



Editors' Preface

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The 2013 Colorado College State of the Rockies Report Card

Brendan Young

Celebrating Ten Years of Focus on the Rockies

Colorado College President Jill Tiefenthaler's Introduction to this *Report Card* describes the decade-long effort of the college to create its Rockies Project. We appreciate the guidance and support of the college over these years as teams of student researchers have explored key challenges, written reports published in the annual *Report Cards*, and brought to campus experts able to help the campus and community engage in dialogue. Our two-year long focus on the Colorado River Basin has brought new dimensions to traditional efforts of the Project.

This shared topic covering 2011-12 and 2012-13 has made possible new dimensions to our work and has broadened the project and its outreach. Recent CC graduates have served as field explorers, during 2011-12 carrying out a 1,700 mile "source to sea" kayak trip from the origins of the Green River in Wyoming down the Colorado and to the delta. During 2012, four field explorers traced the origins of the Colorado River near Rocky Mountain National Park to the end of the Grand Canyon National Park, doing water quality studies and interviews with stakeholders. Social media have accompanied these new dimensions to what some call "citizen science" and

others describe as "adventurers assisting science." Original videos, blogs, Facebook posts, and speaking tours, such as a Fall 2012 lecture tour among the northeast Ivy League universities, immensely broaden our outreach in ways that speak to other age groups and constituencies.

The Colorado River Basin: A Second Year of Focus

The Colorado River Basin, covering a major portion of the eight-state Rockies region and extending into Mexico, has been the unified focus for all parts to the State of the Rockies Project during summer 2011 and the 2011-12 academic year and again for summer 2012 and 2012-13 attention. This basin encompasses portions of seven states in the American Southwest and continues into Mexico, supplying water to households, communities, businesses and farms, as well as natural ecosystems. Roughly 40 million people rely on the river for water, energy, food, and healthy ecosystems. Climate studies indicate the potential for inadequate water supplies throughout the 1,700-mile river system from the origins of the Green River high in Wyoming's Wind River Range to its historic outlet over the Colorado River Delta, emptying into the Sea of Cortez. Along its twisted path arise majestic mountains, deep canyons, tributaries, and a wealth of flora

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and fauna. The basin is indeed a natural treasure of world-class caliber, but heavily threatened. We have dedicated two years of focus on the Colorado River Basin in order to help assure that the next generation inherits a natural and economic system as spectacular, diverse, and bountiful as has existed in the past, but is in transition today. The changes currently underway and those needed for the future must have new voices, especially those of today's youth, for they will live with the results.

A driving force behind our attention to the basin has been a parallel major two-year study conducted by the Bureau of Reclamation (BOR) of the water demand-supply imbalances that exist. We have used their studies and preliminary reports along the way and this year's focus on "water friendly futures" is well timed to supplement the BOR study's final conclusions released December 12, 2012. Thus, some of these conclusions have formed the foundation for our work and are worth our attention:

Secretary of the Interior Ken Salazar today announced the release of a study – authorized by Congress and jointly funded and prepared by the Bureau of Reclamation and the seven Colorado River Basin states – that projects water supply and demand imbalances throughout the Colorado River Basin and adjacent areas over the next 50 years. The Colorado River Basin Water Supply and Demand Study, the first of its kind, also includes a wide array

of adaptation and mitigation strategies proposed by stakeholders and the public to address the projected imbalances.

The average imbalance in future supply and demand is projected to be greater than 3.2 million acre-feet by 2060, according to the study. One acre-foot of water is approximately the amount of water used by a single household in a year. The study projects that the largest increase in demand will come from municipal and industrial users, owing to population growth. The Colorado River Basin currently provides water to some 40 million people, and the study estimates that this number could nearly double to approximately 76.5 million people by 2060, under a rapid growth scenario.

"There's no silver bullet to solve the imbalance between the demand for water and the supply in the Colorado River Basin over the next 50 years – rather, it's going to take diligent planning and collaboration from all stakeholders to identify and move forward with practical solutions," said Secretary Salazar. "Water is the lifeblood of our communities, and this study provides a solid platform to explore actions we can take toward a sustainable water future. While not all of the proposals included in the study are feasible, they underscore the broad interest in finding a comprehensive set of solutions."

U.S. Dept. of Interior, Office of the Secretary, News Release: "Secretary Salazar Releases Colorado River Basin Study Projecting Major Imbalances in Water Supply and Demand" Dec. 12, 2012.

