The 2009

COLORADO COLLEGE

STATE OF THE ROCKIES REPORT CARD

An Outreach Activity of Colorado College: Vision 2010

Colorado College's Rocky Mountain Study Region

The Colorado College State of the Rockies Project is designed to provide a thoughtful, objective voice on regional issues by offering credible research on problems faced by the Rocky Mountain West, and by convening citizens and experts to discuss the future of our region. Each year, the State of the Rockies provides:

- Opportunities for collaborative student-faculty research partnerships;
- An annual *State of the Rockies Report Card*;
- A companion State of the Rockies Symposium.

Taken together, these three arms of the State of the Rockies Project offer the tools, forum, and accessibility needed for Colorado College to foster a strong sense of citizenship for both our graduates and the broader regional community.

THE COLORADO COLLEGE
STATE OF THE ROCKIES PROJECT

AN OUTREACH ACTIVITY OF
COLORADO COLLEGE
VISION 2010

Cover photo by:
Stephen G. Weaver

The 2009

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STATE OF THE ROCKIES REPORT CARD

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Table of Contents

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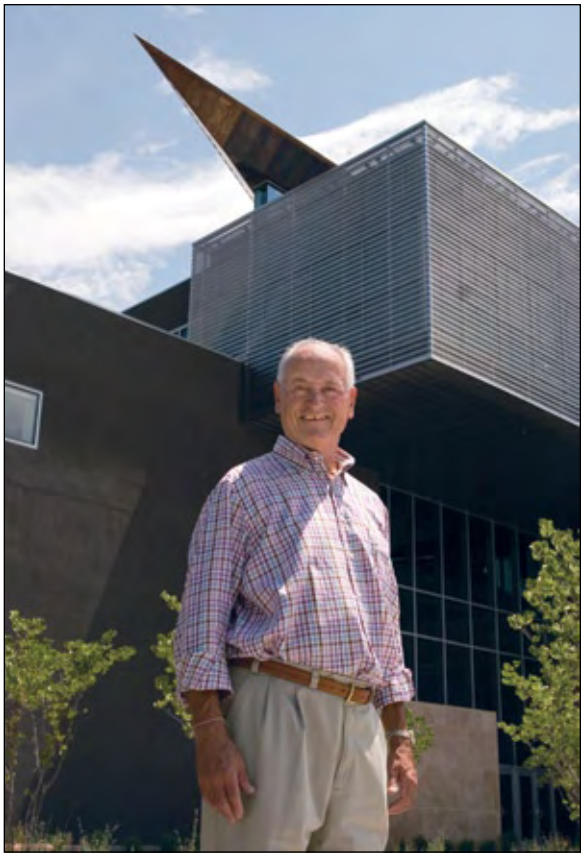
The Colorado College State of the Rockies Project

Research, Report, Engage!

An Introduction from the President

The 2009 Colorado College State of the Rockies Report Card

Welcome to Colorado College's sixth *State of the Rockies Report Card*. Continuing our yearly tradition, during the summer of 2008 some of our best undergraduate students completed innovative, peer-reviewed research that now comprises major sections of this *Report Card*. Along with the *Report Card*, Colorado College has sponsored a monthly fall/winter speakers series on "The Wild Rockies" and a Rockies Symposium with a unifying theme: "Visions of the Rockies in 50 Years: Will Our Children Thank Us?" During the Symposium we are proud to recognize our 2008-2009 Champions of the Rockies, Ed and Betsy Marston, for their reinvigoration of a stellar publication in the Rockies: *High Country News*.



This year's *Report Card* content is largely focused upon wildlife, one of the key natural treasures of the Rockies and a distinguishing aspect to the wildness and beauty we cherish. A related section evaluates the Wild and Scenic River system in the Rockies and how this federal act has protected certain reaches in the West compared to other federal designations and unprotected streams. A key variable for the Rockies' future is a growing population affecting our natural resources, and in this *Report Card* we consider the concentration of population growth within large metropolitan areas, a demographic trend known as a "megapolitan" region. Rockies Snapshots look at preservation of the Rockies' historic past, crime and incarceration, and the degree of cooperation Rockies federal politicians devote to supporting our region's issues and concerns. As in previous *Report Cards*, we continue our "at a glance" Rockies Baseline: Vital Signs for a Region in Transition.

In prior years the *Report Cards* have examined how specific issues challenge the Rockies region and its natural, cultural, and historic importance. These have included regional energy issues, the condition of our national parks and health of our forests, expected impacts of climate change, success stories among our Native American peoples, toxic waste, creative occupations, and civic engagement. Media coverage has supplemented our annual conference and speakers series efforts, bringing regional, national and international attention to the issues studied and the results found by our undergraduate researchers. We are proud to continue the decades' long tradition of Colorado College contributing to and strengthening our surrounding region's social, economic, and environmental qualities.

Colorado College has been defined and continually redefined by the Rockies region. The college was founded by General William Jackson Palmer in 1874 with the intent to educate and "civilize" the regional population in the New England liberal arts tradition. Evolving programs and majors have been relevant to the region's needs, from early day mining and engineering to our current regionally focused programs in environmental and southwest studies. Generations of students and professors have benefited from this magnificent region, using field trips and research to better understand disciplines such as geology, biology, economics, sociology, and the environment.

The college is a private, four-year liberal arts institution enrolling 1,900 students. Located in downtown Colorado Springs on a 94-acre campus at the base of Pikes Peak, we seek to fulfill our mission statement that speaks to our unique intellectual adventure:

> *At Colorado College our goal is to provide the finest liberal arts education in the country. Drawing upon the adventurous spirit of the Rocky Mountain West, we challenge students, one course at a time, to develop those habits of intellect and imagination that will prepare them for learning and leadership throughout their lives.*

We pursue these goals by offering first and foremost an excellent undergraduate education in the liberal arts, taught through our unique course schedule known as the Block Plan, where students and faculty participate in a single course taught over three and a half weeks. In doing so we encourage a spirit of intellectual adventure, critical thinking, hands-on learning, and personal responsibility within an environment of small learning communities where education and life intertwine. Just as our Rockies region is challenged by numerous issues and problems, we challenge some of our strongest students to get involved in each year's State of the Rockies Project, connecting them with the complex issues around us and preparing them for active careers and leadership.

Thank you for delving into this latest issue of our annual *Colorado College State of the Rockies Report Cards*. We strive to make each *Report Card* a comprehensive, balanced, accurate, and accessible annual statement on some of the key challenges and controversies facing the eight Rocky Mountain States: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming. Our students, staff, and many alumni live and recreate in this spectacularly beautiful region and thus are heavily vested in maintaining its vitality. We know many others have similar concerns and wish to protect the region's communities, environment and economy. The Colorado College State of the Rockies Project is intended to make a continuing, positive regional difference that future generations will value.

Richard F. Celeste
President, Colorado College

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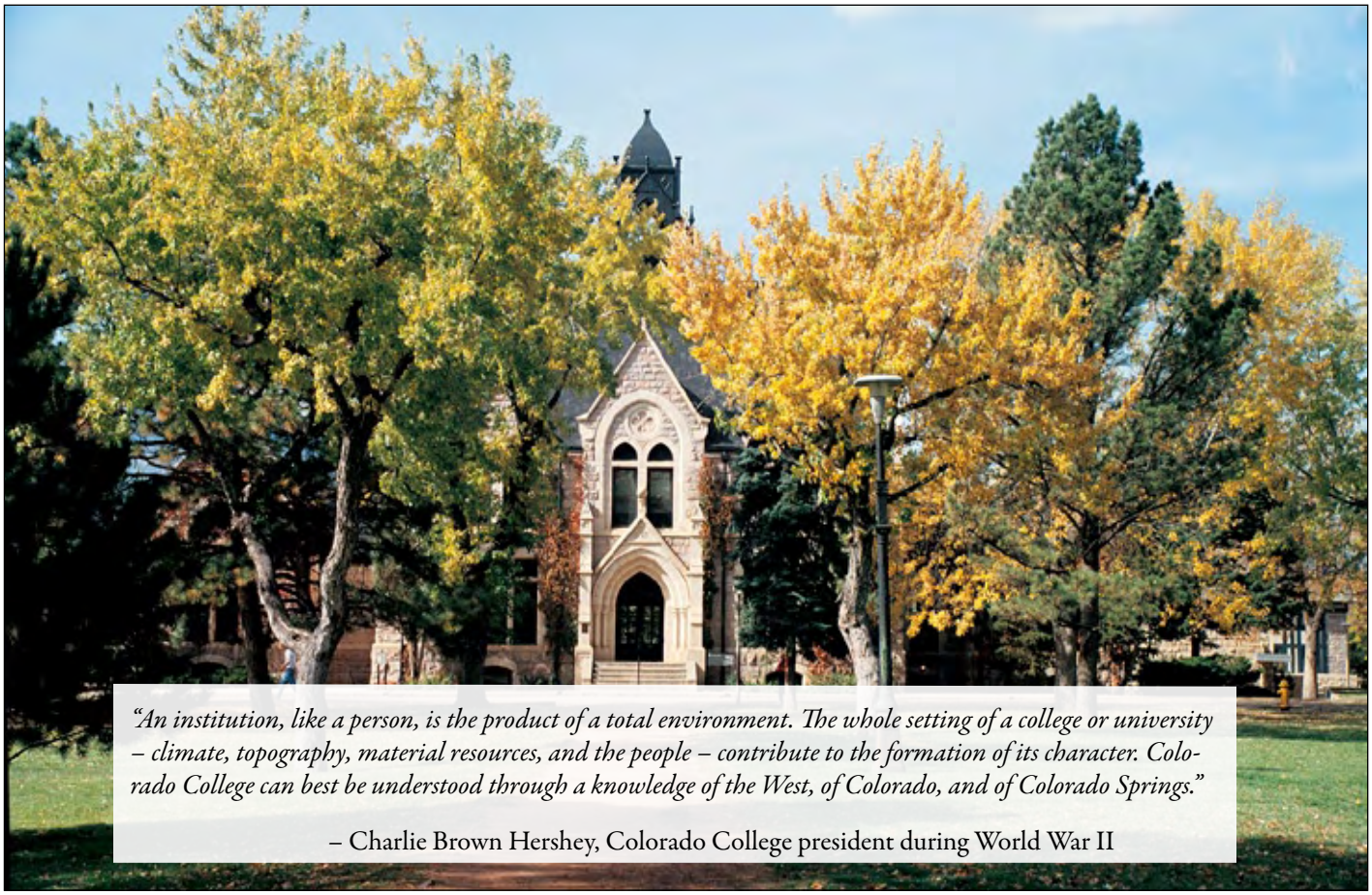
The 2009 Colorado College State of the Rockies Report Card

By Walter E. Hecox

Colorado College today, as for the past 133 years, is strongly defined by location and events of the 1800s. Pikes Peak abruptly rises out of the high plains that extend from the Mississippi and Missouri rivers towards the west. Peaking at 14,000 feet, this eastern-most sentinel of the Rocky Mountain chain first attracted early explorers and was later the focus of President Jefferson's call for the southern portion of the Louisiana Purchase to be mapped by Zebulon Pike in 1806. Gold seekers in 1858 spawned the start of the "Pikes Peak or Bust Gold Rush" of prospectors and all manner of suppliers to the mining towns. General William Jackson Palmer, while extending a rail line from Kansas City to Denver, in 1869 camped near what is now Old Colorado City and fell in love with the view of Pikes Peak and red rock formations now called the Garden of the Gods. An entrepreneur and adventurer, Palmer selected that site to found a new town with the dream that it would be a famous resort—complete with a college to bring education and culture to the region. Within five years both Colorado Springs and Colorado College came into being in the Colorado Territory, preceding Colorado statehood in 1876.

Early pictures of present-day Cutler Hall, the first permanent building on campus that was completed in 1882, speak volumes to the magnificent scenery of Pikes Peak and the lonely plains. Katherine Lee Bates added an indelible image of the region. In 1893 she spent a summer teaching in Colorado Springs at a Colorado College summer program and on a trip up Pikes Peak was inspired to write her famous "America the Beautiful" poem. Her poem helped spread a celebration of the magnificent vistas and grandeur of Pikes Peak and the surrounding region, and provided bragging rights for Colorado College as "The America the Beautiful College."

The last quarter of the eighteenth century was challenging both for Colorado Springs and Colorado



"An institution, like a person, is the product of a total environment. The whole setting of a college or university – climate, topography, material resources, and the people – contribute to the formation of its character. Colorado College can best be understood through a knowledge of the West, of Colorado, and of Colorado Springs."

– Charlie Brown Hershey, Colorado College president during World War II

Cutler Hall, Colorado College

About the author: Walter E Hecox is professor of economics and environmental studies at Colorado College and the Project Director of the Colorado College State of the Rockies Project.

© Marisa Lafontaine '10

CC students at Conundrum Hot Springs near Aspen, Colorado

College. Attempts to locate financial support in the east and ease the travails of a struggling college were grounded on the unique role of Colorado College in then President Tenney's "New West" that encompassed the general Rocky Mountain region. His promotion of this small college spoke of Colorado College being on the "very verge of the frontier" with a mission to bring education and culture to a rugged land. Even then, Tenney saw the college as an ideal place to study anthropology and archeology, use the geology of the region as a natural laboratory, and serve the mining industry by teaching the science of mineralogy and metallurgy. In the early 1900s a School of Engineering was established that offered degrees in electrical, mining, and civil engineering. General Palmer gave the college 13,000 acres of forest land at the top of Ute Pass, upon which a forestry school was built, the fifth forestry school created in the US and the only one with a private forest.

Subsequent decades brought expansion of the institution, wider recognition as a liberal arts college of regional and national distinction, and creation of innovative courses, majors, and programs. The unique Block Plan, implemented in the 1970s, consists of one-at-a-time courses lasting three and one-half weeks each that facilitate extended course field study, ranging across the Rockies and throughout the Southwest. Thus CC has a rich history indelibly linked to the Rockies.

Today is no different: CC has new programs that meet evolving challenges in the Rockies, including environmental and Southwest studies programs, a sustainable development workshop, and exciting fieldwork offered by a variety of disciplines. Students can thoroughly explore the Rockies through the block plan and block-break recreation.

