watershed management and restoration. Mr. Schrader and Mr. Herrera have dedicated their lives to improving the health of watersheds by providing educational programs, research, and community service to New Mexico (River Source, n.d.). Through River Source, Mr. Schrader and Mr. Herrera have been working together for over a decade helping communities in New Mexico develop the skill sets to combat threats posed to local watersheds. They tasked our team with developing and organizing a means to communicate River Source's story and available services to residents of New Mexico.

Our team assessed the current educational programs that River Source delivers to local schools. We then interviewed educators who we met on field trips, and who had worked with Rich Schrader and Carlos Herrera before our project. Using the feedback from educators and what we discovered about River Source's existing programs, we recommend a new page on River Source's website that functions as a highlight of all their available services. Finally, we researched effective environmental and climate change education pages to aid in developing a mockup of what River Source could add to their website. Included in the following report is a brief background of the climate change threats that New Mexico's watersheds face; understanding these threats is essential to understanding the importance of River Source's mission. We then discuss different environmental education organizations and strategies that these organizations have in place. An in-depth description of our sponsor, River Source,

concludes our background. We then describe the methodologies we followed, and the findings and recommendations that came as a result.

2. Background

"People were poor in material comforts…but they were rich in what they valued most, time, family and the freedom of the land," William DuBuys writes in his text *Enchantment and Exploitation: The Life of Hard Times of a New Mexico Mountain Range* (DuBuys, 1985, p.198-199). Land has always been important in New Mexico. New Mexico is the traditional homeland of various indigenous groups, including twenty-three federally recognized tribes that live here today (Native American Election Information Program, n.d.). Generations of agriculturalists that have lived off the land call New Mexico home.

Today, New Mexicans continue to rely on the land to provide them with food and water. Unfortunately, the current climate conditions that have been occurring have been impacting New Mexicans' ability to depend on the land. New Mexico is home to numerous watersheds that communities across the state utilize; these watersheds are threatened by a diverse range of climate change threats (Davis, 2022). However, the climate changes that are occurring are unavoidable and underway. Therefore, it is important for New Mexico's youth to learn about their environment and environmental maintenance: if New Mexico youth understand both current climate events and ways to mitigate environmental problems, communities will be well equipped to combat future climate threats.

2.1 New Mexico Residents' Connection to the Land

Before understanding the science and devastation of climate threats to the land, it is crucial to consider the communities living there. New Mexicans have strong connections with the land they inhabit. However, healthier futures for New Mexico's environment and watersheds depend on the participation of younger generations in caring for the land.

For youth to participate in climate management, it is important they understand the traditions and strategies that are in place. Acequias are an important example of New Mexican watershed management. During the time of the Spanish colonization of Mexico, the tribal communities had to find ways to take control of the land that was rightfully theirs; they adopted acequias, which were introduced by the Hispanos, and are an ancient method of water irrigation ("New Mexico Nomad Lifestyle," 2021, n.p.; Hicks & Peña, 2003). These community irrigation ditches evolved over the years to become local forms of governance.

Today, acequia associations typically have a democratic leadership structure, where all officials are elected by the parciantes. The Bylaws for the Acequia de La Puebla, in La Puebla New Mexico, serve as an example of acequia organization infrastructure. The Acequia de La Puebla is run by three elected officers and an elected mayordomo (Bylaws of the Acequia de La Puebla, 2014). This once again reinforces the long-standing communal system that acequias helped to develop, and the model for participatory governance by landowners over their water.

Acequias represent much more than a molded ditch/canal; acequias are physical representations of a community's appreciation and devotion to the land. The acequias are one example of the many traditional land management strategies that communities in New Mexico utilize. However, younger generations of these communities grow up in completely different

circumstances; they spent most of their time learning in schools rather than on family land such as a farm or ranch.

In recent years, several watershed disasters and climate threats have altered the lives and landscapes of New Mexican residents. Below, we discuss recent watershed disasters and the specific climate science of these events. Following is a discussion of environmental education organizations, and the important role they play in getting young New Mexico students involved in managing and caring for their land.

2.2 Recent History of Watershed Disasters

The Forestry Division of New Mexico's Energy, Minerals, and Natural Resources Department (EMNRD) exists to help manage climate change issues and natural disasters. The division focuses on vegetation, reducing hazards, and maintaining forest health. The ENMRD was initially catered to extinguish wildfires and regulate timber sales. However, the department is expanding to promote healthy watersheds to ensure clean and reliable water for communities within the state. Water management issues are prevalent in the Forestry Division's work because drought and flooding are related to health of the forests and therefore impact multiple communities. For forest fire risk prevention, different mitigation strategies are followed by the division's employees. For example, forestry division officials start prescribed fires or burns to reduce overgrown trees and brush because they are often responsible for starting and spreading wildfires (US Department of Agriculture, 2016). The EMNRD works with the public and partner organizations to achieve this goal. This system extensively benefits rural communities, private landowners, and current/future generations of the state.

New Mexico is currently in a drought, with the region broken into three different levels of droughts: D0 (abnormally dry), D1 (moderate drought), and D2 (severe drought)

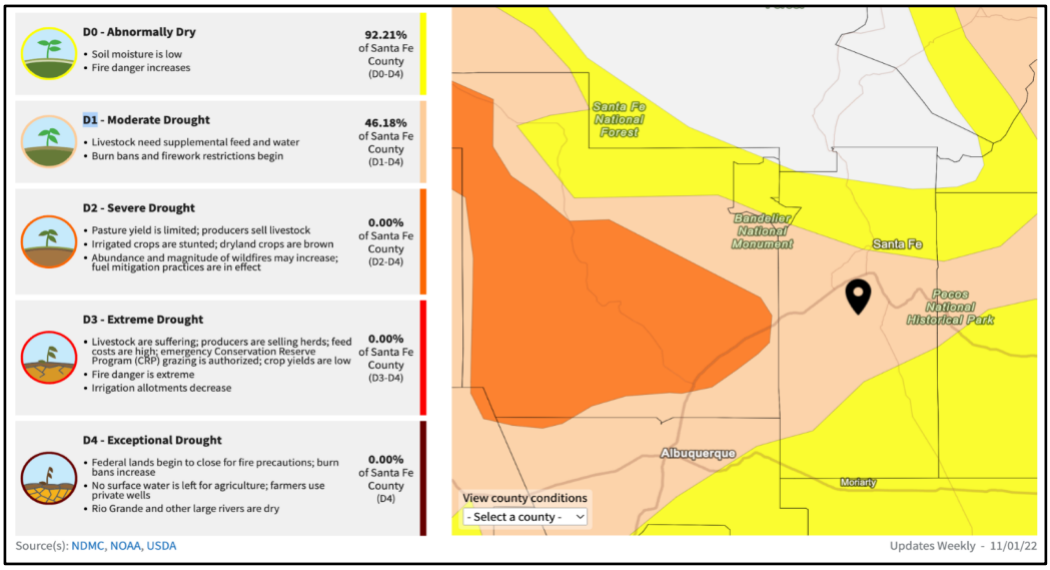

Figure 1: *Drought map of Santa Fe County (National Drought Mitigation Center et al., 2022)*

Looking at the U.S drought monitor, we can see that most of Santa Fe County is abnormally dry, with the rest being moderate (National Drought Mitigation Center et al., 2022). With persistent drought conditions, the likelihood of wildfires breaking out naturally increases as time goes on.

A past example of the effects a wildfire can have on watersheds is the Cerro Grande fire of 2000. In May of that year, the Cerro Grande Fire outbreak damaged the land and the surrounding watershed. Environmental conditions were impacted, and an increase in flash floods and surface and groundwater contamination occurred. Several communities were impacted, leaving the homes burned, water and soil contaminated, and area wildlife harmed. (Cerro Grande Fire and Its Aftermath, 2000) (Lonnie et al., 2000). The fire prompted development strategies to mitigate risks and help the public prepare for natural disasters (Cerro Grande Fire and Its Aftermath, 2000) (Lonnie et al., 2000).

More recently, this past April, another devastating wildfire occurred in Hermit's Peak; it started on April 6th, 2022 and was not declared fully contained until August 21st, 2022.

Figure 2: *Burn scar in the Sangre De Cristo Mountain Range caused by Hermit's Peak Fire wildfire. Photo Courtesy of team member Tim Rinaldi*

This fire resulted in a loss of vegetation, exposure of soil to erosion, and increased water runoff (Hermit's Peak Fire Information - InciWeb the Incident Information System, 2022). Runoff flooding can increase sediment and debris flow and damage cultural and natural resources. All these factors can damage local watersheds and affect residents' lives. Unfortunately, a common theme in both these disasters was that they both started as prescribed burns (Overton, 2022; Lonnie et al., 2000). The local communities have now become distrusting of the forestry division because many residents disagreed with the prescribed burn in Calf Canyon.