Since we have built on last year's student researcher findings about the basin, the launching pad for exploring in more detail where water uses can be managed in a more "friendly" manner are key conclusions from the April, 2012 Report Card's section: Dear Colorado River Basin Water Users, Experts, and Enthusiasts:

We represent that "future generation" and through intensive research and observation we have earned "standing" in discussions about the Colorado River's future. In this letter we present Five Actions we find are essential if this national, even global, natural wonder is to stand tall and remain dynamic throughout our lives and those of our children. We are convinced that exciting changes are underway "at the margins" of these immense problems and challenges. Aggressive water conservation measures in the West's urban areas are proof we can meet the "frugal" needs of growing urban areas, but not the "frivolous" wants. Experiments with water banking and rotational crops in agriculture convince us that the "old" techniques of flood irrigation in a "use it or lose it" legal structure can be replaced with conservation that does not threaten our ability to grow crops in sustainable agricultural areas of the Rockies. All of these actions will take changes in legal structure and administration, as well as large amounts of new capital. However, if we once found literally billions of dollars in the "age of construction" then we know with immense will and perseverance we can fund the "age of conservation." And the outcome will gradually result in the Colorado River and its tributaries, as well as the delta, having a reasonable but essential "share" of nature's bounty in



Secretary of the Interior Ken Salazar speaking at the 2012 State of the Rockies Conference.

the form of sustainable flows all the way to the sea.

Here are the five actions we recommend so that a viable, living Colorado River Basin exists, even thrives for our children:

•**Action 1:** *Recognize the finite limits of the river's supplies and pursue a "crash course" in conservation and water redistribution that sustains current users while leaving water in the river.*

•**Action 2:** *Modify and amend the "Law of the River" to build in cooperation and flexibility.*

•**Action 3:** *Embrace and enshrine basin-wide "systems thinking" in the region's management of water, land, flora and fauna, agriculture, and human settlements.*

•**Action 4:** *Give "nature" a firm standing in law, administration, and use of water in the basin.*

•**Action 5:** *Adopt a flexible and adaptive management approach on a decades-long basis to deal with past, present, and projected future variability of climate and hydrology.*

2012 Colorado College State of the Rockies Report Card: "The Colorado River Basin: Agenda for Use, Restoration, and Sustainability for the Next Generation," p. 129.

These recommended actions were presented directly to Governor John Hickenlooper and Secretary of Interior Ken Salazar during the April 9-10, 2012 Rockies Conference.

Using A Proven Approach: Research-Report-Engage

Central to the 2012-13 year's activities, as in the past, are the three goals of the Colorado College State of the Rockies Project:

•**RESEARCH:** To involve Colorado College students as the main contributors to the *Report Card* and conferences.

•**REPORT:** To produce an annual research document on critical issues of community and environment in the Rocky Mountain West (the *Report Card*).

•**ENGAGE:** To host annual monthly speakers' series and conferences at Colorado College, bringing regional experts together with concerned citizens.

Research

Summer 2012 Field Trip Perspectives

Six student researchers engaged in field research about water use in the basin for 10 days: July 17-27, 2012. Their field visits included energy operations and related water use in the Glenwood Springs, Colo., area; meetings with the Colorado River Water Conservation District; Grand Junction, Colo., visits to orchards and meetings with the USDA Natural Resource Conservation Service; meetings with the Water Conservancy District in St. George, Utah; review of Las Vegas' water issues/projects and meeting with the Conservation Manager of the Southern Nevada Water Authority; Boulder City, Nevada. tour of the Nevada Solar One Concentrated Solar Plant; and tour of Glen Canyon Dam in Page, Arizona.

In addition, these six researchers spent a week on the Colorado River, going through Cataract Canyon. They joined a Rockies Project sponsored second research trip on the Colorado River. This entailed four adventurers exploring parts of the Colorado River from both scientific and "stakeholder" perspectives. The Down the Colorado Expedition started in



Rockies researchers exploring the Dollhouse area of Cataract Canyon in Canyonlands National Park, Utah.



Rockies researchers rafting through Cataract Canyon in Canyonlands National Park, Utah.

June, 2012 at the headwaters of the Upper Colorado River in Rocky Mountain National Park and headed downstream for three months. While on the river, they took video and photographs, interviewed basin stakeholders, and recorded water quality data. Working with partners in the Marine Ventures Foundation, the Colorado College State of the Rockies Project, and the river conservation group, Below the Surface (Outside Magazine's 2012 "readers of the year"), they have created a robust, interactive internet-based geographical overview of the Colorado River Basin. The goal of the expedition was to make the voices of various stakeholders and "river experts" heard, as well as provide a virtual tour of the Colorado River through narratives, photographs, videos, and scientific research.