The State of the Rockies Project

The Colorado College State of the Rockies Project is designed to provide a thoughtful, objective voice in regional issues by offering credible research on challenges and problems facing the Rocky Mountain West, and through convening citizens and experts to discuss the future of our region. Each year the Project seeks to

- •Research: offering opportunities for collaborative student–faculty research partnerships
- •Report: publishing an annual Colorado College *State of the Rockies Report Card*
- •Engage: convening a companion State of the Rockies Conference and other sessions.

Taken together, these three arms of the State of the Rockies Project offer the tools, forum, and accessibility needed for Colorado College to foster a strong sense of citizenship among our students, graduates, and the broader regional community.

Editors' Preface & Executive Summary

The 2009 Colorado College State of the Rockies Report Card

By Walter E. Hecox, Elizabeth L. Kolbe, and Matthew K. Reuer

In our sixth year carrying out the State of the Rockies Project, we strive to better understand an incredibly diverse and complicated eight-state region facing a variety of challenges. Always learning from past years' efforts, we refine our research methods, focus on new issues and problems, and involve another group of undergraduate research students. We seek to bring fresh perspectives to major issues through credible research and written materials in the *Report Cards* as well as through our monthly speaker series and annual symposia.

Thanks to continued generous funding, we selected a team of five student researchers to engage in summer 2008 research and field exploration, resulting in research reports that have been peer-reviewed, revised, and published in this annual *Report Card*. We focus on three related but distinct dimensions of wildlife in the Rockies, as well as additional topics on wild and scenic rivers and major demographic changes altering the urban and rural fabric of the American West.

Two mid-summer field trips connected our research students with local experts and specific issues. A northern Rockies field trip explored wildlife and its conflicts with energy development (Pinedale, Wyoming), bison management in Yellowstone National Park, elk management strategies at the National Elk Refuge (Jackson, Wyoming), and human interference in wildlife range and migration throughout the northern Rockies. A southern Rockies field trip to New Mexico added to our knowledge, looking at issues of threatened and endangered species and reintroduction efforts on the Ted Turner Vermejo Park ranch, viability of traditional ranching on the historic Fort Union ranch, and the unique management experiment by the Forest Service and others at the Valles Caldera Preserve in central New Mexico.

Following past *Report Card*s, we begin the *2009 Report Card* with the "Rockies Baseline," which examines key, annually updated demographic indicators for the U.S., the Rockies region, and each of the eight Rockies states. The Baseline presents basic facts and trends in this rapidly changing region.

The first section focuses on megapolitan areas and rural economic clusters resulting from the population dynamics in the Rockies. The influx of new residents and internal migration in the Rockies are spurring development of once open lands in some areas, but resulting in stagnation and decay in others. Vast new urban complexes are becoming a new frontier of opportunities and challenges, supported by employment opportunities, real estate development, transportation corridors, and natural amenities. At the same time, however, rural "hinterland" towns with limited services and opportunities are literally withering up as they lose their commerce and young people.

© Samuel Landsman '12

About the co-editors: Walter E. Hecox is professor of economics in the Colorado College Environmental Program and project director for the State of the Rockies Project; Matthew K. Reuer serves as technical director of the Environmental Program and staff contributor to the Rockies Project; and Elizabeth L. Kolbe is the 2008-09 Rockies Project program coordinator.

A section on wild and scenic rivers continues our tradition of exploring Western water and its use by a growing population. Based on the concept of "sustainable water resources," as articulated by the U.S. Geological Survey, we examine the surface water resources of the Rockies which are protected by the Wild and Scenic Rivers Act and catalogued by the National Rivers Inventory. The resulting federal and state protections of specific reaches are discussed, such as for the Gunnison River in south central Colorado. Finally, we present case studies examining the frequently heated debates between local advocacy groups and government water managers are presented, such as the ongoing conflict with the Cache La Poudre River.

The next three 2009 research topics, each focused on wildlife, are introduced by a faculty overview of U.S. laws and policies protecting wildlife. These topics are "nested" together, taking distinct but related perspectives on the complex issue of wildlife in the Rockies.

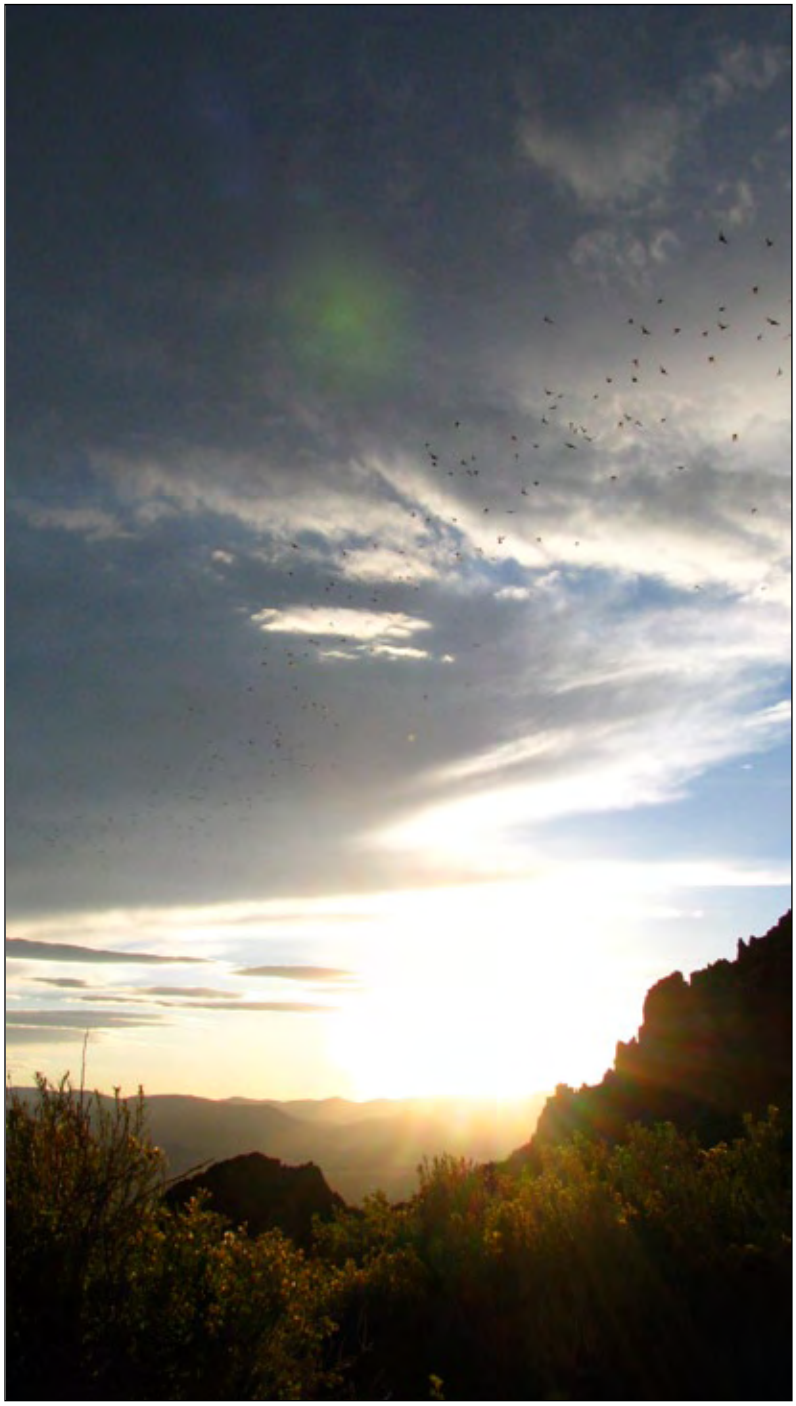
A section on historic range and current condition comes first, introducing this natural treasure, providing a context for the past regional prevalence of species, and discussing their vastly reduced current extent and health. The second section examines several areas in the Rockies where vast riches of both wildlife and energy resources and development coexist, creating challenges and tradeoffs to use and management. Pinedale, Wyoming, embodies our current dilemma: our thirst for more domestic energy collides in areas with world-class wildlife populations and habitat. Wildlife management tools and techniques are presented in the final section. This section traces the history of wildlife management from the ecological rule of natural predator-prey relationships, to early human intervention through subsistence hunting, and finally to more contemporary management tools (recreational hunting, relocation, harassment, and even disease management).

Speaking to a long-standing tradition of the *Rockies Report Cards* "grading" the region on a variety of attributes, this year we briefly look at three areas: crime and incarceration in the Rockies, historic preservation in the Rockies, and an evaluation of regional representation by elected officials.

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

- To involve Colorado College students as the main contributors to the *Report Card* and conferences.
- To produce an annual research document on critical issues of community and environment in the Rocky Mountain West (the *Report Card*); and
- To host an annual speaker series and symposium at Colorado College, bringing regional experts together with concerned citizens.

Through these goals, the Rockies Project aims to inspire *Report Card* readers and Rockies events attendees to creatively contemplate, discuss, and engage in shaping the future of our beloved, beautiful, and fragile region—the Rocky Mountain West.



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By Walter E. Hecox, Elizabeth L. Kolbe, and Matthew K. Reuer

Rockies Baseline: Vital Signs for a Region in Transition
State of the Rockies - Elizabeth Kolbe and David Carlson

Each year, the State of the Rockies Project updates a set of key demographic indicators—the Vital Signs—to take the pulse of the Rockies region. This year, data from the 2007 American Community Survey are compared against data from the 2000 Census. The "Rockies Baseline" show that we are diverse, well-educated, and earn more money than we used to. Our homes are worth more, our rent is cheaper, and we continue to see strong job growth. Perhaps the most critical indicator of all, the region's population is still growing swiftly, at 2.6 times faster than the U.S. population.

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***Rockies Snapshot:* Federal Representation**
Guest Contributor – Chris Jackson

This section examines to what extent our federal representatives and senators cooperate on regional issues. We also compare Western and non-Western politicians to answer the question of whether Rockies politicians favor policies which benefit our home region.

***Rockies Snapshot:* Historic Preservation**
Guest Contributors – Chris Jackson and John MacKinnon

As more people migrate to the Rockies region and development continues, preserving historic sites is vital to protecting the region's cultural heritage. Jackson and MacKinnon measure, map and emphasize the importance of active preservation and integration of historic buildings into modern communities. The National Register of Historic Places greatly contributes to the identification of historic structures, but still more attention and care are needed to continue and expand historic preservation.

***Rockies Snapshot:* Incarceration and Crime**
Guest Contributors – John MacKinnon and Chris Jackson

"Incarcernation and Crime" describes the geographical distribution of crime throughout the Rockies and the patterns of incarceration by federal, state, and private prisons. We highlight areas that "export" incarceration services by specializing in the provision and staffing of prisons (public and private facilities) that import jail inmates from other regions.

Repopulating the Rockies
State of the Rockies – Porter Friedman

The Valley of the Sun, the Enchanted Corridor, the Front Range, Treasure Valley, Las Vegas, and the Wahsatch Front; these are the Rockies' megapolitan areas, or geographic areas where two or more cities and their previously independent economies merge together. Broadening the scope of a report published by the Brookings Institution in July 2008, we define six Rockies megapolitan regions. Additionally, we highlight the phenomena of rural economic clusters, a trend that draws populations away from small Western towns and big cities to mid-sized, service-rich towns. Within rural economic clusters, we identify three specific types of clusters: rural service clusters, rural resource extraction clusters, and rural recreation clusters.

Wild and Scenic Rivers
State of the Rockies – Sarah Turner

The rivers and streams of the Rockies are among the most beautiful in the nation and their waters the most coveted by a growing Western population. In this section, the State of the Rockies Project focuses on the intricacies of the Wild and Scenic Rivers Act and the role it plays in Rockies' water protection. Enacted in 1968, the Wild and Scenic Rivers Act protects rivers with outstandingly

remarkable values in their free-flowing condition. Although the Act only protects two percent of the region's rivers, it provides an exceptional model for state and local river protection measures. We also examine other river designations and current debates on water sustainability in the Rockies.

Faculty Overview **- United States Laws and Polices Protecting Wildlife**
Guest Contributor – Phillip M. Kannan

Phillip M. Kannan, a distinguished lecturer and legal scholar-in-residence in the Colorado College environmental program, opens the wildlife section of the *2009 Report Card* with a discussion of laws and policies protecting wildlife. A responsibility once held by individual states, wildlife protection has evolved into a complex, multi-faceted endeavor shared by state and federal governments. The federal government, through the power of the interstate commerce clause and property clause 2, has usurped primary control, but states are allowed to enact wildlife protection laws where consistent with federal policy. The result is a broad web of protection, but no piece is adequately straightforward or comprehensive.

Wildlife: Range and Condition in the Rockies
State of the Rockies – Julia Head

As climate change, pollution, and urban development pressure wildlife diversity and abundance, the Rockies Project explores the historical and current range and condition of the region's key species. When settlers first came to this region, they efficiently killed most of the plains bison to allow for cattle grazing on fenced private land. The early pioneers similarly battled with large predators that killed or bothered their stock, such as wolves and grizzlies. The protection, reintroduction, and resurgence of these species are a success story for wildlife, but are often met with resistance and controversy. This section of the *Report Card* serves as a backdrop for the following sections, "The Impacts of Energy Development on Wildlife" and "Wildlife Management in the Rockies."

The Impacts of Energy Development on Wildlife
State of the Rockies – Alex Weiss

The energy resources of the Rockies exceed those of any other U. S. region. Past *Report Cards* have examined the development of fossil fuels in the Rockies and the potential and existing capacity for renewable energy development. This section of the *2009 Report Card* examines the impact of energy development, notably oil and gas drilling operations, on wildlife and their habitat. In addition to an overview of the region's energy versus wildlife issues, this section provides a detailed case study of energy development on the Pinedale Anticline (Pinedale, Wyoming). This region possess world-renowned wildlife commingled with vast energy resources. Nowhere are the tradeoffs between nature and human needs more visible.

Wildlife Management in the Rockies
State of the Rockies – Scott Wozencraft

In the Rockies region, the deer and the antelope still may play, but they play by our rules. As humans encroach ever more frequently on wildlife habitat, encounters between humans and wildlife increase and become more dangerous for both. Bears digging in garbage cans, foxes denning in backyard gardens, and elk walking down Main Street are common occurrences. Wildlife populations, constantly in flux, create myriad challenges for wildlife managers as they strive to simultaneously protect the animals, their habitat, and humans. This section of the *Report Card* outlines the role of state wildlife agencies in their quest to manage the region's wildlife and the various management tools currently in use.