2.3 Effects of Different Climate Conditions

The aforementioned climate disasters are obvious examples of the many disasters that have devastated New Mexico residents. In order to understand how residents' lives are impacted and the strategies educators need to teach the youth, it is first essential to understand the different climate conditions themselves. Climate conditions are interrelated with the impacts that they have on society. For example, a common occurrence because of drought and flooding is ecosystems and human health being harmed (Climate Change Impacts, 2021). These impacts can further spread into infrastructure and food production (Climate Change Impacts, 2021). Climate conditions will inevitably keep occurring and affecting society, so it is crucial to understand their cause and effects. Below, we describe the most common issues, wildfires, drought, flooding and contamination and their impacts on the environment.

2.3.2 Drought

Droughts are classified into four different calibers, moderate (D1), severe (D2), extreme (D3), and exceptional (D4). These classifications are based on how long a drought lasts; the longer it continues, the more severe it is (U.S. Drought monitor, 2022). When an area experiences a drought, water levels in ponds, rivers, lakes, and streams get low or diminish. As a result, farmers struggle greatly with drought because they have little or no water to irrigate their farms, lowering crop yields (Ray et al., 2018).

New Mexico has consistently high temperatures and a lack of rain and snowfall during respective seasons. An issue that can occur because of this is an abnormally low flow of water in watersheds. Low annual precipitation causes river levels to decrease or even dry up altogether, leaving communities lacking water and landscapes at increased risk of wildfire. The soil from dried-up rivers can be damaged because cracks form in the soil, which reduces its moisture and stability. The dry riverbed soil is more susceptible to wind erosion and therefore, loss of topsoil needed for revegetation growth. These factors negatively impact a river's future, as it is harder to get a river to flow again once it dries.

2.3.3 Wildfires

Due to the ongoing drought in NM, wildfires are becoming more common. Wildfires are when fires burn through forest areas, creating dry, hydrophobic plains (Winter, 2022). Due to the dry landscape created by drought, wildfires can start quickly due to natural causes such as lightning or, more commonly, by humans accidentally, from smoking, fireworks, or anything that spreads ashes or fire (U.S. Department of the Interior, 2021). Wildfires can affect the surrounding community, burning homes, leaving many homeless. In addition, they can quickly wipe out animal habitats and vegetation and pollute the air as they release carbon dioxide; carbon dioxide can be lethal to humans or animals if enough is inhaled (U.S. Department of Agriculture & U.S. Forest Service, 2016). Wildfires can also cause ashes and stormwater runoff to contaminate sources of water.

2.3.4 Flooding

When rainfall hits the hydrophobic areas affected by the wildfires, water cannot be absorbed and thus results in runoff and flooding. A physical threat that emerges from this is erosion. Erosion results from water continuously running across the soil, eventually forcing the

soil to break and start moving. As a result, this creates a deep channel that water continuously runs through. Erosion destroys valuable topsoil for vegetation and exposes unwanted sediment minerals underneath (National Geographic Society, 2022). Rain occurring over a flat, dry plain, flooding results in uncontrolled flow. Flooding can affect the soil, cutting off its oxygen flow and inhibiting the growth of some forms of vegetation (NOAA SciJinks, 2022). Flooding and erosion affecting vegetation led to unprotected soils, harmful invasive weeds, and the degradation of agriculture. In addition, flooding and erosion can destroy surrounding properties such as homes and yards. These conditions negatively affect the lives of people daily. For example, when a flood happens to pass through, they can be so powerful that they could crack the foundation of a house or even kill a human being, carrying them away in the strong current a flood creates.

2.3.5 Contamination

Water traveling from the top of a watershed to the bottom must cross a large variety of land surfaces and channels, making it susceptible to contaminants. A source of natural contamination can come from algae or unwanted biological growth. Alternatively, most common pollutants come from man-made factors like machines and factories, which release chemicals and gasses that can turn to solid form, mixing in with the water source. The water can be undrinkable and can even destroy vegetation it runs through; this affects both human food production as well as wildlife food and nutrients supply. Storm water runoff provides a pathway for debris and sediment build up to flow downhill into rivers, lakes, and reservoirs. When natural and/or man-made contaminants affect water quality, both wildlife and communities are affected.

Low water flow leads to vegetation loss which allows for increased soil erosion. With a loss of vegetation surrounding rivers, erosion becomes more likely to happen as plants and trees protect the topsoil. The roots, leaves, and cover from vegetation allow the soil to keep its dense shape, shading it from the sun. With vegetation loss, the soil dries up and becomes more susceptible to being blown away by the wind (Soken-Huberty, 2022*).* This also causes water sources that experience nearby vegetation loss to be more polluted because sedimentation or soil erosion “is the leading cause of non-point source pollution nationally” (Schira, 2016). Water pollution can also affect wildlife in the river, potentially killing fish or other animals due to high PH levels. Some communities rely on aquatic animals for food, so vegetation loss can potentially hurt food sources.

2.4 Surface and Groundwater in New Mexico

These climate events have a significant impact on New Mexico's water sources. New Mexico is already known to have water scarcity, and the rising temperature and drought only exacerbate the problems. Under these conditions, surface water is heavily impacted (The Climate Reality Project, 2020). Due to high temperatures, in 2013, farmers received less than ten percent of their typical irrigation water, leading them to rely on groundwater (The Climate Reality Project, n.d.). Farmers are affected by the water shortage, so the food supply has been impacted. In addition, the dried-up land from wildfires cannot be replenished because of the water shortage, affecting many of the residents' lives. New Mexico's water sources must have a healthy environment because of their prevalence in the residents' lives.

In Santa Fe, 26% of the city’s water comes from the ground, while the other 74% is collected in surface bodies of water (i.e., lakes, rivers, and reservoirs) (The Nature Conservancy, 2022). New Mexico has two primary water sources, groundwater, and surface water. The city of Santa Fe gets its water supply from the Rio Grande, groundwater wells, and reservoirs within the

Santa Fe National Forest (Municipal Watershed Management | City of Santa Fe, New Mexico, n.d.). The Rio Grande is a major body of surface water that Santa Fe County communities utilize. It delivers the city San Juan-Chama Project Water and is treated by the Buckman Direct Diversion facility. The Santa Fe River is another supplier of surface water to the county. Municipal reservoirs are treated at the Canyon Road Water Treatment Plant.

Due to the varied water supply resources, different laws and regulations exist to help preserve and maintain them. It is important that surface and groundwater be kept clean since many rely on this source, not only for personal use but it is also a crucial water source for agriculture and industry (New Mexico Environment Department, 2022). General water rights dictate that individuals can use water from any local water resources (New Mexico Legal Aid Inc, 2017). This does not mean that any individual has ownership of the water, but it is a communal resource. Water rights are crucial in the state of New Mexico to maintain healthy quantities of surface and groundwater. The Ground Water Quality Bureau issues permits to help manage contamination according to The New Mexico Ground and Surface Water Permit Regulations (New Mexico Environment Department, 2022). These permits help ensure that water being released back to the environment does not have groundwater contamination.

2.5 Environmental Education in New Mexico

As the younger generations of New Mexico age into adulthood, they will be responsible for taking care of their land. Similar to math and language arts, environmental and watershed education are crucial topics for New Mexico's youth to learn. Teaching younger generations about environmental and watershed management is a critical step in ensuring the future health of New Mexico's watersheds and communities.

The state of New Mexico has challenges in its education system, seen in low high school graduation rates and decreasing test scores in math, reading, and science at both elementary and secondary education levels (National Center for Educational Statistics, 2021; U.S. Department of Education, 2022). Despite this, groups are still trying to provide New Mexico communities with environmental and watershed education resources. The state receives help from a variety of organizations that have taken the initiative in aiding communities with these challenges. One example is Audubon New Mexico, a chapter of the National Audubon society. The organization offers camps, educational resources, and school programs. Their programs are "hands-on, nature-based activities … designed to meet both Common Core State Standards and the New Mexico STEM Ready Standards and Benchmarks", focusing on elementary and middle school students (Audubon New Mexico, 2022, n.p.). Audubon New Mexico is also a leader in conservation of wildlife in the state. Audubon New Mexico is a great example of an organization outside of the Public Education Department taking action to help address climate threats.

Another organization working towards a better future is Environmental Education of New Mexico (EENM). Outdoor learning is a focus of the organization, and it provides communities with the support needed to encourage leaders and educators. Going into the 2020-2021 school year, EENM provided reentry support to the Public Education Department of New Mexico. The organization stressed how "environmental education is an interdisciplinary educational process that helps people learn more about individual and community connections to natural systems" and the importance of outdoor classrooms (Environmental Education of New Mexico, 2021, n.p.). EENM also supported the Senate Bill 32 (SB 32) (SENATE BILL 32, 2022), Outdoor Learning Program Funding, which was signed by the Governor in March (Haan-Amato, 2022). The organization also offers certificate and fellowship programs along with

organizing community gatherings. EENM is a valuable liaison for the local communities of New Mexico to get environmental education resources.

