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Charlie Blumenstein Stewardship Internship Final Report

Carpenter Ranch Preserve, Hayden, Colorado

Summer 2024

Introduction

For the duration of summer 2024, I had the privilege of living and working on the Carpenter Ranch in between Steamboat and Hayden Colorado. Throughout this internship I gained numerous skills and experiences that truly made this opportunity invaluable to me. In the quiet of the west, I gained a better understanding and appreciation of the agricultural community and the intersections of community and environmental stewardship. With support from The Nature Conservancy (TNC), I was able to complete my own field study on rising temperatures in irrigation ditches, involve myself in ongoing projects happening on the ranch, give tours of the property I quickly grew to love, and find space for myself in Colorado land conservation.

Throughout my life I have always had a connection to the outdoors and more specifically the water. I grew up in Fort Lauderdale, Florida with the intercoastal down the road, the beach a 15-minute drive from me, and the Everglades a 20-minute drive. This privilege instilled an appreciation for the ecosystems around me and a feeling of great responsibility for my own environmental stewardship. Throughout high school, I pursued these interests by being heavily involved in the Environmental Science and Everglades Restoration magnet program via my course selections and community service commitments. However, upon moving to Colorado I felt an extreme disconnect from that side of myself as I began to pursue a chemistry degree with a physics minor on a pre-engineering track. Suddenly the time I had previously dedicated to being outdoors had been dedicated to studying in the library as I had no idea where to begin in

such a drastically different climate and terrain. Through my internship this summer, I was able to find a place for myself in Northwestern Colorado terrain as I explored the Yampa River and the globally rare riparian area. I was able to appreciate the Bobolinks as they nested in the hayfield, the crawdads in the river, the marmots under the barn, and so many more species I had never seen before. That feeling of deep appreciation was found once again as I learned and worked on the ranch.

Day to Day Activities

My favorite aspect of this job was that every day looked different for me. There was no one set role that I created for myself on the property, which gave both Matt, my supervisor on Carpenter Ranch, and I the flexibility to control our own schedules. Some of my main responsibilities included landscaping on the property, providing tours and information to guests, and painting the interior of the intern house. It was in these roles that I gained very valuable experiences and life skills that I will continue to carry with me throughout my career. With Matt's guidance I learned basic maintenance skills that are necessary but unapplicable to someone who has lived their whole life in apartments. For example, through weed whacking and trail mowing I learned how to use a pull start engine, or even more basically how to use a clutch on the 4-wheeler. After this summer I can confidently express that I am competent in these general skills to future employers, only adding to my value as a possible employee. Even with the simpler task of painting, I gained a better understanding of what type of paint is necessary in which rooms, how to caulk, and a greater appreciation for my own hard work as it will be appreciated for years to come.

Outside of general maintenance tasks, I was also involved in ongoing water monitoring projects that would eventually inspire my personal research project. Every day I would use the ranch truck to drive out to the Marshall Roberts and Sage Creek irrigation ditch and hike to their respective flumes to document the water levels and photograph the flumes. These flumes correspond with the CFS, cubic feet per second, of the water flowing in the ditch which can be imagined as roughly one basketball of water per second. I would take the data that I collected and input it into a spreadsheet along with the USGS Yampa River flow rates to provide a frame of reference for our ditches. At the end of the summer, because I am interested in mathematical modeling and analysis, I graphed the data to provide visual and statistical analysis of the summer's flow rates. With this the Nature Conservancy can determine if Carpenter Ranch is receiving the water it is supposed to as detailed by their senior water rights. This information is useful for The Nature Conservancy as they are conscientious of their water usage from the Yampa River with a mission to balance productive agriculture with environmental responsibility. Through the mentorship of The Nature Conservancy's water team, such as Jennifer Wellman and Diana Lane, I was inspired by both the deep dependency and appreciation that the community and The Nature Conservancy have for the Yampa River.

Additionally, in the time frame when the other two interns from the University of Redlands were working with me, I was able to explore how to use GIS through easement monitoring and game camera hanging. With the addition of two other people on our team who both had previous experience with using and studying GIS, Matt felt comfortable sending us into the field to monitor easement points on the Carpenter Ranch Property and the Yampa River Preserve. For this I learned how to download field maps, navigate the ArcGIS program, and upload monitoring points from the field to the company's ArcGIS online account. While in the

field we would also hang game cameras as part of Chelsea Beebe's project for TNC's science team with the goal of documenting what wildlife is prevalent in areas of the property.