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© Julia Head '09

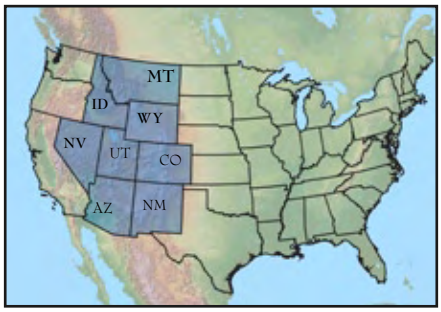
Rockies Baseline

Vital Signs for a Region in Transition

By Elizabeth Kolbe and David Carlson

The 2009 Colorado College State of the Rockies Report Card

Each year, the Colorado College *State of the Rockies Report Card* updates the Rockies Baseline. This brief, data-rich section highlights the key statistics of the Rockies' states, the region, and the nation. Like a yearly check-up on a growing body, the baseline inventories the vital signs for a growing and changing region.



Most of the trends and statistics reported in this year's baseline mimic those reported in years past. The statistics that stand out year after year not only emphasize the unique qualities of our region, but show the effects of our relatively new growth.

Looking at the region as a whole, our population is young and continues to grow faster than the national average. More of our students graduate from high school, and we have just as many students completing college, graduate, and professional degrees as the rest of the country. Our median home value is higher than the nation's, and our median rent is lower. Though still lower than the national average, our household, family, and per capita incomes are growing at a faster rate. Every category of employment except one has grown faster in the Rockies since 2000.

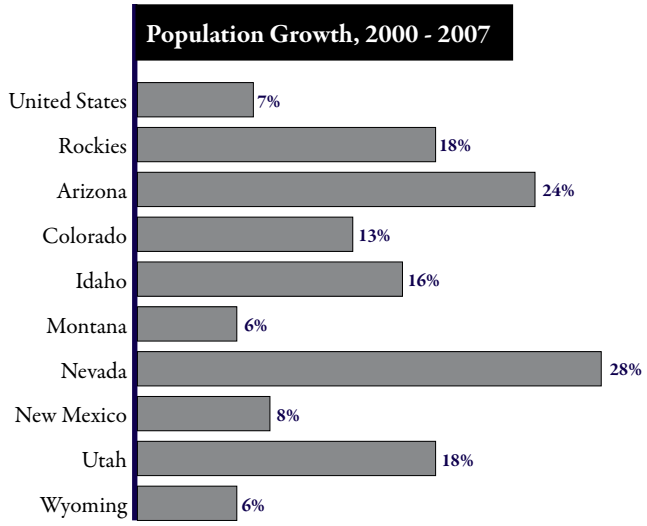
Most of the statistics reported in this year's baseline are encouraging, but a few present opportunities for improvement. Though a higher percentage of women graduate from high school in the Rockies, the gap between men and women in higher education is wider than the rest of the nation. Also, as incomes for every group in Montana and Wyoming boom, Utah has shown no change in household income since 2000 and Colorado's household income has decreased during the same interval.

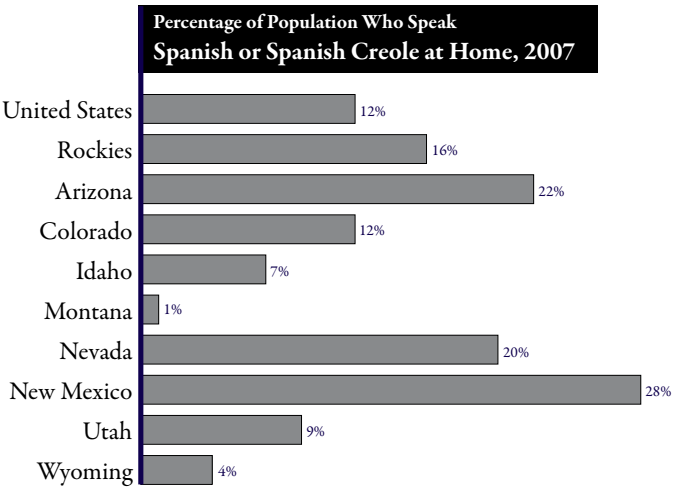
As we transition into a new economic and political era, the State of the Rockies Project will continue monitor the pulse of the region.

About the authors: Elizabeth Kolbe (Colorado College '08) is co-editor of the State of the Rockies Report Card, and program coordinator for the Colorado College State of the Rockies Project. David Carlson (Colorado College '10) is a 2009 Student Intern for the Rockies Project.

Population & Age, 2007

	Total Population, 2007	Population Growth since 2000	Percentage of Population Age 0 - 17	Percentage of Population Age 65+	Median Age
United States	301,621,159	7%	25%	13%	37
Rockies	21,360,990	18%	26%	11%	35
Arizona	6,338,755	24%	26%	13%	35
Colorado	4,861,515	13%	25%	10%	36
Idaho	1,499,402	16%	27%	12%	34
Montana	957,861	6%	23%	14%	39
Nevada	2,565,382	28%	26%	11%	36
New Mexico	1,969,915	8%	25%	13%	36
Utah	2,645,330	18%	31%	9%	28
Wyoming	522,830	6%	24%	12%	37



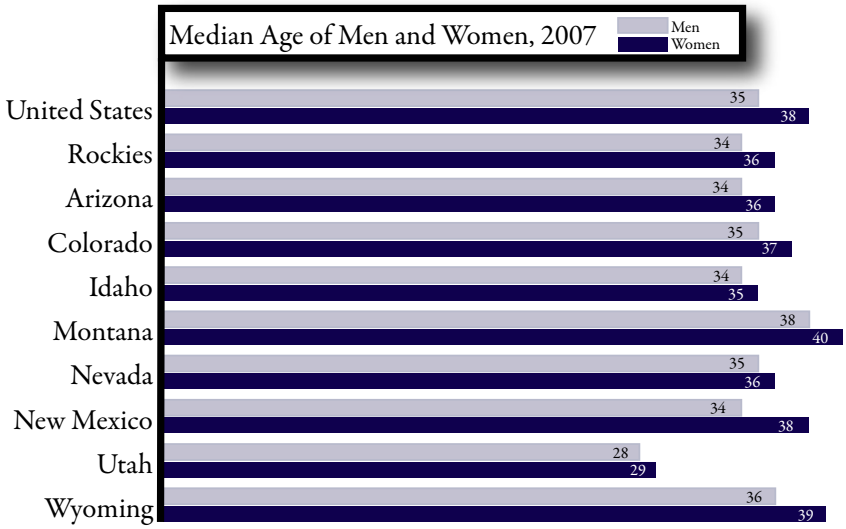


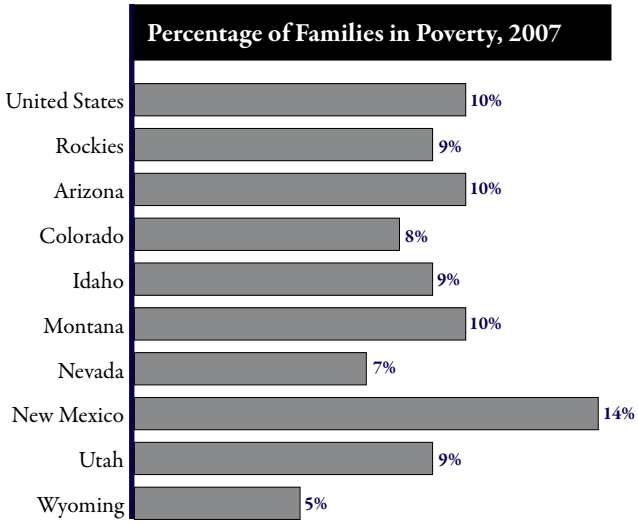
Language, 2000 and 2007

Percentage of population age 5 and older who speak the following language at home	English Only, 2007	Language other than English, 2007	Language other than English, 2000
United States	80%	20%	18%
Rockies	78%	22%	20%
Arizona	72%	28%	26%
Colorado	83%	17%	15%
Idaho	90%	10%	9%
Montana	96%	4%	5%
Nevada	73%	27%	23%
New Mexico	64%	36%	37%
Utah	86%	14%	13%
Wyoming	94%	6%	6%

People in Poverty

	2000	2007
United States	12%	13%
Rockies	12%	12%
Arizona	14%	14%
Colorado	9%	12%
Idaho	11%	12%
Montana	14%	14%
Nevada	10%	10%
New Mexico	18%	18%
Utah	9%	10%
Wyoming	11%	9%



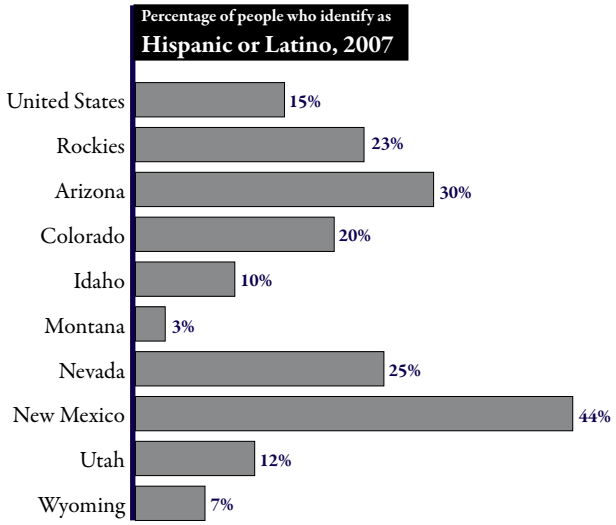


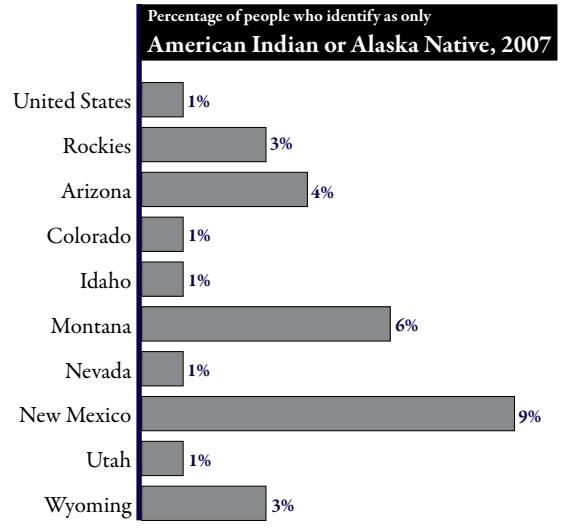
Families in Poverty with Children Under 18, 2007

Percentage of the Following Groups Whose Income in the Past 12 Months is Below the Poverty Level	All Families	Married-Couple Families	Female Householder, No Husband Present
United States	15%	6%	37%
Rockies	14%	7%	36%
Arizona	16%	8%	35%
Colorado	13%	7%	34%
Idaho	13%	7%	38%
Montana	17%	9%	44%
Nevada	11%	5%	29%
New Mexico	22%	11%	46%
Utah	10%	5%	33%
Wyoming	9%	3%	26%

Race and Ethnicity, 2007

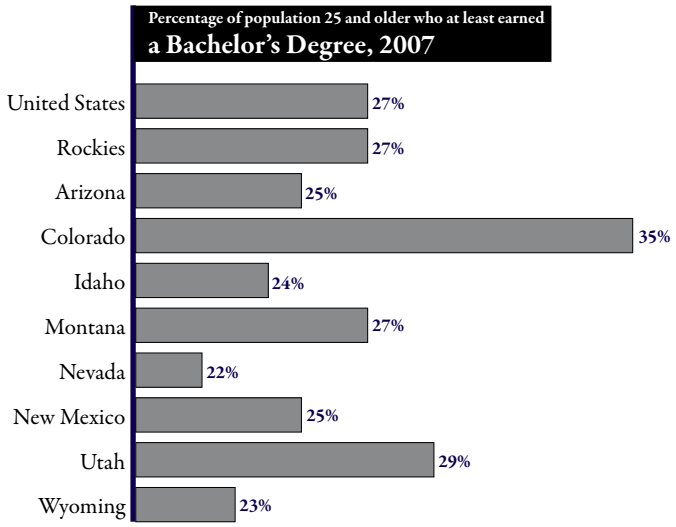
Percentage of the Population Who Identify as the Following	American Indian or Alaska Native	Black or African American	Hispanic or Latino	White
United States	1%	13%	15%	74%
Rockies	3%	4%	23%	81%
Arizona	4%	4%	30%	76%
Colorado	1%	5%	20%	84%
Idaho	1%	1%	10%	92%
Montana	6%	1%	3%	90%
Nevada	1%	8%	25%	74%
New Mexico	9%	3%	44%	69%
Utah	1%	1%	12%	90%
Wyoming	3%	2%	7%	92%

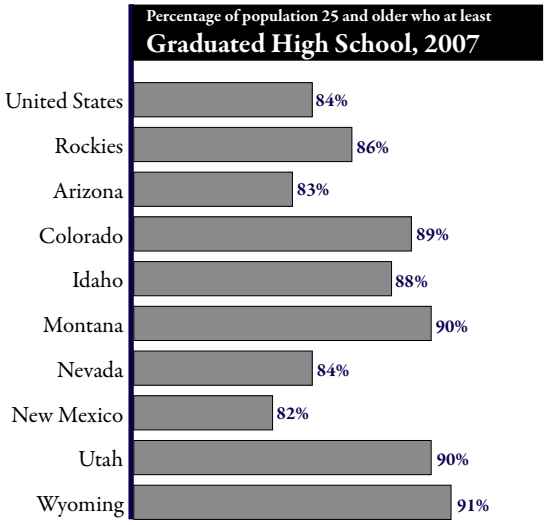




Foreign Born Population, Citizenship Status, and Year of Entry, 2007

	Total Population Foreign Born	Percentage Foreign Born of Total U.S. Population	Percentage of Foreign born that are naturalized U.S. citizens	Percentage of foreign born that are not U.S. citizens	Percentage of foreign born that entered before 2000	Percentage of foreign born that enetered 2000 or later
United States	38,059,694	13%	43%	57%	72%	28%
Rockies	2,489,589	12%	33%	67%	68%	32%
Arizona	991,584	16%	30%	70%	66%	34%
Colorado	485,170	10%	32%	68%	67%	33%
Idaho	83,904	6%	35%	65%	72%	28%
Montana	16,057	2%	55%	45%	75%	25%
Nevada	497,821	19%	38%	62%	71%	29%
New Mexico	182,936	9%	33%	67%	73%	27%
Utah	215,757	8%	33%	67%	62%	38%
Wyoming	16,360	3%	37%	63%	64%	36%