Both organizations run their programs to engage children in appreciating and maintaining their environments. They share the belief that a healthier future for the environment and watersheds are reliant on the participation of younger generations. Audubon New Mexico made it a priority to provide educational programs for students of underserved communities which by themselves have limited access to outdoor classroom programing; the organization claims that "practicing inquiry through place-based environmental learning is engaging and will increase the likelihood of students taking a stronger interest in math and science courses", hoping that this will lead to students being more prepared for college (Audubon New Mexico, 2022, n.p.). EENM believes that through investing in community leaders and a diverse range of educational experiences, "the ultimate recipients of our work will be our students from preK-12th grade" (Environmental Education of New Mexico, n.d.). The organizations and their missions have helped us understand River Source and similar groups. Additionally, these organizations have helped us consider future directions that programs can take, that are discussed later in this report, building upon our foundational knowledge of River Source.

2.6 Introducing Our Sponsor

River Source provides educational and training programs to school systems and government agencies; they also provide consulting services, ecological restoration, and land assessment for private landowners. River Source is an international corporation with a fiscal sponsor, the Partners in Education Foundation. Rich Schrader founded River Source in 1997 after his experience in the University of New Mexico's Community and Regional Planning Program (River Source, n.d.). Carlos Herrera joined Mr. Schrader and River Source in 2011, brought on as the operations and project director. Mr. Herrera grew up as a member of the Cochiti Pueblo and is a skilled drum maker and willow basket artisan.

Mr. Schrader describes the majority of River Source's work as ecological restoration. Their work with students in New Mexico includes two major programs: Watershed Watch and Outdoor Campus Assessment. Outside of their work with schools, River Source works with private landowners and government organizations. River Source shares the data that they collect with the communities they assist to help visualize otherwise difficult climate threat concepts. Currently they use Google Earth, ArcGIS and Drone Deploy to get the students involved in outdoor activities to help educate them. River Source has asked our team to help them spread awareness of their services and educational programs. River Source also brings on interns during the summer through their Watershed Academy program

Figure 3: *Left to right: Rich Schrader & Carlos Herrera, our sponsors, and directors of River Source. Photo courtesy of Rich Schrader*

3. Methodology

Our goal was to develop strategies to help River Source publicize their story and educational services. To achieve this, our group established the following objectives:

Objective #1: Understand the River Source program and the various opportunities it provides to students and educators

Objective #2: Identify how River Source communicates their content to Santa Fe students and educators

Objective #3: Identify which delivery strategies have the highest student engagement and why

Objective #4: Develop an effective way to communicate River Source's content to the stakeholders with whom they interact

3.1 Objective #1: Understand the River Source program and the various opportunities it provides to students and educators

Our team developed this objective to better understand the details of how River Source's educational program is run. We requested access to past lesson agendas, documents, and presentations from our sponsors to analyze. We specifically looked at each document's content and when River Source would use it during their programs. This allowed us to better understand the organization of their program. We also completed three days of participant observation with River Source on their teaching trips.
The schools that we observed were Monte del Sol Charter and Santa Fe Indian School. We observed the Monte del Sol students on their campus twice, on November 7th and the 17th, and observed the Santa Fe Indian school students by a river in the Buckman area of Santa Fe on November 11th. Ages of the students we observed ranged from 8th-12th grade. Our team then developed a code to organize our observations from the documents and trips we attended (Figure 4). The last method we used were semi structured interviews to get an outside view of the educational program

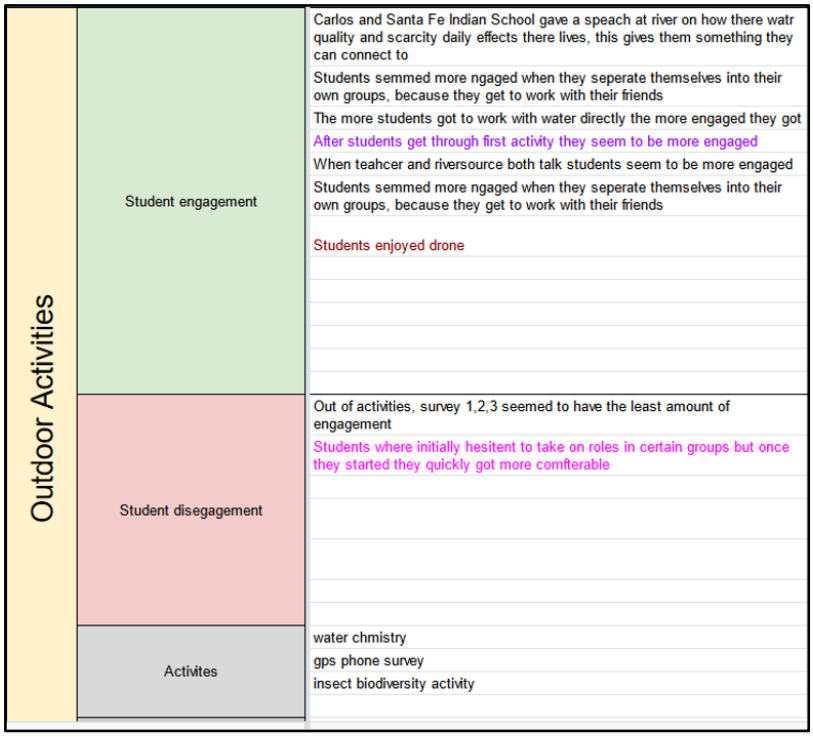

Figure 4: *Code for organizing document and observation data*

Participant observation

Before we began the participant observation, it was important to establish rapport with the students and teachers we were involving ourselves with to make an unusual situation more comfortable. The paper *Participant Observation as a Data Collection Method* helped our team understand how to establish our reason for being there. We made sure to introduce ourselves by highlighting the following details: affiliations, length of time for the observation, and information on our backgrounds (Kawulich, 2005). Our group also learned through experience and research that participant observation can be a complicated method of fieldwork. The steps that are taken to complete participant observation are often determined at the moment, based on the conditions and location of the event (Laurier, 2010). In order to structure our work, our team constructed a template for our field notes that identified key themes to look for when observing. The template can be seen in figure 5.

How are the students…	… paying attention during lecture? … participating in the discussion or activity? … distracted if at all? … more engaged in tasks? … interacting with other students/teachers? … interested start vs the end?
What got students engaged?	☐ Presentation ☐ Discussion ☐ Activities
Where did the students lose interest?	☐ Introduction ☐ Presentation ☐ Terminology ☐ Activities ☐ Conclusion

Figure 5: *Template for what to look for while taking field notes*

Semi Structured Interviews

A method that allowed us to learn more about student engagement was semi-structured teacher and intern interviews. Semi-structured interviews are a way to get distinct experiences from the interviewee since the questions are open ended (Johnson, 2016). We interviewed four teachers and one intern to inform us of our research. The teachers and interns we interviewed had been working with River Source or previously worked with them. These interviews varied from thirty minutes to an hour with a focus on how students are in the classroom and during field trips. We used open-ended questions, which allows the interviewee to build on their unique perspectives as follow up questions can often be asked (Johnson, 2016). In our interviews, this technique had helped the team get a better perspective of what the teachers thought worked and what did not work in the classroom. See appendix A for a list of all interview questions.

3.2 Objective #2: Identify how River Source communicates their content to Santa Fe students and educators

To see how River Source communicates their content, our team started off with studying River Sources past lesson agendas, documents, and presentations. We also completed participant observation, which allowed us to see first-hand how River Source communicates their content. After this we conducted semi structured interviews with teachers that River source has worked with to see the ways River Source communicates their content in sections of the program, we were not able to observe. These methods allowed us to get a grasp on how the River Sources educational program is run (objective 1), which allowed us to see what communication strategies they use

3.3 Objective #3: Identify which delivery strategies have the highest student engagement and why

To identify what methods worked to encourage student engagement in River Source's programs, we conducted surveys, semi-structured interviews, and participant observation. When interviewing teachers that were involved in River Source's programs, the team determined what they saw as effective teaching methods, having a deeper knowledge of their students' behaviors. Through coding after each interaction, we were able to pull what worked and what did not work in terms of effective and engaging methods of communication. Through the educational trips we attended with Mr. Schrader, our team was able to observe what areas the students seemed most engaged in. Finally, the team surveyed students from Monte Del Sol to better understand what they enjoyed in the presentation and what they would like to see more of in the future.

Participant Observation

During the trips our group attended, we took field notes and observed the different areas where the students were the most and least engaged. With the field notes, we developed a code that allowed us to see a pattern within the students. These patterns allowed us to understand which areas the students enjoyed and interacted with the most. Doing these observations allowed us to see what specific parts the students had enjoyed and been excited to learn. These observations allowed us to see specifically where the highest level of engagement occurred

Classroom Surveys

At the end of each River Source program, a survey was distributed to the students to get feedback of what they thought and to see if they learned anything. The survey was distributed to students ranging in age from 8th to 12th grade. This survey can be seen in appendix D. The survey allowed us to determine whether students were paying attention during the presentation and activities; it also helped us determine if the students generally enjoyed what was happening during activities. In the survey we looked for recurring answers and developed a code to organize the information into themes that could be useful when presenting the observations to River Source.