Every other Thursday afternoon, the Ranch would also be visited by a Rocky Mountain Youth Corps (RMYC) group. I assisted the groups in performing various projects around the ranch during each of their visits. Some of these projects included weeding invasive species from the property, re-mulching paths around the Ranch house, and watering over 100 Cottonwood trees planted on the bank of the Yampa River by the William's ditch to counteract some of the degradation effects. Their visits were always a warmly received change of pace from the usual quietness of the ranch. As someone who spent a lot of my youth involved in a similar program in my hometown, seeing these kids spending their summer excited to be outdoors reminded me of the environmentalist part of me with which I was trying to reconnect. I also learned a lot from the counselors who work for the RMYC about what youth outreach and environmental stewardship looks like in Steamboat, Colorado.

Events

As a part of The Nature Conservancy team, I also had the privilege of being invited to a few events where I was able to learn more about the intersection of community, agriculture, politics, and environmental stewardship in this area. One of these events occurred on June 28th, 2024, for the Maybell Float. Due to my interest in the water team, Jennifer Wellman invited me to participate in the celebration of the completion of the Maybell Diversion project that had been ongoing since roughly 2017. The project's main goals were to modernize the headgate at the Maybell Ditch Diversion to reduce droughts in this stretch of the Yampa River for rehabilitation. With this, more water will be available for the agricultural community by reducing water waste

in the area. There will also be better passage and habitat for the endangered and threatened fish species that live in this habitat. To celebrate this feat, partners of the project were invited to float down this stretch of the Yampa to see the new headgate up close and personal and appreciate all the hard work that everyone put in for it to become reality. Some of the guests included Mike Camblin, a rancher in the community who uses water from the Maybell ditch and also acts as the President of the Maybell Irrigation District, three of the environmental engineers who spent over two years designing the new headgate that can be controlled and monitored from a cellular device powered via solar panels and radio technology, Colorado State Senator Dylan Roberts and Colorado State Representative Meghan Lukens who both helped secure federal and state funding for the project, and other pillars of the community invested in the recreation of the area and the preservation of such an important habitat.

Coming from Florida, where water quality was always the main priority, I was surprised to learn of the long and ongoing history of water scarcity in the West. The improvement of 100-year-old infrastructure is necessary for all members of these communities and requires the input of everyone for the solution. Seeing the passion of the participating members of this float and their determination to continue making improvements like these was truly remarkable. Additionally, as an aspiring engineer the complexity of the headgate was really fascinating to me as it required a deep and seamless understanding of the river and the technology. This experience shaped the way I see careers in the environmental field, as I hadn't been exposed to them prior. Before I imagined a lot of individual field work, but now I understand the amount of collaboration that happens to accomplish these projects.

Additionally, I also had the privilege of participating in the Attorney General visit on July 25th, 2024, at Carpenter Ranch. TNC is a participating member in many communities around

Colorado, especially in Routt County as Carpenter Ranch acts as an educational and meeting center for the area. Attorney General Phil Weiser and his team visited Carpenter Ranch to discuss with Matt and other TNC employees their continued conservation projects. It was interesting to see the intersection of politics and environmental preservation and how both parties need each other's support. This visit, and others from different groups in the community, provided a lot of insight into how there isn't a single organization who could fix these problems on their own.

Research Project

The main draw for this internship was the opportunity to conduct an independent research project. Coming in, I knew I would be really interested in the water projects and management that The Nature Conservancy was deploying on the property, however, I only had the aforementioned experience of environmental stewardship in Florida, where water quality was our main priority. After speaking with Jennifer Wellman, the head of the water team in TNC's Colorado Business Unit, shortly after my onboarding, I quickly realized that water quantity was TNC's main priority. For good reason, as in the spring the Yampa flows fairly steadily as snow melts from the Rockies but as the temperatures increase and the snow fully melts, the water level significantly drops and needs to be rationed to the community and agricultural sector to ensure no one goes completely without.

However, this did not mean that water quality wasn't an issue in Routt County. Between Steamboat's large recreational tourism industry and the extensive agricultural runoff, pollutants like phosphorus and nitrogen find their way into the river decreasing the quality and impacting the natural habitats. The Yampa River has been monitored over the years by local organizations such as the Friends of the Yampa, the Yampa Valley Sustainability Council and the USGS to

track the effects the pollution may be causing. Some of these reports have been used to rationalize the increase in cyanobacteria and algae within the upper Yampa River basin. The presence of these bacteria in the water decreases the quality of the water as they absorb the healthy nutrients and dissolved oxygen in the river's ecosystem. After my conversation with Jennifer Wellman, I decided that it would be interesting to see how the water from the Yampa is being impacted as it moves through the man-made irrigation ditches and whether the globally rare riparian area that we protect is helping mitigate some of the damage through shade coverage and filtration along the ditch banks. Also, collection of data on water quality in the present is imperative for analyzing how our ecosystems are being impacted by climate change in the future.