Home Values and Costs, 2007

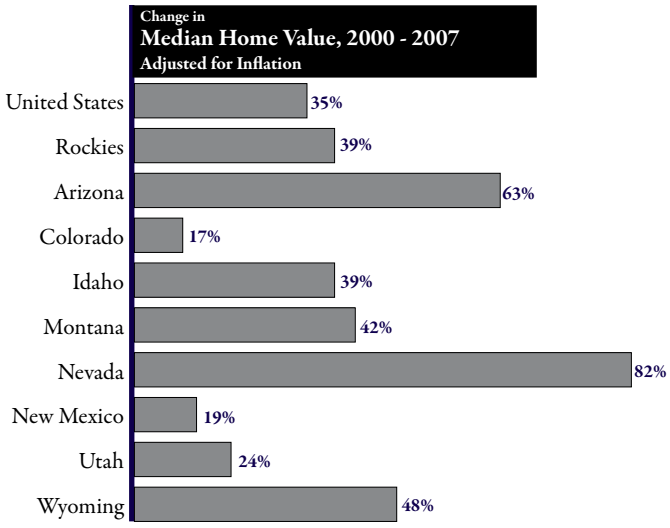
	Median home value for owner-occupied units, 2007	Median monthly costs for housing units with mortgage	Median monthly costs for housing units without mortgage	Median rent, 2007
United States	$194,300	$1,464	$407	$789
Rockies	$225,000	$1,435	$338	$783
Arizona	$237,700	$1,464	$334	$819
Colorado	$233,900	$1,569	$361	$788
Idaho	$178,100	$1,162	$302	$654
Montana	$170,000	$1,141	$352	$579
Nevada	$311,300	$1,779	$427	$980
New Mexico	$155,400	$1,130	$284	$637
Utah	$218,700	$1,358	$340	$733
Wyoming	$172,300	$1,162	$323	$636

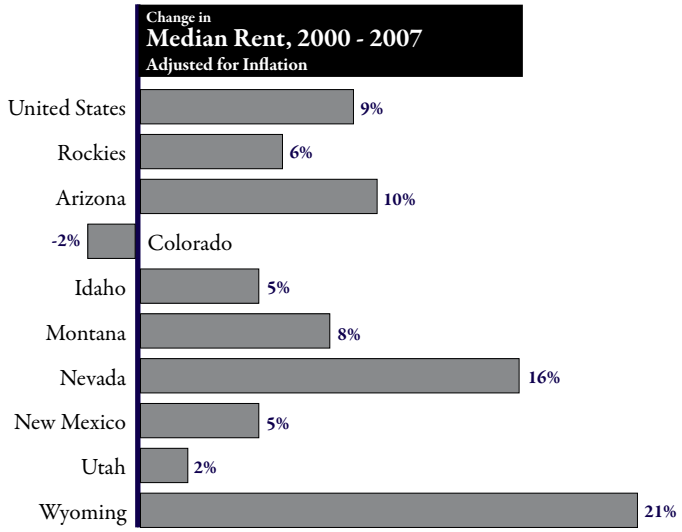
Educational Attainment by Sex, 2007

Percentage of the Following groups who at Least:	Graduated High School		Earned a Bachelor's Degree		Earned a Graduate or Professional Degree	
	Male	Female	Male	Female	Male	Female
United States	84%	85%	28%	27%	11%	10%
Rockies	86%	87%	28%	26%	11%	9%
Arizona	83%	84%	26%	24%	10%	9%
Colorado	88%	89%	36%	34%	13%	12%
Idaho	88%	89%	26%	23%	9%	6%
Montana	90%	90%	28%	26%	10%	8%
Nevada	84%	84%	22%	21%	8%	7%
New Mexico	82%	83%	25%	25%	11%	10%
Utah	90%	90%	32%	26%	12%	7%
Wyoming	91%	91%	24%	23%	8%	7%

Housing Units, 2007

	Total Occupied Housing Units	Owner-occupied Units as a Percentage of Occupied Housing Units	Renter-occupied Units as a Percentage of Occupied Housing Units	Percentage of Renter-occupied that are Nonfamily Households	Percentage Vacant of Total Housing Units
United States	112,377,977	67%	33%	48%	12%
Rockies	7,774,402	68%	32%	47%	14%
Arizona	2,251,546	68%	32%	47%	16%
Colorado	1,859,965	69%	31%	52%	13%
Idaho	560,567	72%	28%	44%	11%
Montana	371,954	70%	30%	54%	15%
Nevada	954,067	60%	40%	44%	13%
New Mexico	734,847	70%	30%	48%	15%
Utah	835,320	72%	28%	40%	10%
Wyoming	206,136	69%	31%	52%	15%





Household Income by Type, 2007

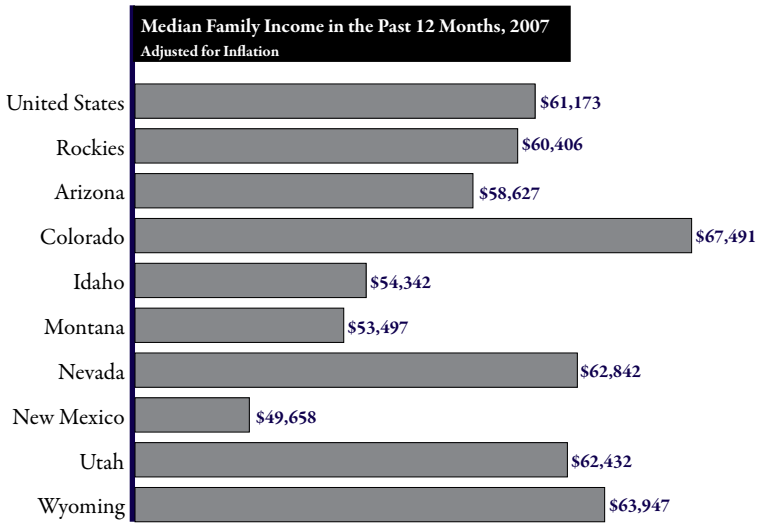
Adusted for Inflation. Means found using the population receiving each income type.

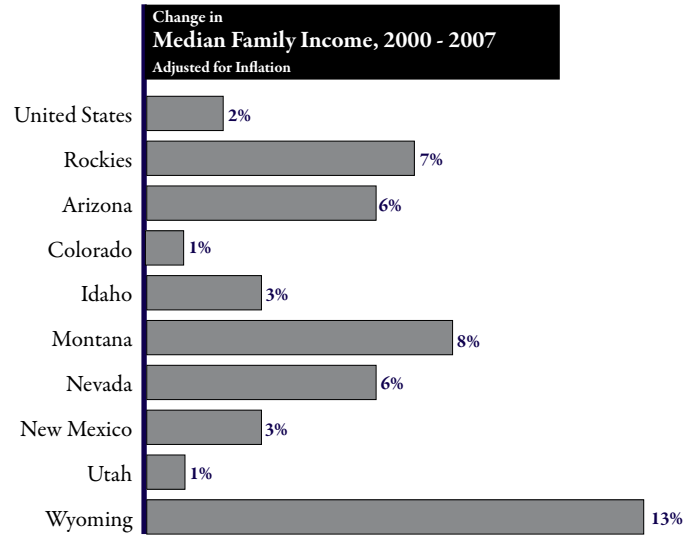
	Mean Earnings, 2007	Mean Earnings, Change Since 2000	Mean Social Security Income, 2007	Mean Social Security income, Change Since 2000	Mean Retirement Income, 2007	Mean Retirement Income, Change Since 2000	Mean Supplemental Security Income, 2007	Mean Supplemental Security Income, Change Since 2000	Mean Cash Public Assistance Income, 2007	Mean Cash Public Assistance Income, Change Since 2000
United States	$69,972	24%	$14,493	28%	$20,362	17%	$7,757	23%	$3,247	7%
Rockies	$66,003	25%	$14,581	28%	$22,033	22%	$7,869	24%	$2,922	13%
Arizona	$66,280	43%	$15,066	33%	$22,456	42%	$8,183	34%	$3,122	71%
Colorado	$71,082	35%	$14,164	18%	$24,164	32%	$7,566	16%	$3,142	21%
Idaho	$59,684	1%	$14,755	34%	$18,712	-3%	$7,818	24%	$1,963	-19%
Montana	$54,234	35%	$14,084	27%	$18,649	23%	$7,238	18%	$2,148	-12%
Nevada	$70,481	27%	$14,570	28%	$22,895	23%	$8,974	31%	$3,308	18%
New Mexico	$55,060	25%	$13,523	28%	$20,968	13%	$6,978	19%	$2,646	-8%
Utah	$66,977	22%	$15,281	29%	$21,213	20%	$7,972	21%	$2,845	-1%
Wyoming	$65,687	45%	$14,187	25%	$17,910	10%	$7,444	13%	$3,283	37%

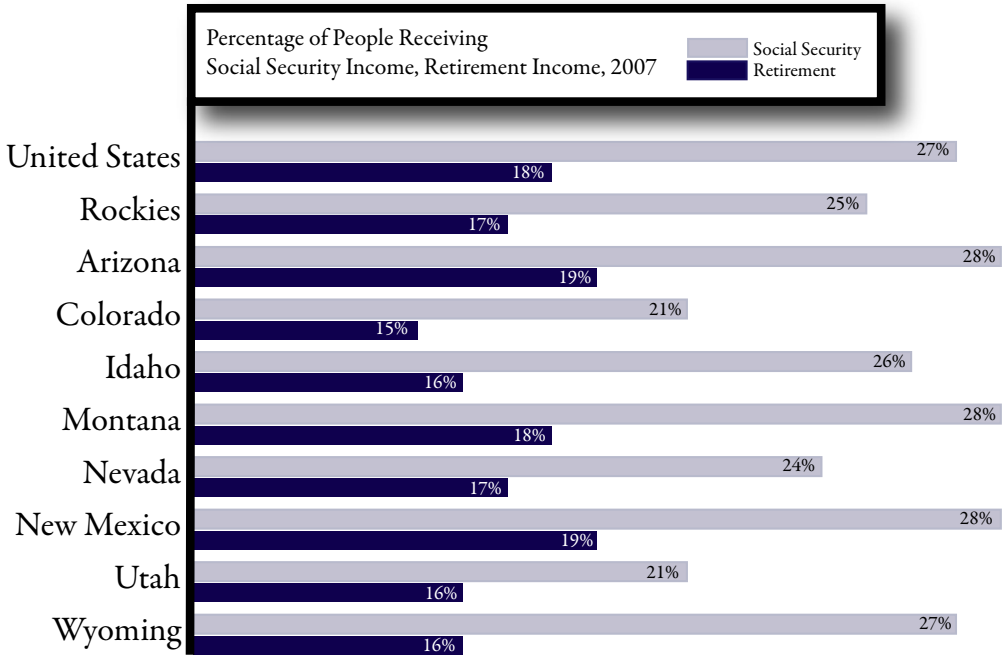
Income, 2007

Adusted for Inflation

	Median Household Income, 2007	Change in Median Household Income Since 2000	Mean Household Income, 2007	Median Family Income, 2007	Change in Median Family Income Since 2000	Mean Family Income, 2007	Per Capita Income, 2007	Change in Per Capita Income Since 2000
United States	$50,740	1%	$69,193	$61,173	2%	$80,265	$26,688	3%
Rockies	$50,918	2%	$67,102	$60,406	4%	$76,885	$25,463	4%
Arizona	$49,889	3%	$66,132	$58,627	5%	$75,786	$24,811	2%
Colorado	$55,212	-3%	$73,037	$67,491	1%	$85,583	$29,133	1%
Idaho	$46,253	3%	$60,595	$54,342	4%	$68,835	$23,105	8%
Montana	$43,531	10%	$56,165	$53,497	10%	$66,227	$22,937	11%
Nevada	$55,062	3%	$72,518	$62,842	3%	$81,398	$27,729	5%
New Mexico	$41,452	1%	$56,170	$49,658	5%	$63,945	$21,822	5%
Utah	$55,109	0%	$69,014	$62,432	2%	$76,630	$22,603	4%
Wyoming	$51,731	14%	$67,721	$63,947	17%	$80,576	$27,687	21%



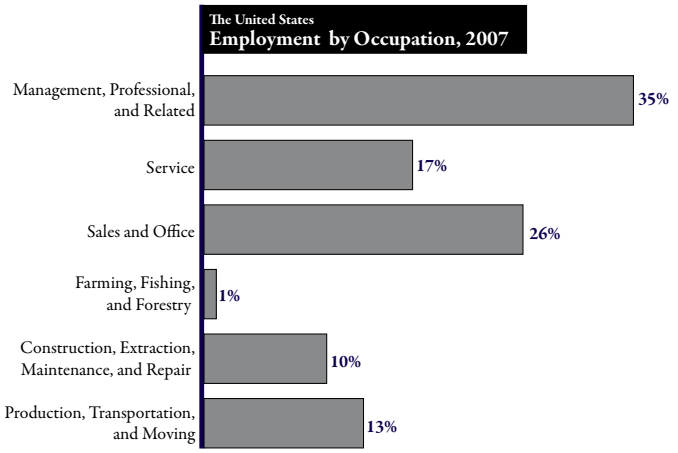


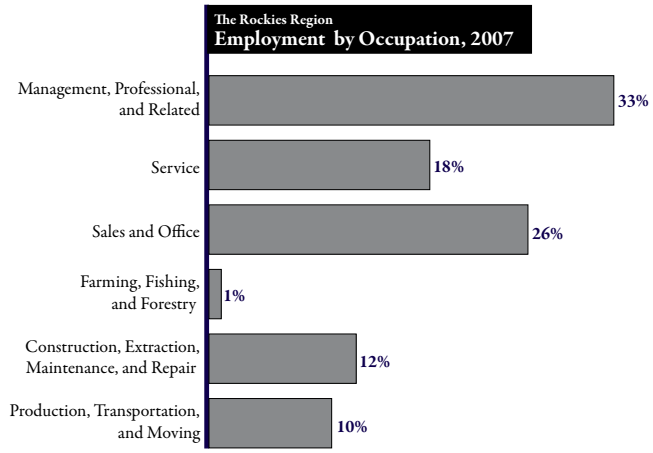


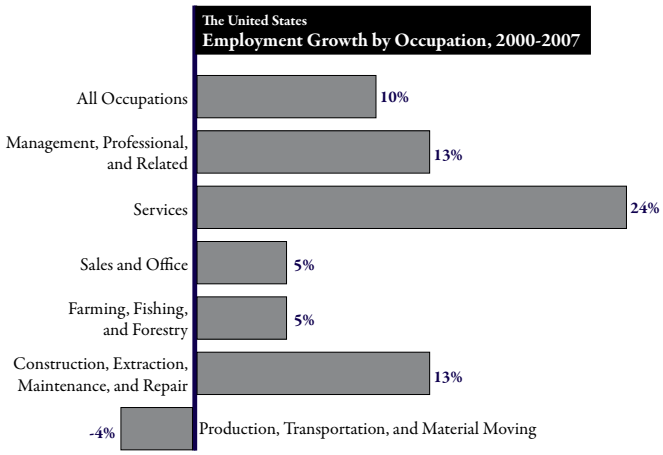
From the American Community Survey, 2007: Retirement income includes: (1) retirement pensions and survivor benefits from a former employer; labor union; or federal, state, or local government; and the U.S. military; (2) disability income from companies or unions; federal, state, or local government; and the U.S. military; (3) periodic receipts from annuities and insurance; and (4) regular income from IRA and Keogh plans. This does not include Social Security income.