3.4 Objective #4: Develop an effective way to communicate River Source's content to the stakeholders with whom they interact

To understand the most effective ways for River Source to communicate their contact to their programs and general communities the team conducted surveys, semi-structured interviews, along with participation observation. The most effective way to extract this data was through our semi-structured work with the multiple teachers that have worked with River Source in the past. From coding after each interview, the team noticed themes that helped identify what areas River Source was strong with relaying what they do to the public and furthermore, what areas needed a little more work.

Research existing climate education websites

To better understand ways to best communicate River source's content, we have researched prestigious and informative environmental related websites. We looked through River Source's two main websites learn.riversource.net and riversource.net in detail paying close attention to the organization, length, mobility, content, and ease of access to them. By investigating these websites our team was able to gather a deep understanding on how environmental information is properly presented to different audiences, especially high school students. The two main websites the team focused on were the New Mexico Audubon and Santa Fe Watershed website *(National Audubon Society*, 2016; *Education & Outreach – The Santa Fe Watershed Association*, n.d.). These two had pages specifically on education, which allowed us to compare them with River Source's pages.

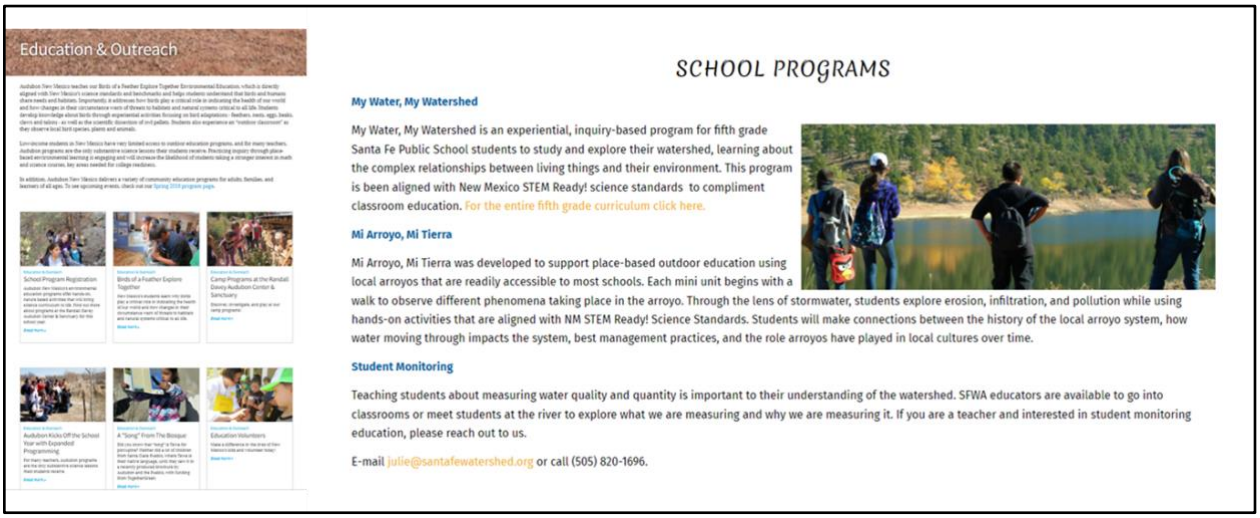

Figure 6: *Example Education pages from the New Mexico Audubon and Santa Fe Watershed websites*

Along with this, the team discovered River Sources YouTube channel, which had video content on their past trips and surveying. Understanding these two public faces of River Source from an outside perspective allowed the team to compare what was being conveyed and what was missing.

4. Findings and Recommendations

Our findings and discussion chapter reflects our understanding of River Source's educational programs. We first discuss the major content and structure of River Source's educational program. Following this, we discuss their teaching and engagement strategies. We attended field trips to observe the programs that River Source described as Watershed Watch and Outdoor Campus Assessment. From this, the team analyzed the different teaching strategies that River Source uses during the programs. Ultimately, we determined that the Through the outdoor education portion had the most student engagement. The information we learned further helped us determine the best way to share River Source's story.

4.1 River Source's Educational Program

As discussed, River Source is an international corporation with a fiscal sponsor; River Source both does consulting work on watersheds for private landowners and has an educational program. Rich Schrader and Carlos Herrera are the directors of the corporation, and they hire interns or other environmentalists when the organization has larger jobs.

In their consulting work with private and public landowners, River Source goes to ranchland or river areas that need ecological restoration. They start by monitoring the land and assessing what problems are occurring. River Source then estimates how much the work will cost. They provide this estimate to either the city for a grant to do the work or sometimes directly to the person hiring them. If the work is approved, River Source completes it and gets paid by the landowner. During this consulting work, River Source looks to eliminate problems such as erosion, flooding, and vegetation loss which can all negatively affect the way a river flows. For example, if River Source identified that flooding occurred due to the riverbank's diminishment because of vegetation loss, River Source would then plant seeds to revegetate the sides of the river. This would let the river flow smoothly again in the near future

River Source also travels to different schools to provide environmental and sustainability programs. They work with people of all ages, but their educational programs generally target 6th to 12th grade students. On November 7th and 17th 2022, our team observed River Source's educational program at Monte del Sol Charter School, where the River Source team worked with 8th and 12th grade students. The first day we accompanied River Source on an outdoor educational field day, and the second day was the final presentation of the River Source educational program. The program at Monte del Sol took place over a span of four days. To learn additional details about the program days we missed we interviewed Kari Hagel and Ty McCormick, two science teachers from the school.

Our team also attended a school program on November 11th with the Santa Fe Indian School. This trip took place in the Buckman area of Santa Fe, one of the few rivers from which Santa Fe receives its water. This program was with a group of junior year highschoolers, and their chemistry teacher Carlos Santistevan. During the program Mr. Santistevan directly assisted River Source and taught a species indexing station. Our team interviewed Mr. Santistevan and other teachers like Marion Markham.

In addition to these teacher interviews, our team interviewed Mr. Schrader several times about the educational aspects of his corporation. Through these interviews and the information, we gathered on the trips we attended, our team was able to develop and understand how the

River Sources program was run. From this, the team can fully understand the different aspects of River Source's educational program. We describe these below.

4.1.2 Overview of River Source's Educational Programs

The programs that River Source runs with schools are generally around three to six days long, the first day occurs entirely in the classroom. The following two to three days are called field days, and they are spent outside of the classroom, on a school's campus, or by a river. Finally, the program's final day or two are spent inside the classroom

4.1.3 Day 1: Presentation

Rich Schrader always starts his in-school programs with a presentation that introduces River Source, and the work team members do (see fig 7). After this, he moves on to front-loading information about relevant topics: this includes vocabulary, as well as activities that offer students context and an idea of what the next few days of the program may entail. He also includes multimedia, such as pictures and sometimes videos, which offer more visual information for students.

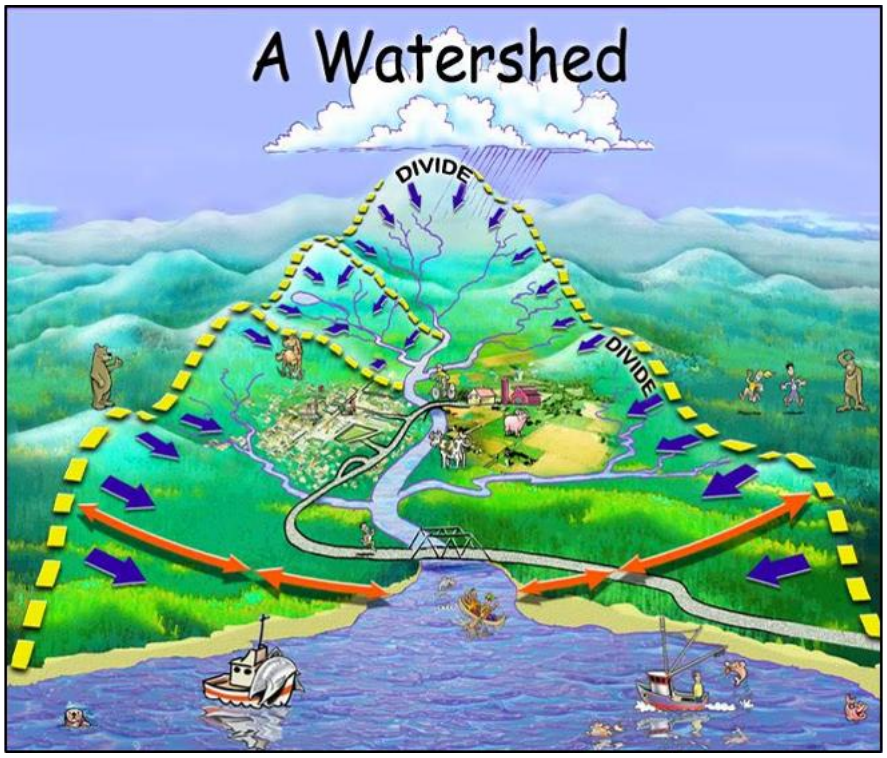

Figure 7: *An example of a slide from one of River Source's intro presentations*

4.1.4 Day (2-4) Field Days

The next few days of the program are field days, where the students participate in activities outside the classroom. The activities occur at their school or a site on a river; this site is decided by River Source and the teachers with whom they work. The educational work has two categories: 1) outdoor campus assessment, and 2) watershed watch; after both activities' participants perform ecological restoration. Ecological restoration is when solutions are provided and implemented based on the problems that River Source and the students identified. For example, at Monte del Sol school, students identified that they had some areas with vegetation loss. The students and River Source then collaborated and produced the idea to plant native grass in this area to revegetate this part of the land (see figure 8).