Report

The results of the summer 2012 student research, illuminated by the above field trips, form sections of this 2013 *State of the Rockies Report Card*:

- Lake Powell to Lake Powell: Portraits of the Upper Colorado River
- Overview: Colorado River Basin Water Demand and Supply Imbalance
- Agricultural Water Use in the Colorado River Basin: Conservation and Efficiency Tools for a Water Friendly Future
- Municipal and Industrial Water Use in the Colorado River Basin: Moving Towards a Paradigm Shift in Water Reclamation
- Water and Watts: How Electrical Generation Has and Will Continue to Shape the Colorado River and Can Renewable Energy Lead the Colorado River Basin into a Water Friendly Future?

The results of each 2012-13 Rockies student

researcher reflect a summer of intensive research, the two-week field trip, fall 2012 re-writes, peer reviews, and editing in preparation for the publication of the following sections in this *Report Card*. For this, our tenth *Report Card*, students worked in groups of two to tackle the issues surrounding the three main uses of Colorado River water: Agriculture, Municipal and Industrial Use, and Energy. In addition to these core sections, this year's *Report Card* is also supplemented with additional sections. The first, a section written by one of our expedition managers, Zak Podmore, covers the Rockies Project's Down the Colorado Expedition conducted during the summer of 2012. Next, a summary of the Bureau of Reclamation's recently released Colorado River Supply and Demand Study outlines the context for much of our work over the last year and the premise for much of the conservation and efficiency strategies highlighted in all three major sections of this report.

Zak Podmore: "Lake Powell to Lake Powell: Portraits of the Upper Colorado River"

Developing off the successes of the Rockies Project's 2011-2012 Source to Sea Expedition, the Project once again set out to explore the Colorado River Basin up close and personal. This time our expedition, led by Will Stauffer-Norris and Zak Podmore, accompanied by Carson McMurray and David Spiegel, began their journey at the headwaters of the Colorado River in Rocky Mountain National Park. Beginning in June, the team spent the next three months paddling the length of the river from the snowcapped peaks of the Rockies, down through Colorado's West Slope, and into Utah's desert canyons, winding their way through the Colorado Plateau. In August, the expedition ended its journey in unconventional fashion by solar rafting across the river system's second

largest reservoir, Lake Powell. Throughout their expedition, the team interviewed various basin stakeholders from county commissioners to West Slope farmers in an attempt to piece together a personal narrative of the basin's many dependents. This section of the *Report Card* and a video series set to be released in the spring of 2013 attempt to do just that by examining the perspectives and opinions of the many who live near the river and depend on a water friendly future for their way of life.

Shannon Thomas and Walter E. Hecox: “Overview: Colorado River Basin Water Demand and Supply Imbalance”

This year's summer research and the focus of the Project's other initiatives were loosely based around the work that the Bureau of Reclamation has been conducting over the last two years on the Colorado River Basin Supply and Demand Study. The multiyear study has focused on the trends of growing demand and diminishing supply for the river basin. Basing much of our investigation into the river's future off of the results of this study, we began the *Report Card* by outlining the findings from the Bureau. As many of the following

sections repeatedly use the data and assumptions covered in the overview, we have chosen to lay out the applicable information regarding the study in this initial, central location.

Nathan Lee and Alice Plant: “Agricultural Water Use in the Colorado River Basin: Conservation and Efficiency Tools for a Water Friendly Future”

Water use by the agricultural sector consumes the vast majority of the Colorado River's supply. While this share is projected to diminish in the coming years, agriculture will still continue to be the dominant user of water in the basin. Many posit that in a world of increasing demand and diminishing supply, the agricultural sector will be the source of “new” supplies as its share diminishes due to conservation practices and economic trends. However, the truth about water use and conservation in the sector is far from simple. From an investigation of irrigation efficiencies to an examination of the detriments of “buy and dry” tactics to increase municipal supply, this section takes a number of different perspectives at how the region's robust agricultural community might approach a water friendly future.