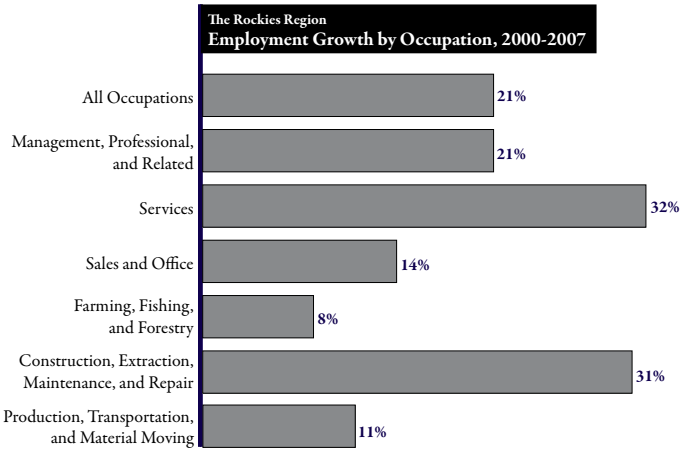
Employment by Occupation, 2007

Percentage of Civilian Population 16 and Older in the Following Occupations	Management, Professional, and Related	Service	Sales and Office	Farming, Fishing, and Forestry	Construction, Extraction, Maintenance, and Repair	Production, Transportation, and Material Moving	Employed Civilian Population 16 and Older
United States	35%	17%	26%	1%	10%	13%	142,588,118
Rockies	33%	18%	26%	1%	12%	10%	10,197,295
Arizona	33%	18%	26%	1%	12%	10%	2,839,644
Colorado	37%	16%	25%	1%	11%	10%	2,489,006
Idaho	33%	15%	25%	2%	12%	13%	714,072
Montana	32%	18%	25%	2%	12%	10%	469,972
Nevada	27%	25%	26%	0%	12%	10%	1,247,341
New Mexico	34%	18%	24%	1%	12%	10%	885,283
Utah	33%	14%	28%	0%	11%	12%	1,273,013
Wyoming	30%	17%	23%	1%	15%	13%	278,964









Employment Growth by Occupation, 2000 - 2007

	Management, Professional, and Related	Service	Sales and Office	Farming, Fishing, and Forestry	Construction, Extraction, Maintenance, and Repair	Production, Transportation, and Material Moving	All Occupations
United States	13%	24%	5%	5%	13%	-4%	10%
Rockies	21%	32%	14%	8%	31%	11%	21%
Arizona	28%	42%	18%	18%	41%	13%	27%
Colorado	13%	30%	5%	26%	18%	5%	13%
Idaho	24%	15%	16%	9%	33%	10%	19%
Montana	8%	17%	10%	-16%	22%	3%	10%
Nevada	38%	37%	24%	2%	43%	31%	34%
New Mexico	16%	26%	9%	11%	26%	6%	16%
Utah	25%	26%	19%	-4%	31%	11%	22%
Wyoming	17%	21%	10%	-20%	21%	15%	16%

Employment by Industry, 2007

Percentage of Civilian Population 16 and Older Employed in the Following Industries	Agriculture, Forestry, Fishing/Hunting, and Mining	Construction	Manufacturing	Wholesale Trade	Retail Trade	Transportation/Warehousing, and Utilities	Information	Finance/Insurance, and Real Estate/ Rental/Leasing	Professional, Scientific/Management, and Administrative/Waste Management Services	Educational Services, and Health Care/ Social Assistance	Arts, Entertainment/Recreation, and Accommodation/Food Services	Other Services, (Except Public Administration)	Public Administration
United States	2%	8%	11%	3%	11%	5%	2%	7%	10%	21%	9%	5%	5%
Rockies	3%	10%	8%	3%	12%	5%	2%	7%	11%	19%	11%	5%	5%
Arizona	2%	11%	8%	3%	12%	5%	2%	8%	11%	19%	10%	5%	5%
Colorado	2%	10%	7%	3%	11%	5%	4%	8%	12%	18%	10%	5%	4%
Idaho	5%	10%	11%	3%	12%	5%	2%	6%	9%	19%	8%	4%	5%
Montana	7%	9%	5%	3%	13%	5%	2%	6%	8%	21%	10%	4%	6%
Nevada	2%	11%	4%	3%	11%	5%	2%	7%	11%	14%	24%	4%	4%
New Mexico	4%	9%	6%	2%	12%	5%	2%	5%	11%	22%	10%	4%	7%
Utah	2%	9%	11%	3%	12%	5%	3%	7%	11%	20%	8%	4%	5%
Wyoming	11%	9%	5%	2%	12%	6%	2%	5%	7%	21%	9%	4%	6%

Employment Growth by Industry, 2000 - 2007

	Agriculture, Forestry, Fishing/Hunting, and Mining	Construction	Manufacturing	Wholesale Trade	Retail Trade	Transportation/Warehousing, and Utilities	Information	Finance/Insurance, and Real Estate/ Rental/Leasing	Professional, Scientific/Management, and Administrative/Waste Management Services	Educational Services, and Health Care/ Social Assistance	Arts, Entertainment/Recreation, and Accommodation/Food Services	Other Services, (Except Public Administration)	Public Administration
United States	9%	26%	-12%	-3%	7%	10%	-11%	15%	21%	17%	22%	8%	8%
Rockies	18%	40%	1%	6%	17%	20%	-14%	26%	34%	25%	23%	18%	15%
Arizona	33%	57%	1%	9%	23%	22%	-23%	32%	39%	33%	30%	33%	20%
Colorado	27%	21%	-8%	-3%	7%	17%	-20%	15%	21%	21%	23%	22%	9%
Idaho	8%	53%	-3%	-4%	17%	26%	10%	34%	40%	18%	22%	3%	18%
Montana	4%	40%	-6%	2%	14%	0%	3%	20%	32%	8%	4%	-8%	9%
Nevada	26%	53%	18%	26%	26%	33%	-6%	54%	60%	44%	21%	30%	27%
New Mexico	14%	34%	-1%	-1%	13%	18%	-5%	15%	33%	19%	22%	-1%	3%
Utah	17%	37%	9%	12%	19%	16%	-5%	24%	37%	27%	28%	11%	19%
Wyoming	17%	24%	28%	13%	17%	11%	-21%	12%	43%	14%	10%	0%	14%

Rockies Snapshot:

Federal Representation

By Chris Jackson

The 2009 Colorado College State of the Rockies Report Card

Background

The relationship between the federal government and the residents of the eight-state Rocky Mountain West is complex. Westerners are wary of being an inland colony of the United States, supplying the nation with valuable natural resources and receiving little in return. Such skepticism is not unfounded—federal ownership of nearly 60 percent of land in the Western states leaves the region vulnerable to federal action that either ignores or usurps state and local interests. The history of the West is rife with abuses of this imbalance of power, from haphazard oil shale experiments and fast-tracking oil and gas leasing on Bureau of Land Management (BLM) lands, to proposals to deposit nuclear waste in Yucca Mountain, Nevada. And exploitation is not limited to federal entities—the mining companies, railroads, energy developers, and banks that finance these industries, headquartered outside the region, are just as culpable of benefiting from Western resources, while contributing little to the long-term vitality of the region. Too often Western resources are permanently exported leaving only the shells of boomtowns and environmental blight. Despite the seemingly antagonistic relationship, The West is also dependent on the federal presence. Federally funded water diversion projects deliver water to cities in an arid region, and state and local economies benefit from military bases and federal laboratories. The result is a delicate balance between political sovereignty and federal support.

The *2006 Colorado College State of the Rockies Report Card* included a study entitled "A Common Western Voice: Can the Rockies Be Heard in Washington D.C.?" The study counted campaign stops and expenditure data from the 2004 presidential race to show that the West is a group of "flyover" states with too few Electoral College votes to warrant as much attention as the East or West coasts. The recent 2008 presidential election, however, was a different story. The West provided its own presidential candidates in Arizona Senator John McCain and former New Mexico Governor Bill Richardson, hosted the Democratic National Convention in Denver, and contained several battleground states. Westerners are also playing a significant role in the new Obama administration—former Colorado Senator Ken Salazar has been appointed Secretary of Interior, and former Arizona Governor Janet Napolitano has been named Secretary of Homeland Security.

The Rockies region has made progress gaining influence in national politics, but it is unrealistic to assume that Western issues will take center stage in the White House. We cannot simply wait until our population matches that the East Coast or West Coast to have our voices heard in Washington. However there are other avenues through which our views and voices are represented, but are they functioning effectively?

Ultimately, the responsibility of representing the eight Rockies states in the national arena falls on the delegation of 16 Senators and 28 Representatives who make up our "regional caucus" in both chambers of Congress. Their political prowess and tenacity translate to political legislation that addresses Western issues. Although much action can be taken at the state and local level, the unfortunate reality in the West is that federal laws and policies will continue to have a prevalent impact on the course of our region. Without

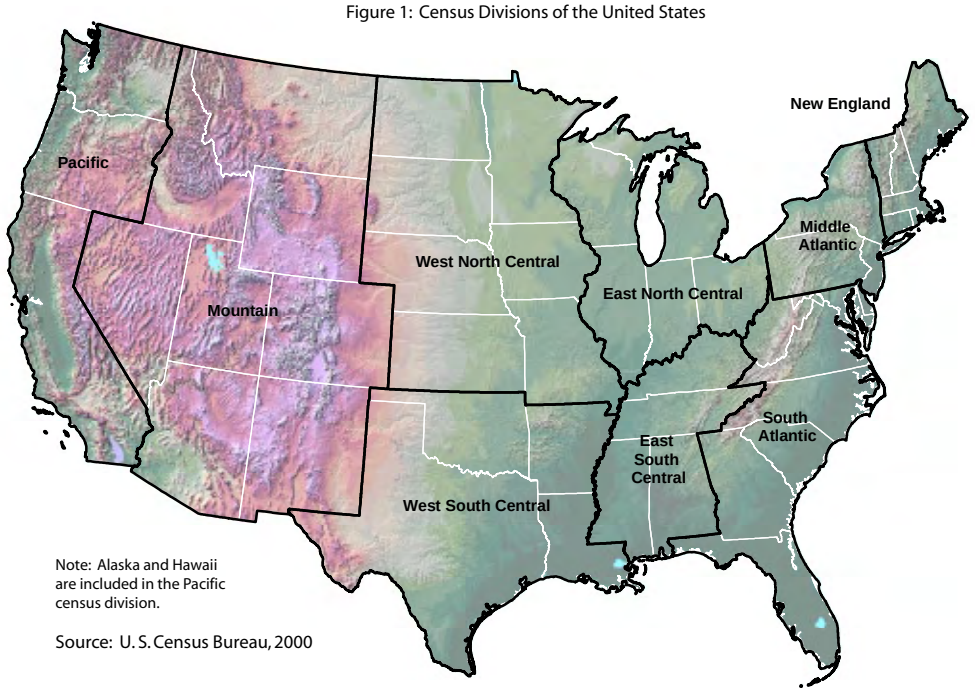
About the author: Chris Jackson (Colorado College '06) was the 2006-07 and 2007-08 Rockies Program Coordinator.

effective political representation our issues and challenges go under-represented.

In addition to the political skill of our individual Senators and Representatives, the Rockies region will enjoy greater national influence if our delegation works together, regardless of party affiliation. Historically, politically unified regions such as the Northeast and the South, can wield greater influence than their states would individually garner. For example, it was once considered impossible to win the presidency without winning the South, resulting in greater attention paid to southern issues. Opinions in the West are as diverse as its people, but many of the critical issues facing our region transcend party affiliation. Even as Westerners are split on Rockies issues such as energy development, conservation, water management, pollution, and immigration, we still depend on our members of congress to elevate the dialogue on these issues to the national level.

How effective is our group of senators and congressmen at representing the Rockies? How does our regional caucus compare to those of other regions? This section of *the 2009 State of the Rockies Report Card* examines the performance of Western members of the 110th Congress which represented our region through 2007 and 2008. Our method for determining the effectiveness of our regional caucus does not look at specific stances on policy issues; rather, it measures both their political power among other regions and the willingness of our delegation to disregard party politics and work together to promote the general welfare of the West.

Figure 1: Census Divisions of the United States



The Political Efficacy Index

The Rockies Project has developed a measure of how effective our regional delegation is at representing the West. We have compiled an index of three indicators: a cooperation score, a bi-partisanship score, and a congressional power score. This index was compiled for each of the nine geographical divisions determined by the U.S. Census Bureau (See Figure 1). By comparing each regional delegation on these measures, we can see how the Rockies senators and representatives stack up. In addition, we present a more detailed look at the individual senators and representatives from the Rocky Mountain West, including their individual bi-partisanship score, percentage of missed roll call votes, and congressional power

Table 1:
Cooperation Score by Division, House of Representatives 110th Congress

Division	Cooperation Score	Party Homogeneity
New England	88	95%
Middle Atlantic	59	67%
Pacific	50	66%
East South Central	46	54%
West South Central	45	58%
Mountain (Rockies States)	***44***	***61%***
Midwest East North Central	43	51%
Midwest North Central	43	52%
South Atlantic	43	56%

Source: Voter Information Services, 2008

Table 2:
Cooperation Score by Division, Senate, 110th Congress

Division	Cooperation Score	Party Homogeneity
East South Central	80	100%
Middle Atlantic	78	83%
Pacific	70	70%
Midwest East North Central	67	80%
New England	61	50%
Midwest North Central	53	50%
West South Central	53	63%
South Atlantic	51	50%
Mountain (Rockies States)	***50***	***69%***

Source: Voter Information Services, 2008

score and corresponding rank among their colleagues in the entire U.S. Senate and U.S. House of Representatives. (See Appendix 1 and Appendix 2).