***Figure 8**: Mr. Herrera demonstrating to the students how to spread native seed*

4.1.5 Watershed Watch

When the outdoor portion of the program is at a river, students often complete three main activities. One activity is water chemistry, which Mr. Herrera teaches. During water chemistry he shows the students how to test different attributes of the water. For example, Santa Fe Indian School students tested water temperature, turbidity, PH levels, and conductivity. Carlos also performed a titration activity with the students to show basic chemical reactions.

***Figure 9:** Mr. Herrera starting to teach the chemistry portion of a program by a dying river*

We also observed an activity called Survey 123, where the students are given phones to take pictures of problems and provide context to collect data points. Some of the problems that River Source has the students look for are dying vegetation and sediment buildup. These surveys help the students identify and learn about specific watershed problems; additionally, River Source keeps this data to track a river's condition year after year. River Source uses this information to perform ecological restoration on the river based on the problems that student participants and educators identified. For example, River Source staff, facilitated by program participants, may notice sediment buildup over the years; this long-term data informs River Source that they need to clear out sediment build-up to allow the river to run smoothly.

The last activity performed is species indexing, where the students can put on waders and enter the river with nets, collecting insects and minnows from the bottom of the river. The students can then organize and examine these organisms in small buckets and identify them through index cards showing pictures of the insects and giving brief descriptions of them. This activity is very useful for the students because they learn about biodiversity in the classroom, and they can now understand it better firsthand with this activity. Mr. Schrader also explains to the students that the effects of flooding, erosion, and pollution affect the sizes and variety of biodiversity they find in the water. For example, one year the students may not find minnows because the turbidity of the water was too high for them to see which can be caused from sediment that got in the water through erosion.

Figure 10: *Students participating in the species indexing station, using nets to capture the species they will then analyze*

Marion Markham, a science teacher at El Dorado community school, noted that “this was the most engaging activity for the students because they directly interact with water and the organisms inside” (Markham, personal communication, 11/21/2022).

4.1.6 Campus Assessment

During campus assessment, River Source’s staff visits a school and instructs students in conducting landscape surveys and assessments; students take pictures, use drones to capture footage, and complete environmental surveys. The campus assessment generally happens on the school's land but can also happen on nearby public land that the school is looking to obtain and optimize. River Source teaches students how to identify potential issues in their landscape through these processes. The campus assessment aims to identify any land or vegetation that has been degraded or destroyed and discover possible opportunities that could make the land function more efficiently. For example, at the Monte del Sol school we observed River Source

instructing students to use GPS-capable phones to take pictures of landscape problems that River Source told the students to look for during the opening presentation. These were turned into data points the class could see from an overhead view and analyze (figure 11)

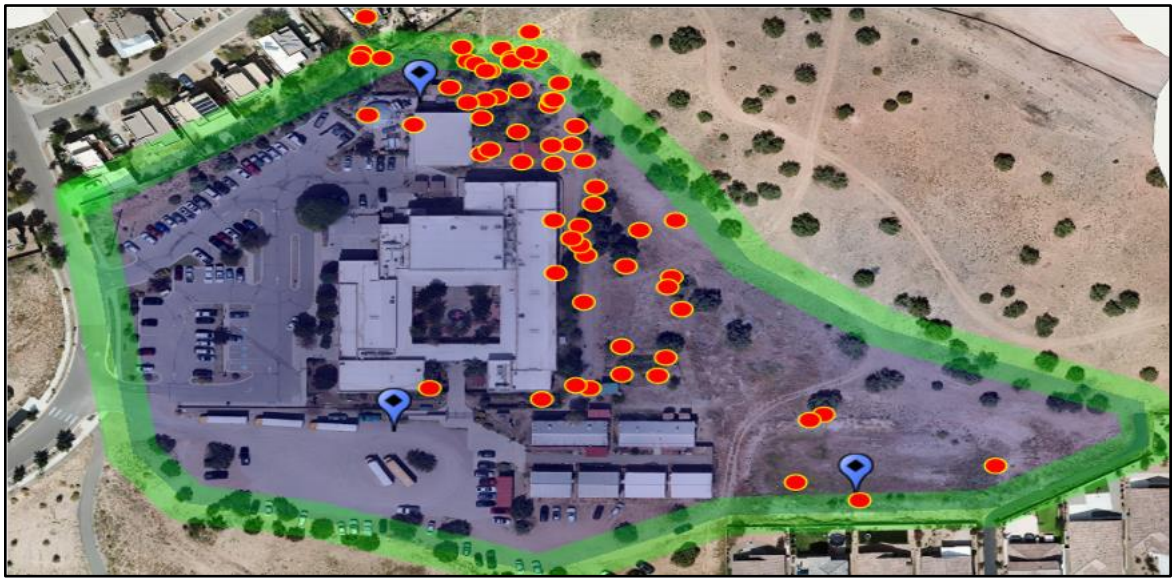

Figure 11: *An overhead view of the scattered data points that students collected from the Monte del Sol assessment of land.*

With campus assessment, River Source can collaborate with participating students to conduct ecological restoration. Through campus assessment, River Source can provide solutions and have the students work in stations completing activities that recover or fix some environmental issues found on campus. For example, at the Monte de Sol charter school, after accessing the land, students discovered that they were having trouble with erosion when it rained because there was no path for the water to be drained. River Source then based one of the students' activities on constructing an erosion canal with rocks that will gather the rainwater and limit future erosion.

Figure 12: *Pictures show Rich working with the kids collecting rocks to build the erosion control dam pictured on the right.*

4.1.7 Day 3-6 (final classroom days)

The final portion of River Source's educational program concludes in the classroom. Mr. Schrader offers a final presentation that summarizes what the students did. In this presentation, he re-explains what they learned and why it was necessary, providing pictures of the students' work. In the final presentation at Monte de Sol, Mr. Schrader also asked the students what they would like to see happen to their land in the future; this helped engage the students in something that personally affects them. Mr. Schrader also provided ideas for the upcoming programs in the following years at these schools as they identified more areas that could undergo ecological restoration.

Overall, the River Source program allows students to do active fieldwork that teaches complex concepts. In a classroom setting, students would typically learn these through a textbook or lecture. Carlos Santistevan, a chemistry teacher at the Santa Fe Indian School, claims that this hands-on fieldwork is valuable and allows the students to connect to science through nature. Mr. Santistevan compared the hands-on activities to conventional textbooks stating, “Textbooks were not made to engage students, they’re boring and dry” (Carlos Santistevan, personal communication, 11/18/22). River Source moves the focus away from the low-engagement textbooks and brings students into the real world of environmental science. River Source explains these programs and offers paid internships to students, which can expand a student’s ability for future work. This is very important as not only does it allow the students an opportunity for a paid job, but it encourages more people to get involved in environmental work.

4.2 River Source’s teaching strategies

River Source’s educational programs necessitate multiple communication strategies between employees and students. Our team found four recurring strategies within the programming: presentations, lectures, hands on outdoor activities, and personal stories. Each method helps the employees present information in unique ways. These four strategies were mainly observed while the team observed River Sources programs at Monte del Sol Charter School and the Santa Fe Indian School.

Figure 13: *Rich Schrader presenting to a class of Monte Del Sol Charter School Students. Photo courtesy of team member Tim Rinaldi*

4.2.2 Presentations

River Source shared presentation files, sample worksheets, and teacher training documents with the team for review. We used these existing documents to understand what topics are covered during educational programs. Our team accompanied River Source to the Monte del Sol Charter School, where we observed an in-class presentation given to a class of 8th graders. The same presentation was given to a separate class of 11-12th graders, and the duration was about ten minutes. The first 3-4 slides of the presentation recapped a previous program that River Source had run with the same classes and students. During this portion of the presentation, however, open-ended questions posed to the class, sparked interest for students and encouraged them to contribute answers.