To further focus my study, I decided to deploy specific sensors that I had available to me through TNC. HOBOware, the name of the company who produces the sensors, has a multitude of specialized technology for field water data collection available. TNC had purchased their Water Temperature Pro Version 2 sensors that they needed someone to program and deploy. The sensors work by collecting data for extended periods of time and then using a coupler to download the data onto a base station that can communicate with a computer with specialized software. From here the software can provide interesting statistical analysis, graphs, and easily accessible raw data that can be used for interpretation. To deploy the sensors, Matt and I went to the Yampa River Preserve and chose 4 separate locations, where we used zip ties to fasten the sensors to PVC pipes attached to rebar, and secured the rebar submerged in the bed of the ditch.

After some discussion with Matt and Jennifer, I chose a one mile stretch of the Marshall Roberts ditch to study for a multitude of reasons. For one, it was the closest accessible space to the main channel of the Yampa River that contained spaces with shade coverage from the Riparian area and space exposed to the sun. The mile stretch also contained a convergence from

a separate ditch (the Grassy Creek ditch) that could provide interesting data on whether the ditch was being impacted by the separate water source. Lastly, I had previously identified filamentous algae within this stretch of the irrigation ditch that had peaked my curiosity for this project. Using ArcGIS online I was able to map the sensors on an accessible map and identify the tree coverage percentage in each location using the USA National Land Cover Database (NLCD) Tree Canopy Cover layer.

By collecting this data, I was able to make some interesting conclusions that related water temperature to water quality and possible algae populations. I discovered that the distance from the headgate, where the water from the river enters the ditch, may be less important than the actual depth of the irrigation ditch. I determined this by comparing my data to the dates at which the water was the lowest as documented through TNC's water monitoring and noticing a pattern of more extreme temperature change at lower depths compared to further distances. Also, it was determined that during the day the ditch water remains steadily over 68 degrees which is the threshold temperature for cyanobacteria growth that could be contributing to the increasing algae populations. Lastly, there was a relatively low standard deviation of temperature change per day of 3.267 degrees, which could be attributed to the high percentage of canopy coverage providing shade from the intense UV of the summer.

In this experience, I gained a better perspective of what studying water entails and the multitude of factors that contribute to water temperature. My hope is that TNC will continue to collect data on water quality in the Yampa River to make more connections to algae populations, agricultural runoff, and increasing temperatures. Personally, this research significantly improved my confidence in my ability to accomplish something that I have never attempted before. It also

gave me a place to explore what stewardship means to me in Colorado, which I will carry with me into my future endeavors.

Reflection

In my time on Carpenter Ranch, I had the opportunity to grow in capacities I wasn't expecting. The independence and quiet of the ranch facilitated space for self-exploration outside, but also within. For the first time I was living alone and separated from the city or the College atmosphere that I was familiar with. I came to know the person I truly am outside of my academic career through work that was unconnected to my major. With this, I was able to study something interesting and meaningful to me without the pressure of a correct result which only reinforced my passion for learning new things. This experience also taught me the value of work life balance, and being able to exist for other reasons than work performance. I had time to pursue old hobbies such as reading, hiking, and cooking as well as new hobbies such as bird watching, meditation, and journaling. Working on the TNC team I also developed a better picture of what I want my future career to look like with the knowledge that environmental activism jobs take many different people with different expertise, not just biologists and environmental scientists.

The Charlie Blumenstein Stewardship Internship gave me new experiences and skills that I will carry with me in all aspects of my future, and I am extremely grateful to everyone who contributed to this position. A special thanks to;

- Matt Ross for his constant willingness to teach me new skills and include me in all aspects of working on the ranch;
- Sally Ross for always treating me with kindness;

- Jennifer Wellman for reinspiring my passion for water science;
- Ana Sanchez for a warm welcome to TNC and support throughout the summer;
- Anya Byers for her compassion and support;
- Lucy Haggard for their patience and willingness to teach me how to use ArcGIS;
- Catherine Schloegel for encouraging me to pursue my research idea and help saving a marmot;
- Dr. Diana Lane for her willingness to teach me about TNC's water management plans;
- Belle Zars for sharing the Carpenter Family history with me;
- The Blumenstein Family for making this opportunity possible and having the faith in current CC students to continue Charlie's legacy and pursue joy in the outdoors.
- The Charlie Blumenstein Internship Steering Committee for spreading information about the internship which encouraged me to apply, and taking the time to be a part of the application review process;

and everyone else who supported and encouraged me this summer.