The cooperation score was calculated for us by Voter Information Services and measures the rate at which members of each region vote the same way on a set of roll call votes.[1] A higher number in this category means that the majority of a regional delegation voted the same way on each roll call vote during the 110th Congress.

The bi-partisanship score measures the rate at which members of each delegation were willing to vote against their party leadership. A high number in this category means a more bi-partisan voting pattern. By including both the cooperation score and the bi-partisanship score, we control for regions that have a relatively homogenous party composition. For example, the New England region has a very high cooperation score but also mostly belongs to the Democratic Party. Concordantly, the region's bi-partisanship score is quite low, thus controlling for party homogeneity in the final index.

Table 3: Bi-Partisanship Score by division, House of Representatives, 110th Congress

Division	Bi-Partisanship
Mountain (Rockies States)	***13.2***
Midwest East North Central	12.3
Middle Atlantic	12.1
West South Central	12.0
East South Central	12.0
South Atlantic	11.4
Midwest North Central	10.8
Pacific	10.5
New England	6.7

Source: Voter Information Services, 2008

Table 4: Bi-Partisanship Score by division, Senate, 110th Congress

Division	Bi-Partisanship
New England	19.1
Midwest North Central	18.8
West South Central	18.0
Midwest East North Central	16.5
Mountain (Rockies States)	***16.0***
Middle Atlantic	15.8
Pacific	15.1
South Atlantic	15.1
East South Central	13.0

Source: Voter Information Services, 2008

U.S. Capitol Building, Lincoln Inaguration, 1861. Photo from the Library of Congress

Finally, the index includes the aggregate congressional power score, which is the average of each individual senator's and representative's power score. The congressional power scores were calculated by Knowlegis, LLC.[2] The scores are compiled based on four criteria:

- Position - considers tenure, committee assignments and leadership position
- Indirect influence - examines how each member uses the media and congressional caucuses to affect legislation
- Legislative activity - measures how effective each member is at passing substantive legislation and passing amendments to legislation
- Earmarks - using data from "Taxpayers for Common Sense," this variable measure how much money each member secured for local projects

In short, the congressional power score measures the effectiveness of each senator and representative. Again, the congressional power score was not calculated by the Rockies Project, rather, it was developed by Knowlegis and made available online as a tool for comparing member of the House and Senate.

Results

Cooperation Score

The cooperation score measures the rate at which members of each region vote the same way in roll call votes. While certainly a rudimentary measure of regionalism (not all regional issues are settled by legislation that reaches a roll call vote, such as successful oversight in the committees of jurisdiction), the cooperation score does provide a point for comparison. Although not an input in the final index, we have also provided a column for "Party Homogeneity," which depicts the percent that each region's delegation to each chamber is comprised of members of the same party (Table 1 and Table 2). Not surprisingly, the regions with the highest cooperation rates are also the most politically homogeneous regions.

Table 5: Average Congressional Power Scores by Division, House of Representatives, 110th Congress

Division	Average Knowlegis Congressional Power Score
New England	23.9
Middle Atlantic	21.3
Midwest East North Central	20.9
Pacific	20.9
South Atlantic	18.9
East South Central	17.4
West South Central	17.2
Midwest North Central	16.4
Mountain (Rockies States)	***13.8***

Source: Calculated Using Data From Knowledgis and Roll Call, 2008

Table 6: Average Congressional Power Scores by Division, Senate, 110th Congress

Division	Average Knowlegis Congressional Power Score
Middle Atlantic	33.3
New England	33.0
Midwest East North Central	32.0
Mountain (Rockies States)	***31.0***
Pacific	30.1
East South Central	26.3
Midwest North Central	25.1
South Atlantic	23.7
West South Central	23.3

Source: Calculated Using Data From Knowledgis and Roll Call, 2008

Bi-Partisanship

The bi-partisanship score measures the rate at which members of each regional caucus break with their party leadership on roll call votes (Table 3 and Table 4). This indicator is included in the index to augment the cooperation score by controlling for party homogeneity. A higher rate score indicates a greater demonstrated willingness to "go against" an elected official's party of affiliation.

Congressional Power Score

The congressional power score measures individual political prowess that stems from the position, influence, ability to pass legislation, and ability to collect earmarks for their state that each member represents. The Rockies Project is including these scores in the combined Political Efficacy Index, but the scores themselves were generated by Knowlegis and made available online. (Table 5 and Table 6).

Table 7: Political Efficacy Index by Division, House of Representatives, 110th Congress

Division	Cooperation Score	Bi-Partisanship Score	Average Knowlegis Congressional Power Score	Percent Rank	Grade
New England	88	6.7	23.9	100.0%	A
Middle Atlantic	59	12.1	21.3	87.5%	A-
Midwest East North Central	43	12.3	20.9	75.0%	B
Pacific	50	10.5	20.9	62.5%	C+
South Atlantic	43	11.4	18.9	50.0%	C
East South Central	46	12.0	17.4	37.5%	C-
West South Central	45	12.0	17.2	25.0%	D
Midwest North Central	43	10.8	16.4	12.5%	D
Mountain (Rockies States)	***44***	***13.2***	***13.8***	***0.0%***	***D***

Source: Calculated Using Data From Knowledgis, Roll Call, and Voter Information Services, 2008

Political Efficacy Index

The index considers the cooperation score, bi-partisanship score, and congressional power score as equal factors in measuring an effective regional delegation, and grades each region based on the composite of all three factors (Table 7 and Table 8).[3]

The results for the regional study show that the Rockies delegation to the House of Representatives ranks 8th of 9 in the political efficacy index, and the group of Rockies Senators ranks 6th of 9 in the political efficacy index. Looking at each individual category reveals the strengths and weaknesses of our delegation.

On the positive side, the Rockies regional caucus in the House of Representatives in the 110th

Table 8: Political Efficacy Index by Division, Senate, 110th Congress

Division	Cooperation Score	Bi-Partisanship Score	Average Knowlegis Congressional Power Score	Percent Rank	Grade
Middle Atlantic	78	15.8	33.3	100.0%	A
New England	61	19.1	33.0	87.5%	A-
Midwest East North Central	67	16.5	32.0	75.0%	B
Mountain (Rockies States)	***50***	***16.0***	***31.0***	***62.5%***	***C+***
Pacific	70	15.1	30.1	50.0%	C
East South Central	80	13.0	26.3	37.5%	C-
Midwest North Central	53	18.8	25.1	25.0%	D
South Atlantic	51	15.1	23.7	12.5%	D
West South Central	53	18.0	23.3	0.0%	D

Source: Calculated Using Data From Knowledgis, Roll Call, and Voter Information Services, 2008

Table 9:
Total and Per Capita Congressional Earmarks by Rockies States, 2008

State Rank: In Dollars per Capita Received out of 50	Geography	Total Congressional Earmarks, 2008	Earmark Dollars Per Capita, 2008	2007 Population Estimate
8	New Mexico	$211,940,090	$108	1,969,915
9	Idaho	$155,662,700	$104	1,499,402
10	Montana	$91,685,490	$96	957,861
11	Nevada	$217,322,770	$85	2,565,382
22	Utah	$134,709,500	$51	2,645,330
28	Wyoming	$21,921,600	$42	522,830
49	Colorado	$91,835,710	$19	4,861,515
50	Arizona	$118,554,400	$19	6,338,755
Mountain (Rockies States)		***$1,043,632,260***	***$49***	***21,360,990***
United States		$11,997,454,836	$40	410,878,291

Source: Taxpayers for Common Sense, 2008

By the measures employed in this study, the Western regional delegation to congress is not as effective in representing its home region as other regional delegations. What does this mean for the West? The success of a regional agenda is difficult to measure, especially when there is little consensus on exactly what that agenda entails. One method may be to measure how many dollars in earmarks are flowing into each region. Data compiled by the organization "Taxpayers for Common Sense" show that the West is actually receiving more dollars per capita in earmarks ($48.86) than the national average ($39.85). Two Western states, however, Colorado and Arizona, rank 49th and 50th respectively (Table 9).

If the Western delegation is indeed less effective than other regional caucuses, what is the reason? One possible explanation is that the West is currently a region in political transition. The West is diverse in both people and opinions and lacks a unified stance on its critical issues. The result is a politically divided region. Looking at our results, it is not surprising to see a connection between regional cooperation and party homogeneity in a region. In the House, the two regions with the highest cooperation score also had the highest percent of members belonging to the same party. The results are the same in the Senate. Political Congress had a higher bi-partisanship score than any other region, meaning our representatives are the most willing to break with their party leadership. Our House cooperation score, however, was quite low, meaning that although our representatives were willing to vote against their party, they did not necessarily vote with their fellow Westerners. The biggest shortcoming, however, was the aggregate House Congressional power score, which was the lowest of all regional caucuses.

The Rockies delegation to the Senate in the 110th Congress performed slightly better than their colleagues in the House. The Western Senators' cooperation score was the lowest of all regional delegations, their bi-partisanship score was exactly in the middle, and their aggregate power score, was 4th of 9, boosted by high-ranking senators such as Montana's Senator Max Baucus, Arizona's Senator John McCain, and Senate Majority Leader Harry Reid of Nevada.

Appendix 1:
Detailed Profile of Western Members of the U.S. Senate, 110th Congress

Last Name	First Name	State	Party	Bi-partisanship Score	Regional Unity Score	Missed Votes	Percent of Total Votes Missed	Knowlegis House Power Rank	Knowlegis House Power Score
Kyl	Jon	AZ	R	80	18	4	2%	18	38.23
McCain	John	AZ	R	61	45	173	81%	10	46.75
Allard	Wayne	CO	R	83	14	12	6%	79	17.31
Salazar	Ken	CO	D	54	12	0	0%	47	26.82
Craig	Larry	ID	R	89	16	6	3%	98	4.34
Crapo	Michael	ID	R	90	15	3	1%	72	18.52
Baucus	Max	MT	D	54	15	2	1%	6	53.27
Tester	Jon	MT	D	52	15	5	2%	92	13.88
Bingaman	Jeff	NM	D	48	9	2	1%	16	38.67
Domenici	Peter	NM	R	87	20	20	9%	46	26.91
Ensign	John	NV	R	81	16	13	6%	42	29.41
Reid	Harry	NV	D	51	0	3	1%	1	109.7
Bennett	Robert	UT	R	91	15	3	1%	76	17.77
Hatch	Orrin	UT	R	91	16	3	1%	39	30.47
Barrasso	John	WY	R	86	15	0	0%	99	3.56
Enzi	Michael	WY	R	85	15	3	1%	63	20.81

Source: Calculated Using Data From Knowledgis, Roll Call and Voter Information Services

Conclusion

unity may also affect the congressional power scores. In both chambers, seniority drives influence. Solidly Republican or Democratic regions, where it is easy for members of the favored party to get reelected, probably have more committee chairmanships and seniority. Periods of political transition, like that occurring in the West, mean high turnover among politicians, which can in turn negatively affect committee appointments and congressional power scores. Ironically, the same political transition that makes legislating difficult also put Western states on the political map for the 2008 presidential race, thus elevating the profile of Western issues in national debates.

The 2008 elections brought a new president, as well as two new senators and six new representatives in Rockies states. Already, we have seen increased representation in the cabinet, and hopefully this will increase the consideration of Rockies issues in the national agenda. Real progress, however, must come from those whose job first and foremost is to look out for the interests of the West. We must now turn our attention to the 111th congress and hope that the new Western members will perform better than their predecessors, while the veteran members of our delegation improve their political skills and expand their influence to better serve the Rockies. Citizens of the West can do their part by encouraging the discussion of Rockies issues in ways shared with our congressional delegation. Such steps will help bring us closer to finding our common Western voice.

[1] The calculation was a two-step process. First, the voting pattern of every regional division for each roll call vote was tabulated using the formula (For-Against)/(For+Against)*100. Second, these calculated values of all available roll call votes were averaged to determine a regional score.

[2] Available online at http://www.congress.org/congressorg/power_rankings/index.tt

[3] Each region is assigned a Z-score for each variable that makes up the indicator in order to normalize and compare numerically different variables. The Z-score for a representative and for a given variable is equal to the value of the variable for that unit minus the mean value of the variable for all counties all divided by the standard deviation of the variable for the group. $Z = (X - Xmean)/Sx$, where Z is the Z-score, X is the value of a variable for a unit, Xmean is the mean value of the variable for all units in the group, and Sx is the standard deviation of the variable for all units in the group. After each region is assigned a Z-score for each variable that makes up the indicator, each region is assigned an overall Z-score by averaging the Z-scores for all the counties. Then, each region is ranked in order of its overall Z-score for the indicator.