The ends of the presentations are where our team found signs of disengagement in the student bodies. For example, the class of 8th grade students began to have side conversations as our sponsors were still in the middle of the presentation. In the class of 11th-12th graders, we saw students use air pods and go on their phones under the tables. From speaking with teachers, we learned that student attention spans for presentations and videos are ten minutes max and to not front load the information. When the information is front loaded, the students get the data all at once. This leads to them having a hard time understanding the complex information that is being presented.

4.2.3 Lectures

Lectures are another core component of River Source's educational programs. For both programs our team observed, we found key differences between lectures given with and without the aid of presentations. River Source employees gave effective lectures when the material was presented concisely and used terms with which the students were familiar. Our team observed that the 3-5 minute, easy to understand lectures kept student's eyes on the speaker and led to less confusion during the activities.

4.2.4 Hands-on Outdoor Activities

Hands-on outdoor activities employed by River Source are the highlight of their educational programs. At the Monte del Sol Charter, our team found that the three stations River Source set up, effectively connected students' knowledge from previous classes to tangible activities. This strategy gave students the opportunity of putting theory from River Sources presentations and lectures into practice.

Figure 14: *Carlos Herrera working with Monte Del Sol students to implement erosion control pathways on school grounds. Photo courtesy of team member Tim Rinaldi*

Working on land that the student's school maintains builds a meaningful connection between words on a screen and real life. The field work that the Santa Fe Indian School students completed had similar impacts. As we learned from our interview with SFIS Chemistry teacher Carlos Santistevan, many of the students live along and/or get water from the Rio Grande and conducting ecological restoration at the riverbanks held great significance for them (Satistevan, personal communication, 11/18/2022). River Source strives to give students experiences to deepen their connection with the land. The employees excel at conducting the hands-on outdoor activities and having students put theory into practice.

4.2.5 Personal Stories

During field trips, River Source employees engaged students in conversations. We discovered that personal stories are a large part of these conversations, and how River Source employees tell their story. Taking time in between explanations of the activities to get to know students as independent individuals is important for environmental education. Social identity is a concept that is central in environmental education, as it explains how individuals often understand information presented to them "in ways that align with and reinforce their group commitments" (Armstrong et al., 2019, p. 44). We found that River Source employees naturally tell stories during work. Students were more receptive and engaged in listening to the River Source employees after employees shared their social identities. Knowing the motivations of River Source employees-built trust with the students. Moreover, younger audiences are more open to positive climate change behavior (Armstrong et al., 2019) and by identifying with students on a personal level, River Source employees presented information to students in meaningful ways.

As an example, River Source's director of operations and programs, Carlos Herrera led the field trip for Santa Fe Indian School students on the Rio Grande. During this time, he told them about his personal heritage and background as a member of the Cochiti Pueblo. Establishing this background and his connection to the technical material that he would cover encouraged students' attention and built trust. Our team noticed, even on a cold and windy day, students became eager to get into the river and participate in activities with River Source that might have otherwise been meaningless to the students. Our team also found students breaking up into groups and sharing the connections they made between the technical content and their personal experience further enhanced the impact of the lesson. When we visited the Monte Del Sol Charter School, students were broken up into groups to rotate through the outdoor stations

set up by River Source. The smaller groups allowed each student to contribute to the activity and talk through the project with their group mates.

These four strategies (presentations, lectures, hands-on outdoor activities, and personal stories) help us answer how and why River Source communicates their story to students. The goal of the program is to inspire students to take further action against the threat of climate. River Source does this by connecting their personal stories with the environment to technical skills that are required to manage ecological disruptions. Building trust between students and employees increased engagement and receptiveness to the material and stories of River Source. The programs also provide students with a positive example of how they can further their future in the Climate and Environmental management industries.

4.3 Collaboration with Educators

Our team conducted four interviews with teachers and educators for whom River Source has run programs. We found that the majority of teachers learned about River Sources programs through word of mouth. Many heard of River Source through their colleagues and had never visited River Source's website. We found some relevant information on the website regarding River Source's story and the services they provide but found a lack of knowledge of the website amongst teachers. On their website, there is no publicized way for educators to reach out to River Source. Because of this, we found that many of the educators we interviewed contacted Mr. Schrader directly. There are additional ways that River Source could make itself known to schools. One of our interviewees, Ty McCormick, a teacher at Monte Del Sol Charter, suggested that River Source try to attend teacher professional days or workshops to further expand their network.

Teachers loved the programs that River Source ran, all expressing positive feedback for the hands-on outdoor activities. We learned that River Source programming was most effective when teachers collaborated with River Source employees on the technical content covered. In our interviews with educators, they stated that when the material from the River Source programming coincided with the curriculum that was taught in their classes, the students were more engaged.

Once the two parties agreed on what to cover, the teachers were supportive and thankful for the programs that River Source provided. For example, Carlos Santistevan, a chemistry teacher at Santa Fe Indian School, expressed that after the first couple of visits River Source made with his classes, he was able to work with River Source employees to better design their programs with a focus around the topics he covered in his class. Mr. Santistevan noticed that once the topics in River Source programming were aligned with his class

Figure 15*: Mr. Herrera and Monte Del Sol Sustainability teacher Kari Hagel flying River Source's drone. Photo courtesy of team member Tim Rinaldi*

curriculum, students were able to gain more knowledge from the program.

Our team determined that this dynamic between River Source employees and the teachers is crucial to the success of the programs. Collaboration between educators and River Source employees is the first step in developing a comfortable learning environment for students. Our team read agendas that River Source used in the past to give to the teachers, as well as agendas for teacher training days that River Source conducted at their office. Our team was not able to go to any of the teacher training programs, which limits our findings on this topic. However, from reviewing the existing documents and interview responses we gathered, we found that River Source would benefit from having a concrete method of getting educator feedback and collaboration.

4.5 Engagement Gap Between Teaching Strategies

After analyzing field trips and interviews notes, we saw an engagement gap within the different teaching methods. The two main teaching methods are indoor learning and outdoor education. From these two different methods, we saw that River Source presents critical concepts and data visualization during the indoor learning portion. The outdoor education aspect had hands-on activities related to what they learned in the classroom. What worked well with the students in the program was the outdoor education portion. Students could perform hands-on activities outside at school or by the river. From this, they could visualize, analyze, or solve the problems they saw in class. Our team surveyed Monte del Sol students, and figure 16 shows that most students did learn from their outdoor fieldwork.

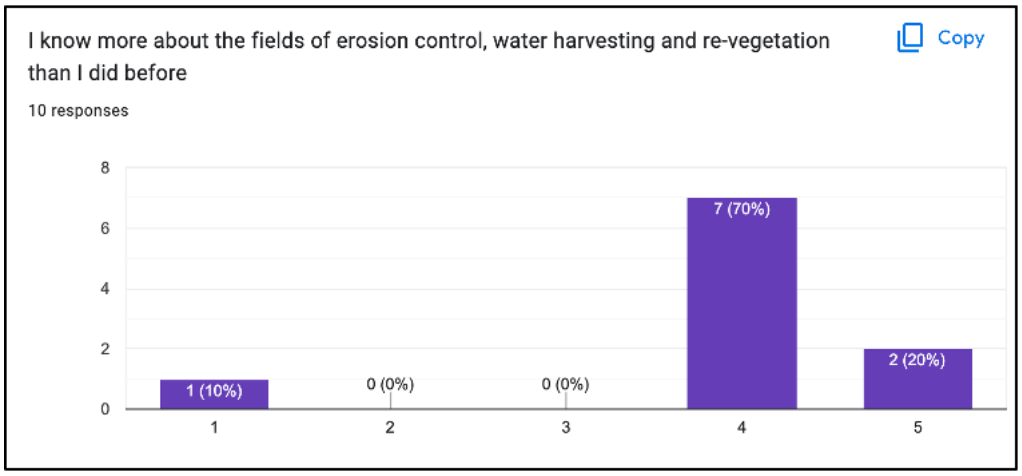

Figure 16: *Survey Response from Monte del Sol students*

Looking at these results, we can see that 90% of the students learned more after completing the outdoor field activities about erosion control, water harvesting, and re-vegetation. A common theme from the teachers we interviewed was that having the students be outside was the best way to get them excited and engaged about what they were learning. As Ekwueme argues, "[h]ands-on-approach has been proposed as a means to increase students' academic achievement and understanding of scientific concepts by manipulating objects which may make abstract knowledge more concrete and clearer" (Ekwueme et al., 2015, p. 47). From the observations and interviews, this concept was clearly shown as the students could make the information, they retained relevant to their lives. The information relating to the students allows them to engage more due to the personal connection. For example, at the Santa Fe Indian School

field trip, Carlos Herrera explained that if waste were dumped in the river, the water the students use at home would become contaminated.

After being able to experience the different aspects of River Source's educational program, we saw that the indoor learning portion was where the students were less engaged. Teacher Kari Hagel stated, "there's a disconnect due to COVID…many students can't sit still" (Kari Hagel, personal communication, 11/19/2022). From our observations, we noticed that the students seemed to lack interest in the topics that were in the indoor presentations. Once they got to the hands-on activities outdoors, engagement increased. The team observed that overall, the indoor portion had not been as effective as the outdoor education aspect.