Matthew McNerney and Shannon Thomas: “Municipal and Industrial Water Use in the Colorado River Basin: Moving Towards a Paradigm Shift in Water Reclamation”

While currently a small share of the river's use, the M&I sector is rapidly growing, fueled by the expanding populations of the Rockies region. From the Colorado Front Range to the metropolises of southern California, municipalities rely on a consistent flow of water from the river to provide residents with their needs and a way of life to which they've grown accustomed. With data showing that the basin's demand may have already grown beyond its limited supply, many argue that there is no longer room for additional water use in the already stressed region. However, as the economy draws people from the rest of the country and beyond, a business-as-usual approach will not suffice to resolve the supply and demand conundrum. Many of the traditional conservation measures still present the opportunity to save water through changes in indoor and outdoor water use for homes and businesses, but additional measures must be taken to reduce per capita daily water use in many of the West's fastest growing cities. Additionally, new conservation techniques and practices must be implemented as well in order to help bridge the growing divide between the supply and demand of the river. In addition to taking a basin-wide approach to examining the necessary routes for municipal and industrial users to achieve a water friendly future, the section also examines some of the current conservation techniques being implemented on a smaller scale with a case study on the Colorado Front Range.

Henry Madsen: “Water and Watts: How Electrical Generation Has and Will Continue to Shape the Colorado River” and Audrey Burns: “Can

Rockies researchers touring a gas rig near Parachute, Colorado.



David Spiegel

A view of the Colorado River and the Henry Mountains in Utah.

Renewable Energy Lead the Colorado River Basin into a Water Friendly Future?"

The energy sector consumes a small share of the Colorado River's supply, but with the current gap between the river's supply and demand projected to widen, every small use of water in the basin must be scrutinized. In the same manner that municipal and industrial demand for water is expected to grow in the coming years, demand for energy in homes and businesses will increase as well. Focusing on the different manners by which utilities might meet these increasing energy demands and shift pre-existing generation towards less water-intensive technologies, this section displays the growing share energy will represent in the expanding water deficit. By suggesting different solutions to help mitigate water use for energy, while also addressing the issues of cost and carbon emissions, this section aims to guide the basin's energy generation sector towards a more sustainable, water friendly future.

Engagement

April Rockies Conference

The April 8-9, 2013 Rockies Conference unveils this *Report Card* and once again brings to campus renowned individuals, around a focus of "Conservation in the Rockies: Issues of citizen science, water friendly futures, and winter recreation." And for the fifth time we recognize an individual of immense importance to the Rockies: Former Governor Richard D. Lamm as the 2012-13 Champion of the Rockies; he joins a renowned roster of earlier "champions"-- Ted Turner, Ed and Betsy Marston, Terry Tempest William, and CC graduate Ken Salazar.

"Citizen Science in the Rockies" is the focus of the Monday, April 8, 2013 Conference session. This brings to campus three renowned experts in the field. J. Thomas McMurray, co-founder of several nonprofits working to promote "citizen science" and the natural beauty of the Rockies region including the Marine Venture Foundation and the Ocean Foundation. Scott Loarie of the Carnegie Institution for Science and Brendan Weiner of Adventurers and Scientists for Conservation will share their field approach and activities pursuing "citizen science." This session will be prefaced by

Carson McMurray, one of the summer 2012 Expedition Down the Colorado and 2012 Rockies Student Researcher, demonstrating our Project's use of GIS to depict "citizen science."

"Outdoor Recreation and the Winter Olympics: Companion or Threat to the Rockies" will be the focus of the Tuesday, April 9, 2013 Conference session, which will include the unveiling of the 2013 *Report Card* and student recommendations for water friendly futures in the Colorado River Basin. Former Governor Lamm, being honored as the 2012-13 Rockies Project Champion of the Rockies, will talk about his opposition to Colorado hosting the 1976 Winter Olympics from the perspective of early Colorado environmental movements. Ceil Folz of the Vail Valley Foundation will then discuss the current work to bring the February 2015 World Cup Ski Championships to Colorado and Vail, again from the perspective of environmental impacts.

Saving the Colorado River Basin: Join In

This year, similar to the last nine years, the Rockies Project has sought to take our motto "research-report-engage" to new heights, mixing traditional dimensions with new social media, speaking to younger audiences in more visual and interactive ways. We have also supplemented last year's efforts to "take a stand" when we presented "Five Actions" that will help save the Colorado River Basin for the next generation. This year's recommendations for changes to achieve a "water friendly future" for the Colorado River Basin again emphasize what youth believe must happen to manage the basin, a vital part of the Rockies Region we continue to use as a focus of our Project's efforts.

In celebrating our tenth year, we once again urge you to be "active" in learning about, enjoying, and helping to protect the spectacular vistas and regions Colorado College is blessed to call "our backyard." Get out there and join in as each new class of CC Rockies Project student researchers and many of our alumni and friends work to protect the solitude, recreation, and enrichment we all gain from these spectacular, but fragile, Rockies environments. Help us advocate for a Rockies region that can and must be managed properly as a regional economy and environment. Your children and their children will thank you!