Appendix 2: Detailed Profile of Western Members of the U.S. House of Representatives, 110th Congress

Last Name	First Name	State	Party	Bi-partisanship Score	Regional Unity Score	Missed Votes	Percent of Total Votes Missed	Knowlegis House Power Rank	Knowlegis House Power Score
Flake	Jeff	AZ	R	16	75	27	4%	372	8.1
Franks	Trent	AZ	R	9	80	10	1%	387	7.27
Giffords	Gabrielle	AZ	D	11	59	13	2%	277	12.91
Grijalva	Raul	AZ	D	8	47	59	9%	246	14.44
Mitchell	Harry	AZ	D	13	61	19	3%	334	10.86
Pastor	Ed	AZ	D	6	51	1	0%	84	28.68
Renzi	Rick	AZ	R	21	91	114	17%	435	-2.59
Shadegg	John	AZ	R	10	80	15	2%	211	16.56
DeGette	Diana	CO	D	7	50	29	4%	66	30.49
Lamborn	Doug	CO	R	9	82	6	1%	411	5.71
Musgrave	Marilyn	CO	R	11	86	36	5%	391	6.92
Perlmutter	Ed	CO	D	6	55	12	2%	172	19.32
Salazar	John	CO	D	6	55	9	1%	314	11.68
Tancredo	Thomas	CO	R	22	75	107	16%	397	6.52
Udall	Mark	CO	D	13	52	149	22%	230	15.2
Sali	William	ID	R	11	83	8	1%	423	4.14
Simpson	Michael	ID	R	20	91	31	5%	220	16.1
Rehberg	Dennis	MT	R	14	94	1	0%	343	10.43
Pearce	Steve	NM	R	12	87	42	6%	273	13.09
Udall	Tom	NM	D	8	51	57	8%	130	23.88
Wilson	Heather	NM	R	20	90	91	13%	235	15.06
Berkley	Shelley	NV	D	7	54	34	5%	77	29.09
Heller	Dean	NV	R	12	87	13	2%	420	4.8
Porter	Jon	NV	R	23	92	16	2%	244	14.54
Bishop	Rob	UT	R	14	84	76	11%	354	9.9
Cannon	Christopher	UT	R	15	79	125	18%	318	11.56
Matheson	Jim	UT	D	14	59	8	1%	86	28.48
Cubin	Barbara	WY	R	32	67	269	39%	295	12.41

Source: Calculated Using Data From Knowledgis, Roll Call and Voter Information Services

Rockies Snapshot:

Historic Preservation

By Chris Jackson and John MacKinnon

The 2009 Colorado College State of the Rockies Report Card

Historic Preservation: Benefits and Challenges

Residents of the Rockies are shaped by the distinctive character of the region, a subtle force often recognized more by tourists than "native" inhabitants. Our region's history and landscape form a foundation for our individual and collective identity as Westerners. Historic places, more than just relics of bygone eras, provide a link to the past in ways that cultivate our unique sense of place. Railway depots evoke visions of perpetual movement and the idea of Manifest Destiny that, for better or worse, was instrumental in the opening of the West. Historic cemeteries and famous battlefields often put our own struggles and trials into a larger context, reminding us that we exist in a narrative much larger than our immediate memory. Archaeological sites, petroglyphs, and Native American settlements reveal a complex and colorful cultural history. Civic halls, gymnasiums, churches, and schoolhouses remind us of the importance of community, especially as social forces push us toward alienation and materialism. Historic mining towns tell the cautionary tale of boom and bust. These images not only color the cultural and social tapestry that enriches our lives, but also provide insight into understanding our current condition.

The benefits of historic preservation extend beyond the inherent value of maintaining our cultural links to the past. Environmentalists and city planners are taking an interest in the corollary effects of preserving historic sites. For example, many historic districts in city centers already exemplify "walkable" and "livable" design concepts coveted by the new urbanism and smart growth movements that are gaining appeal in city planning.[1] Many environmentalists see historic preservation as an energy- and material-saving pursuit—restoring existing buildings rather than tearing them down and building new ones.[2] Communities are also looking to historic preservation as not just a cost-saving mechanism, but a revenue-generating one as well. Rehabilitating deteriorating buildings encourages job growth and can stimulate cultural tourism. A recent study showed that historic preservation in Colorado since 1981 has created nearly 29,000 jobs and generated $2 billion in direct and indirect economic impacts.[3] Interest in historic preservation now extends beyond a small circle of aficionados to include economists, city planners, and environmentalists.

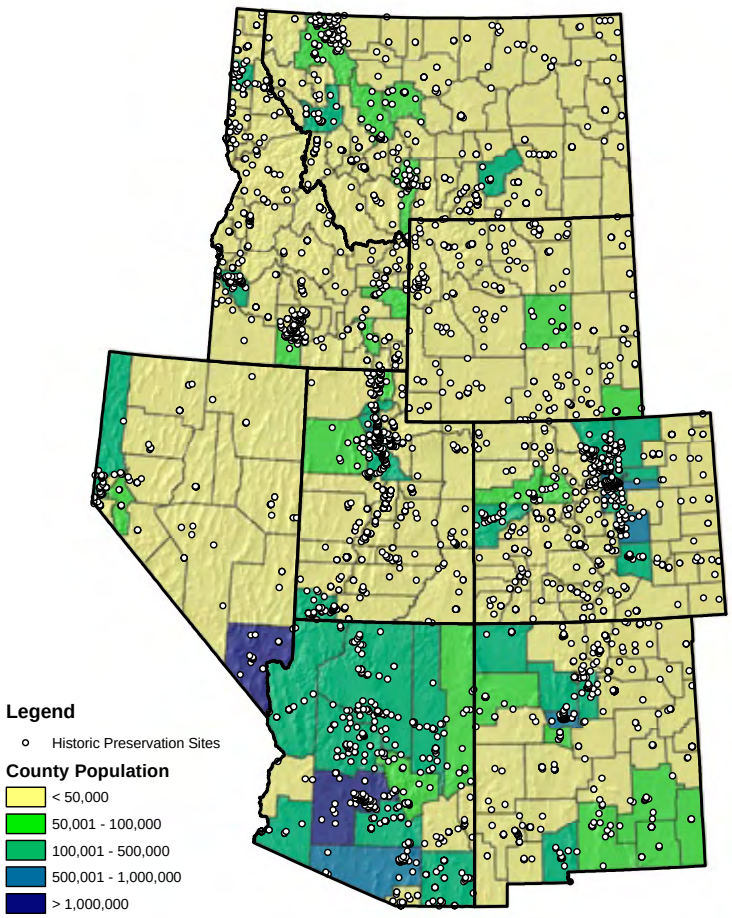
There are many challenges to preserving historic places across the country. For one, historic preservation and protection cannot be a passive endeavor - it is not enough to simply avoid tearing down historic sites. Unless we take proactive preservation steps, the mere passage of time is enough to gradually erase them from our landscapes. Other threats to historic places are human-made. Often communities and private land owners are unaware of the historic significance of certain sites and therefore either unwittingly let them crumble or destroy them in favor of modern development. Increasing land values may compel an otherwise sympathetic site owner to sell to developers. Urban sprawl is also cited as a threat to historic preservation, as it discourages vibrant urban cores which often include historic buildings.

About the authors: Chris Jackson (Colorado College'06) was the 2006-07 and 2007-08 Rockies Program Coordinator. John MacKinnon (Colorado College'06) was a 2008 researcher for the State of the Rockies Project and currently attends law school at Lewis and Clark College.

Sprawl can devalue a community's sense of place and subsequently diminish a historic site's intrinsic worth. Figure 1 identifies designated historic places within Rockies counties, ranked by population; larger urban areas often have more resources with which to protect their history, but also more urgent development pressures. These challenges highlight the need for proactive city development plans and thoughtful and informed citizens to recognize the economic, social, and educational value of historic preservation.

Historic and cultural sites located on public lands, specifically on National Forest Service (NFS) lands, present their own unique challenges. Figure 2 shows the pattern of federal lands overlain by designated historic places. The National Trust for Historic Preservation estimates that of the 325,000 cultural resources identified on NFS land, only 1,936 have been officially listed on the National Register of Historic Places.[4] One problem is assessment: 80 percent of the land the NFS manages has not been surveyed for historic and cultural sites.[5] Another issue is funding—0.4 percent of the agency's budget, which is consistently stretched thin by wildfire mitigation costs, is devoted to heritage resource programs.[6] Historic sites located on federal property are threatened by myriad competing demands on the land, including motorized recreation, timber harvesting, grazing, and mineral extraction.

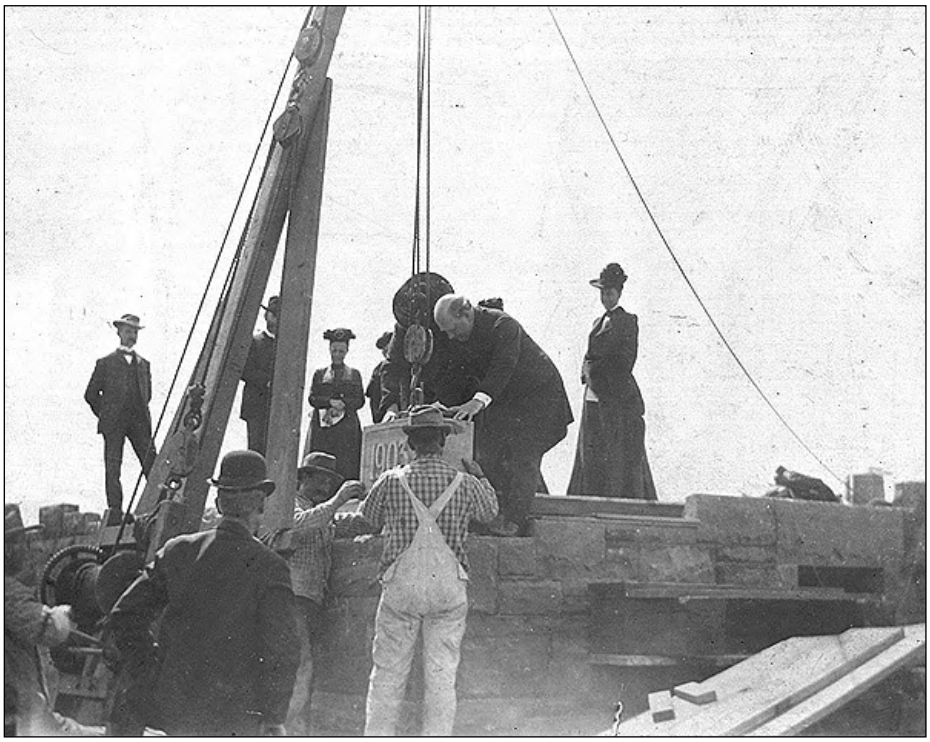
Figure 1: Rockies Historic Places and County Population, 2008



Source: GeoLytics and National Register of Historic Places, U. S. National Park Service

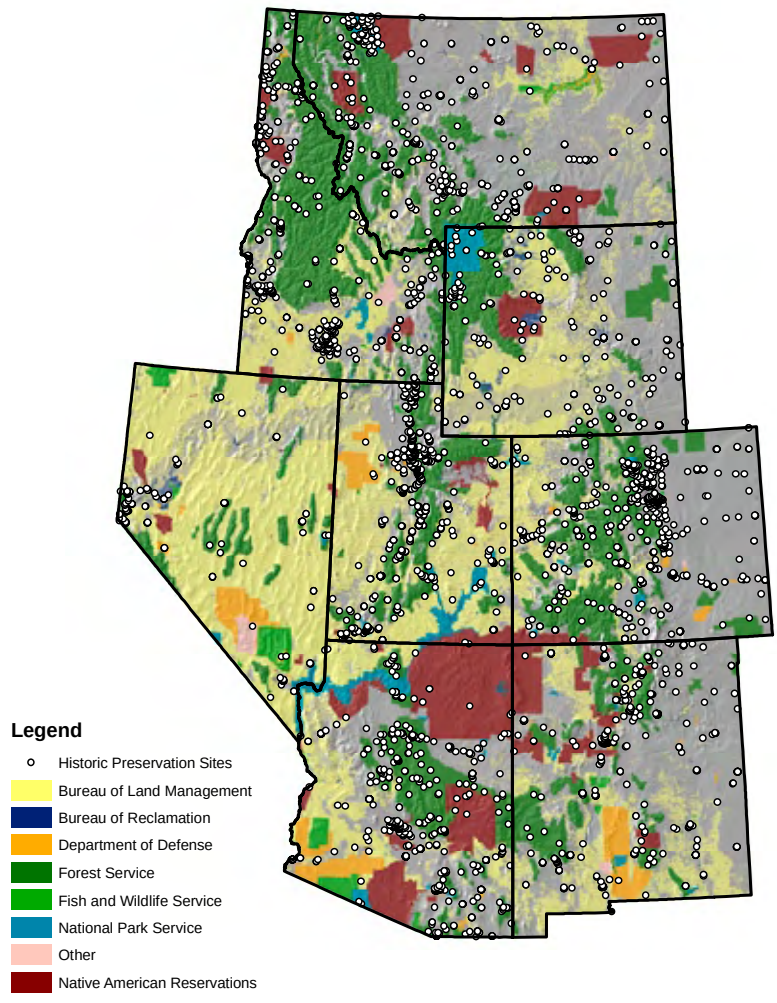
The National Register of Historic Places

Recognizing the value of historic places, the U.S. Congress passed the Historic Preservation Act in 1966, creating the National Register of Historic Places (NRHP), the nation's official list of cultural resources worthy of preservation. The NRHP is maintained by the NPS in the Department of the Interior and contained more than 80,000 individually listed sites as of 2007. Inclusion on the NRHP does not guarantee protection of the site, but does require federal agencies to consider the impact of federally funded, licensed, or permitted projects on historic and cultural sites that are listed on or eligible for listing.



Colorado College, President Slocum lays the cornerstone for Palmer Hall, 1902

Figure 2: Rockies Historic Places and Federal Land Ownership



Source: National Atlas of the United States, U.S. Geological Survey
National Register of Historic Places, U.S. National Park Service

In addition, owners of income-producing properties listed on the NRHP are eligible to receive tax credits for expenses incurred for substantial rehabilitation of their property. They can also be eligible to compete for state and federal grant money such as *Save America's Treasures* and *Preserve America* grants.

Anyone, including individual property owners, historical societies, and local governments, may prepare a site nomination for the NRHP. Nominations for sites located on federal lands are ultimately approved by the relevant federal agency, nominations for sites located on tribal lands are approved by a Tribal Historical Preservation Officers, and all others are approved by the State Historical Preservation Officer. To be listed, a site must have integrity and meet one of four possible criteria demonstrating historical significance:

• *Event*: the site is associated with a key event in history
• *Person*: the site relates to a significant historical figure
• *Design/Construction*: the site embodies distinctive characteristics of a type, period, or method of construction
• *Information Potential*: the site is likely to yield information important to history.

What the Data Show

The NRHP tracks not only where historic sites are located, but also key information about each site, such as the owner, current function, historical function, and nominator. The following data provide an overview of historic sites in the Rockies region:

• There are approximately 5,800 sites in the Rockies, just over 7 percent of the total number of sites listed nationwide

• 89 percent of Rockies historic sites listed on the NRHP are still functioning in some capacity

• 71 percent of Rockies sites listed on the register are privately owned, 15 percent are locally owned, 5 percent are state owned, and 9 percent are federally owned.