4.5 Effective methods to communicate River Source's content

Initialization of a program with an organization or educational institution is the most important first impression River Source can make. This was our team's main question to understand River Source's outreach: how they initialize a connection with an educational institution or community for their programs. We interviewed Marion Markham, a science teacher from the El Dorado community school that has been working at River Source for about 7 years now. Her journey with River Source all began when Mr. Schrader personally emailed the school. That email then passed from one teacher to Marion. In this instance Mr. Schrader initiated the connection by reaching out first. All interviewees noted that Mr. Shrader reached out to them to initiate the relationship. Among all interviews, Kari Hagel and Carlos Santistevan, the River Source website or YouTube channel were mentioned as their means of learning of River Source. In fact, in a survey from 10 respondents taken at Monte Del Sol, only 50% of students remembered that River Source had a website. That being said, a follow up question was presented with 70% agreeing they wanted their surveyed data and programs displayed on a website. This shows that the demand for this informational platform is there and wanted.

Secondly, the team wanted to understand how the public face of River Source was represented and understood by educational institutions and local communities. One main theme that the team extracted from our interviews is that River Source's programs are so far communicated by word of mouth between communities and teachers. In the case of Carlos Santistevan, the start of his collaboration with River Source began when a teacher who previously worked with Mr. Schrader contacted him directly. An intern at River Source, Tian Sandoval, firstly heard about River Source through his teachers informing the class, which then followed with him applying for the internship. In all of these cases, River Source was brought up purely through word of mouth, which then initiated working with them.

Following these findings, the team asked each interview about various methods they thought were beneficial for organization outreach. The most popular suggestion was getting the website more engaging and visual. Along with this, more information about their programs that were clearer and more concise was a popular request. Our team had also asked in our interviews if a promotional video on the website would be a benefit. This suggestion of a promotional video that was engaging visually explaining River Source's whole story that could be right on their main website was received with affirmation from all of the educators we asked that worked with River Source. A visual like a video in River Source's programs was also a popular idea from our interviewed teachers.

4.6 Recommendations

To engage students further in River Source's programs the team suggests from our findings that more visuals could be implemented in their programs. With a few additions, the existing website can be a very powerful tool that would suit River Source's needs for spreading awareness of their story and services. With the increased visuals, students are more likely to engage on more difficult topics like the first big lesson: explaining what a watershed is. As seen in a report by the National Teacher Training Institute, "teachers who use instructional video report that their students retain more information, understand concepts more rapidly and are more enthusiastic about what they are learning" (By the Numbers, 2017). Increased pictures and visualized data can help connect students to what certain concepts mean and why they are doing what they are doing before the program starts. Teachers called this front-loading the information in the first couple presentations before using it out in the field. In our interviews, multiple teachers suggested that this method was effective, so students understood the concepts and key terms before hearing them in the field. Without this step of front-loading terminology and concepts, students may experience disconnection in their learning.

Another important factor in a program is to create acknowledgement and closure on an activity or program before moving on. Giving a student acknowledgement after they just learned about a concept could be doing any activity outside that reflects the knowledge. This is one of River Source's strongest areas as seen in our interviews with the teachers. Making sure to connect the data the students learned to activities is a crucial step toward affirmation on what they learned and why it's important to them. Doing activities is a great way to get students more engaged in their topics so they can connect what they are doing physically to what they have learned. This can create a deeper understanding and appreciation of their learning. Our team recommends developing an official form to give to teachers prior to the start of programming to establish relevant material to cover. This is to ensure the success of the programming and strengthen the relation between teachers and River Source employees.

Finally, for our deliverables we created three videos to help River Source communicate their content. We have two promotional videos explaining what River Source is and why they educate. Then we have an education video explaining and demonstrating what a watershed is. To see the scripts used to create these videos refer to appendix E and F. From our interviews with River Source employees, we found that introduction material is where students get confused the most, particularly when introducing the concept of a watershed. To assist with this, we developed a short, animated video to help facilitate the basic information. These three videos would be placed onto the webpage that we created to help publicize their story and services.

5. Conclusion

River Source's educational programs allow students to learn about different environmental topics in the traditional way, while incorporating outdoor education. These programs get students engaged by doing hands-on activities to visualize what they learn in the classroom. Despite that, there is a struggle with getting River Source's full story out to the public. By doing participant observations and interviews we provided deliverables like a promotional video that can allow the students to be more engaged during the indoor learning. The video consists of an animation showing what a watershed is. We created two additional videos explaining River Source's organization as a whole and then why they educate. Along with that we hope an addition to River Source's website can help promote their story and educational programs to the public better. The webpage would include a description of the educational programs, with pictures provided. Having this video be accessible to the public, allows people to see how River Source deals with current climate events. It is important for these to be publicized due to the ongoing effects that climate has on society and land that we live on. More importantly, the students can see that while issues occur, there are ways to actively help solve and prevent them.

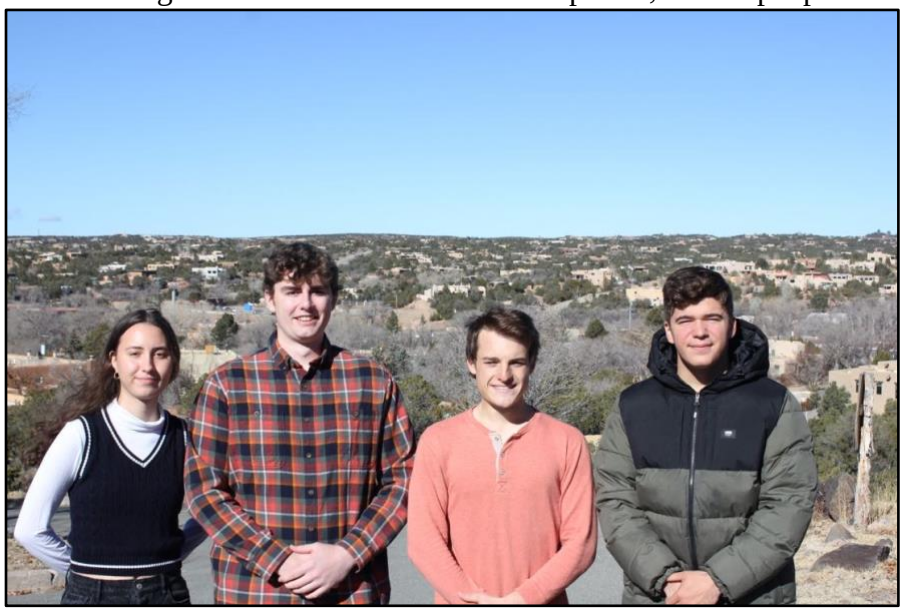

***Figure 17**: Left to right: Vincenza Burdulis, Clayton Hanlon, Tim Rinaldi, Giancarlo Orlandi. Team Watershed!*

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7. Appendix

Appendix A: Interview Questions for Teachers

Informed Consent Agreement for Participation in a Research Study "Climate Adaptation Strategies for Watershed"

Investigators and contact information:

- Giancarlo Orlandi (ggorlandi@wpi.edu)
- Vincenza Burdulis (vrburdulis@wpi.edu)
- Clayton Hanlon (cbhanlon@wpi.edu)
- Timothy Rinaldi (terinaldi@wpi.edu)

- SF22 Team Watershed (gr-SF22.riversource@wpi.edu)

Preamble: We are a group of students from Worcester Polytechnic Institute in MA. Our purpose for conducting this interview is to develop a toolset for our sponsor, River Source, that aims to provide them with strategies to enhance their connection with students. For this interview, we wanted to ask questions about your experience interacting with River Source and the information that the organization presents. The interview will be about 30-45 minutes. Your name will be kept confidential unless you give us permission to use it. This interview is voluntary. You may skip any questions that you do not wish to answer. You may also stop at any time. This research will be available to the public via the WPI Library. Please feel free to ask any questions you have about this research at any time. You may also contact our research advisors, Prof. Zoe Eddy and Melissa Belz, at zeddy@wpi.edu and mbelz@wpi.edu, or our group at gr-sf22.riversource@wpi.edu, with any questions you have about this process.

We would like to record our conversation only for our note taking. Please let us know if it is ok to record audio of this interview.

Purpose: The goal of this project is to develop a model for River Source to enhance their methods of data communication in the educational programs they give to school age individuals in the local communities of Santa Fe and Mora counties.

Procedures to be followed: This interview will ask you to reflect on your work with the students at Monte Del Sol Charter School. The Survey may also ask for additional information including effective communication strategies between schools, outside organizations, and families and perspectives on future goals.

Record keeping and confidentiality: By agreeing with the terms, you are consenting to helping us learn about this experience and its impact on the younger generations of Santa Fe. You should feel free to answer at any level to which you wish to disclose. Your responses will come to us as anonymous entries. We may have a sense about who completed it but cannot tie the data back to particular participants. We will also be sharing this information with our advisors for evaluation

purposes anonymously. This survey is not mandatory, and your consent is given freely of your own choice.

Any publication or presentation of the data will not identify you, unless you agree to be identified.

For more information about this research, contact the investigators (email addresses are at the top of this document. You can see the final project by emailing a request to our contact information or by using keywords in the search at https://digitalcommons.wpi.edu/iqp/

Your participation in this research is voluntary. The project investigators retain the right to cancel or postpone the experimental procedures at any time they see fit.

By agreeing to the above terms, you acknowledge that you have been informed about the study and wish to consent to participate. You will be asked again after completing the survey for your consent as a matter of respect for your right to change your mind.

Interview Questions

1. Can you give a brief introduction of yourself and your position at Monte del Sol Charter School?
2. What are some of the biggest challenges you have in presenting complex information to students in a way that sparks interest rather than confusion?
3. Can you talk about any methods you have found in communicating with the students that enhanced their experience in the classroom? Presentation techniques, lecture vs seminars? Open discussions?
4. What are some administrative challenges that you face regarding resources that you would like to implement into your programs, and the capabilities of Monte del Sol Charter to support you?
5. When organizations like River Source run programs with your classes, what are some areas of improvement you would like to see in the way they present information?
6. Can you describe the process you have to take to get an organization like river source to come to your classes?
7. Can you talk about what knowledge of River Source did you have before they came to your classes? Did you engage with their website?
8. What role do you see learning outside the classroom play in your students' educational experience?

Appendix B: Interview Questions for Interns

River Source Interns (present or past)

1. What motivated you to become an intern at River Source?
2. Why is it important for River Source to increase student participation in their respective watersheds?
3. Can you talk about why it's important for watershed management information to be available to students and younger generations of communities?
4. Can you tell us about any experiences you had working in the classroom or with school students?
    a. What activities did you feel students enjoyed the most?
5. What tools have you used with River Source that you would want to see in the hands of students?

Appendix C: Part of our code for organizing semi structured interview data

	Subject	Xavier Barraza	Tian Sandoval	Ty McCormick
	Position	EEJ Coordinator - Los Hardines Inst.	River Source Intern	Life Science teacher and dual credit - MDS
River Source's Story	Student engagement	Think/Pair/Share with students to increase engagement	Ran survey 123, and believes that this is important to show the kids how to collect data and the tech engages them	Many of the students don't really want to know the information as the world is changing in a way that isn't benefiting us
			Students enjoy working with the water	Information has to be reinforced during activities
			Working in groups as they like to learn in groups and with each other	Teaching them in the class and then getting them to do hands on
			When the teacher gets involved it gets the students even more engaged	Students become teachers "Teaching is the highest form of learning"
	Student/Instructor disconnect	Knowing that each student creates knowledge rather than decimate		Teaching is the most effective way to learn
		Best way to learn is to teach and vice versa		Make more teacher friendly - have the technology to plug in the data
		Instructors aren't there to fill heads with knowledge, but to encourage conversation what students already know		After outdoor education have a portion afterwards that reinforces what they learned
		Share dont tell		When looking at what's happening break it down in the simplest way - look at future effects and the changes that can be made

Carlos Santistevan	Kari Hagel	Marion Markham
Chem and Physics teacher - SFIS	Env. and Life Science Sustainability Teacher - MDS	Science Teacher - El Dorado Community K-8 School
Textbooks aren't written to engage the students "boring and dry"	5-10 minutes max on student attention	Deeper learning stations require quicker rotations (more movement)
Carlos using humor with students	Makes the information relevant to students - asks questions that are directly relevant to them	Don't talk more than 15 minutes without student response or activity
Passion for the content	Relates it back to their family	8-10 minutes of attention span
Connect content to cultural or traditional relevance	There's a disconnect due to covid - many students can't sit still	Thinks the chemistry section is to long to be taught all at one station
RS took classes down the Rio Grande to do erosion control,		Technology with the phones engages the kids
		Marion says the species activity is the most engaging
	If there's too much data the students get bored and don't pay attention	if you can get kids to wonder why something happened, they tend to gain interest
	Too complex - simplified curriculum	Teacher loves hands on data
		field trips excite the students, and there is a sligtly deeer willingness of students to enagege after Rich's prgram
Underserved population - little formal science education	Doesn't frontload the information	Front-load knowledge and vocabulary before programs
Don't front-load knowledge and vocabulary before programs	Many are bilingual so there's a language barrier sometimes	Lack of connection on high concepts like watersheds
Has to spend time filling in the gaps with skills and thinking process		8th graders more equipped to understand connections than 7th graders
Small groups help students share knowledge		Hard to move from concrete to abstract concepts
RS initial visit wasn't relevant to the material that was being taught in class		Chemistry activity is great but could be broken down into a few time periods to keep kids attention span
		Chemistry too early for 7th grade
		Rich sometimes talks about certain topics for to long loosing kids attnetion

Appendix D: Survey Questions Given to Monte de Sol Students

Monte de Sol Land Assess + Restore Feedback

Thank you for participating in the Land, Plants, and Water Assessment & Restoration! We want to make the educational experience interesting and relevant to you so please help us by answering the following questions:

What grade are you in? *

- 8th grade
- 9th grade
- 10th grade
- 11th grade
- 12th grade

My favorite part of the outdoor field work was: *

Short answer text

I learned something about how to stop soil erosion, re-vegetate the land, or harvest water, like: *

Short answer text

Read the following statements and select how much you agree or disagree with each statement.

Description (optional)

I think water, land, and forestry work is a cool field to study or work in *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I think water, land, and forestry work is interesting, but it's not for me *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I know more about the fields of erosion control, water harvesting and re-vegetation than I did before *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

The big take home message I heard on the field trip that I might share with someone is? *

Short answer text

Please list any words or terms that you didn't understand in River Source's presentation *

Short answer text

Are you aware that River Source has a website?

- Yes
- No
- Other...

Would you like to see the projects you took part in on River Source's website? *

- Yes
- No
- Other...

Appendix E: Who are we? video script

Title: "Who is River Source and what do they do?"
Target length: 2:00 mins
Target audience: general public

Who is River Source and what do they do?
Video Script

Why do they matter? - Hook

With rising climate temperatures and lack of rainfall, New Mexico is facing the harsh results of drought, flooding, and forest fires that are destroying the land leaving deep impacts on the communities.

It is more important than ever that New Mexicans become aware of how water conditions are changing and how they can affect them now and in the future so people can take action to make their communities, rivers, and forests healthier and more resilient.

This is River Source's mission: to support people living as good stewards of their watersheds by providing watershed education, teacher training, ecological restoration, capacity building, and job pathways in watershed restoration.

How are they organized?

River Source was founded in 1997, by myself, Rich Schrader. With funding from contracts and later through grants and support from organizations over the years, River Source has grown in size and publicity.

My main colleague Carlos Herrera is the Projects Director and has been a crucial member of this adventure, joining the team in 2011.

River Source also works with a diverse group of part time members, volunteers, contractors, and our interns who we hire in our Watershed Academy internship program.
What does River Source do?

Our staff offers education, research, design, planning, and monitoring services for schools, communities, agencies, and landowners seeking watershed resilience across New Mexico.

River Source works to activate people to seek and test solutions for addressing environmental degradation. We seek and invest in people who, like spark plugs, initiate and spread watershed resilience work in their communities and across the landscape.

We typically provide hands-on experiences in watershed monitoring and ecological restoration for over 3,000 adults and youth each year.

How to get involved?

To continue learning about our programs and our mission, explore our websites riversource.net and learn.riversource.net.

Thank you and we hope to see you in the field by your river and watershed soon!

Appendix F: Why do we teach? Video script

Title: "Why does River Source Educate?"
Target length: 2:00 mins
Target audience: students and teachers

Why do they matter? - Hook

With rising climate temperatures and lack of rainfall, New Mexico is facing the harsh results of drought, flooding, and forest fires that are destroying the land leaving deep impacts on the communities.

It is more important than ever that New Mexico community members are aware of these events and how they affect them now and in the future.

This is River Source's mission: to support people living as good stewards of their watersheds by providing science and policy education, planning, monitoring, and ecological restoration services throughout New Mexico.

How are they organized?

River Source was founded in 1997, by myself Rich Schrader and has grown throughout the years, gaining support and members like my colleague Carlos Herrera who has been a huge help with managing data and reports on our projects and field work.

Why are our programs important?

By capturing data through surveying and drone footage, River Source will work with you to teach real world skills and understand the importance and impacts of the results.

As you work with our team, you will get out of the classroom, work with professionals, and explore different conservation projects like water quality testing, revegetation, willow basket making, and streamline flow and monitoring, making an impact on your local community along the way!

How to get involved?

To continue learning about our programs and our mission, explore our websites riversource.net and learn.riversource.net.

Thank you and we look forward to learning with you!