• Of the Rockies sites listed on the NRHP, 3,276 were nominated for their relevance to an event in history, 162 relate to a historical figure, 2,438 are listed for their design or structural characteristics, and 16 are listed for their information potential.

• The Rockies counties with the largest numbers of sites are listed in Table 1.

Table 1: Top 11 Historic Counties

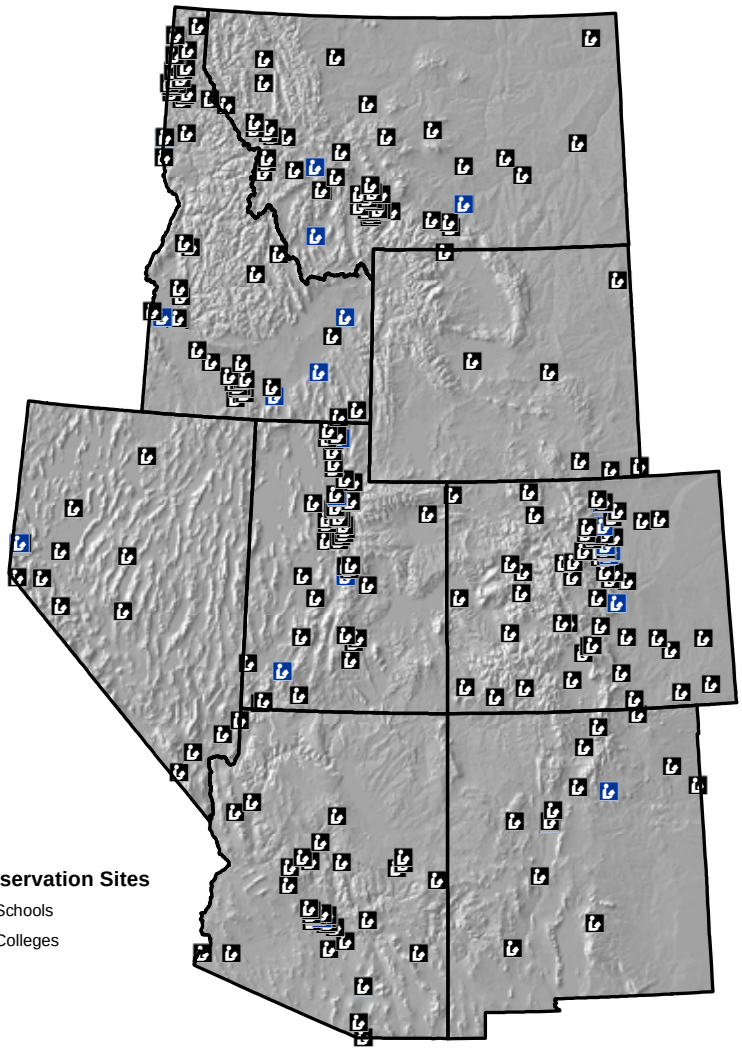
County and State	Number of Sites on the NRHP
Salt Lake UT	291
Maricopa AZ	254
Denver CO	237
Utah UT	156
Ada ID	132
Flathead MT	124
Bernalillo NM	124
Beaver UT	110
Summit UT	102
Coconino AZ	91
Pinal AZ	91

Data Source: National Register of Historic Places

An example of the richness and diversity of historic preservation already accomplished in the Rockies is shown in Figure 3 which identifies preservation to date of historic schools and colleges.

The NRHP, though a rich data set, is an incomplete representation of where historic sites are located. Often, NRHP listings reflect the willingness of owners to nominate their property because they want related tax credits, grants, or recognition. Historic sites that do not provide these incentives for an individual owner can be overlooked. We will not obtain a comprehensive picture of historic sites in the West, or in the rest of the nation, until states pursue cultural resource surveys, which can be driven by public demand for further protection and preservation of historic sites. Until then, organizations such as the National Trust for Historic Preservation and thousands of local historical societies and preservation groups will continue to work to raise awareness about threatened historic places. The economic and cultural value of historic preservation benefits not only a few connoisseurs, but all Westerners who appreciate our region for its vitality and unique character.

Figure 3: Historic Educational Sites in the Rockies



Source: National Register of Historic Places, U. S. National Park Service

[1] "Historic Preservation is smart growth" remarks by Donovan Rypkeema, March 3, 1999. http://hmturnerfoundation.org/html/artsmartgrow.html. Accessed 2/5/09.
[2] Rypkema, Donovan. "Sustainability and Historic Preservation" March 2007. http://www.preservation.org/rypkema.htm. Accessed 2/10/09.
[3] "The Economic Impact of Historic Preservation in Colorado 2005 Update" pg 3
[4] Jarvis, T. Destry. "Cultural Resources of the National Forest System: An Assessment and Needs Analysis" Outdoor Recreation & Park Services, LLC, and The National Trust for Historic Preservation. 2008. pg 64.
[5] *Ibid*, pg. 67
[6] *Ibid*, pg. 10

Ada Theater, "The Egyptian Theater," Boise, ID, Duane Garrett, 1973

Sites Listed on the National Register of Historic Places, by Rockies County, 2008

	County	Number of Sites	Sites per 1,000 County Residents	Sites per 1,000 sq. Miles
Arizona	Apache	13	18.4	1.2
	Cochise	51	39.7	8.2
	Coconino	91	72.9	4.9
	Gila	33	64.6	6.9
	Graham	30	92.0	6.4
	Greenlee	9	123.0	4.9
	La Paz	2	9.3	0.4
	Maricopa	254	6.7	27.5
	Mohave	61	31.4	4.5
	Navajo	38	34.5	3.8
	Pima	75	7.9	8.1
	Pinal	91	38.8	16.9
	Santa Cruz	41	97.3	32.9
	Yavapai	60	29.8	7.4
	Yuma	43	22.1	7.8
Colorado	Adams	9	2.3	7.6
	Alamosa	12	78.9	16.6
	Arapahoe	16	3.0	20.0
	Archuleta	1	8.2	0.7
	Baca	2	50.1	0.8
	Bent	3	53.6	1.9
	Boulder	64	24.2	86.3
	Chaffee	17	99.2	16.7
	Cheyenne	2	100.8	1.1
	Clear Creek	16	181.9	40.5
	Conejos	8	94.0	6.3
	Costilla	4	109.2	3.2
	Crowley	1	18.0	1.2
	Custer	7	173.4	9.5
	Delta	11	35.7	9.6
	Denver	237	41.4	1524
	Dolores	3	173.2	2.8
	Douglas	16	5.9	19.2
	Eagle	7	14.3	4.2
	Elbert	1	4.3	0.5
	El Paso	65	11.4	30.5
	Fremont	20	42.1	13.1

Data Source: National Register of Historic Places

	County	Number of Sites	Sites per 1,000 County Residents	Sites per 1,000 sq. Miles
Colorado	Garfield	14	27.8	4.7
	Gilpin	3	61.0	19.9
	Grand	10	72.6	5.4
	Gunnison	15	102.5	4.6
	Hinsdale	2	227.5	1.8
	Huerfano	6	78.8	3.8
	Jackson	2	144.1	1.2
	Jefferson	40	7.6	51.8
	Kiowa	1	70.0	0.6
	Kit Carson	7	93.1	3.2
	Lake	4	50.8	10.5
	La Plata	6	12.7	3.5
	Larimer	64	23.2	24.3
	Las Animas	14	92.1	2.9
	Lincoln	1	18.0	0.4
	Logan	9	42.8	4.9
	Mesa	26	19.4	7.7
	Mineral	2	194.4	2.3
	Moffat	10	73.4	2.1
	Montezuma	8	31.1	3.9
	Montrose	14	36.4	6.2
	Morgan	13	44.9	10.0
	Otero	13	66.2	10.2
	Ouray	3	68.0	5.6
	Park	9	51.2	4.1
	Phillips	3	63.7	4.4
	Pitkin	32	219.8	32.8
	Prowers	10	70.8	6.1
	Pueblo	53	34.4	22.1
	Rio Blanco	4	64.2	1.2
	Rio Grande	10	77.9	10.9
	Routt	15	68.5	6.3
	Saguache	2	25.1	0.6
	San Juan	2	333.3	5.2
	San Miguel	3	42.6	2.3
	Sedgwick	2	85.4	3.6
	Summit	4	15.8	6.4

Data Source: National Register of Historic Places

	County	Number of Sites	Sites per 1,000 County Residents	Sites per 1,000 sq. Miles
Colorado	Teller	6	27.5	10.7
	Washington	3	67.4	1.2
	Weld	28	11.8	7.0
	Yuma	3	30.4	1.3
Idaho	Ada	132	38.4	126.1
	Adams	6	177.2	4.4
	Bannock	20	26.5	17.4
	Bear Lake	87	1366.4	83.1
	Benewah	4	45.3	5.1
	Bingham	11	25.1	5.2
	Blaine	13	59.8	4.9
	Boise	2	26.3	1.0
	Bonner	14	34.0	7.3
	Bonneville	22	23.3	11.6
	Boundary	7	64.7	5.5
	Butte	2	73.3	0.9
	Camas	0	0.0	0.0
	Canyon	33	18.8	54.4
	Caribou	6	82.8	3.3
	Cassia	3	14.2	1.2
	Clark	2	229.4	1.1
	Clearwater	3	36.1	1.2
	Custer	29	709.6	5.9
	Elmore	18	63.0	5.8
	Franklin	8	63.4	12.0
	Fremont	11	87.8	5.8
	Gem	10	61.4	17.8
	Gooding	12	83.5	16.3
	Idaho	22	140.0	2.6
	Jefferson	5	22.9	4.5
	Jerome	62	311.5	103.9
	Kootenai	36	27.4	27.3
	Latah	38	107.1	35.1
	Lemhi	11	139.8	2.4
	Lewis	3	80.5	6.3
	Lincoln	41	938.4	34.2
	Madison	3	9.1	6.4

Data Source: National Register of Historic Places

	County	Number of Sites	Sites per 1,000 County Residents	Sites per 1,000 sq. Miles
Idaho	Minidoka	1	5.2	1.3
	Nez Perce	24	62.9	28.2
	Oneida	6	144.2	5.0
	Owyhee	7	64.4	0.9
	Payette	13	59.9	31.8
	Power	9	117.9	6.3
	Shoshone	17	135.4	6.5
	Teton	3	39.3	6.7
	Twin Falls	30	42.9	15.6
	Valley	19	225.6	5.1
	Washington	28	276.4	19.1
Montana	Beaverhead	8	93.4	1.4
	Big Horn	28	213.6	5.6
	Blaine	5	77.7	1.2
	Broadwater	4	86.1	3.2
	Carbon	47	488.9	22.9
	Carter	0	0.0	0.0
	Cascade	24	30.4	8.9
	Chouteau	14	254.5	3.5
	Custer	10	87.5	2.6
	Daniels	2	116.7	1.4
	Dawson	10	119.0	4.2
	Deer Lodge	26	285.2	35.1
	Fallon	2	71.7	1.2
	Fergus	28	248.2	6.5
	Flathead	124	147.5	23.7
	Gallatin	80	100.3	30.3
	Garfield	0	0.0	0.0
	Glacier	11	79.8	3.6
	Golden Valley	4	337.3	3.4
	Granite	8	287.0	4.6
	Hill	5	30.7	1.7
	Jefferson	4	35.5	2.4
	Judith Basin	0	0.0	0.0
	Lake	5	17.4	3.0
	Lewis and Clark	40	67.8	11.5
	Liberty	2	99.6	1.4
	Lincoln	4	20.7	1.1

Data Source: National Register of Historic Places

	County	Number of Sites	Sites per 1,000 County Residents	Sites per 1,000 sq. Miles
Montana	McCone	1	59.0	0.4
	Madison	8	111.4	2.2
	Meagher	4	199.9	1.7
	Mineral	10	257.6	8.2
	Missoula	62	62.9	23.8
	Musselshell	2	44.2	1.1
	Park	17	109.5	6.1
	Petroleum	0	0.0	0.0
	Phillips	4	99.2	0.8
	Pondera	2	33.4	1.2
	Powder River	0	0.0	0.0
	Powell	9	135.9	3.9
	Prairie	1	91.2	0.6
	Ravalli	75	186.0	31.3
	Richland	2	22.5	1.0
	Roosevelt	1	9.1	0.4
	Rosebud	16	175.3	3.2
	Sanders	19	163.6	6.8
	Sheridan	5	143.9	2.9
	Silver Bow	11	33.9	15.3
	Stillwater	8	98.0	4.4
	Sweet Grass	5	132.1	2.7
	Teton	1	16.4	0.4
	Toole	3	61.4	1.5
	Treasure	2	275.1	2.0
	Valley	11	154.3	2.2
	Wheatland	0	0.0	0.0
	Wibaux	2	214.4	2.2
	Yellowstone	18	13.3	6.8
Nevada	Churchill	9	37.3	1.8
	Clark	25	1.4	3.1
	Douglas	18	38.4	24.5
	Elko	5	11.3	0.3
	Esmeralda	0	0.0	0.0
	Eureka	0	0.0	0.0
	Humboldt	9	51.8	0.9
	Lander	11	216.3	2.0
	Lincoln	4	94.7	0.4
	Lyon	8	16.4	4.0

Data Source: National Register of Historic Places

	County	Number of Sites	Sites per 1,000 County Residents	Sites per 1,000 sq. Miles
Nevada	Mineral	3	58.9	0.8
	Nye	8	19.6	0.4
	Pershing	5	81.4	0.8
	Storey	8	194.1	30.4
	Washoe	67	17.1	10.2
	White Pine	12	144.2	1.4
	Carson City	38	67.8	241.6
New Mexico	Bernalillo	124	19.9	106.2
	Catron	5	149.3	0.7
	Chaves	14	21.8	2.3
	Cibola	1	3.6	0.2
	Colfax	18	135.2	4.8
	Curry	10	21.6	7.1
	De Baca	4	210.5	1.7
	Dona Ana	17	8.6	4.4
	Eddy	17	32.6	4.0
	Grant	30	105.1	7.5
	Guadalupe	4	81.7	1.3
	Harding	2	246.9	0.9
	Hidalgo	2	40.0	0.6
	Lea	4	6.9	0.9
	Lincoln	6	27.8	1.2
	Los Alamos	4	21.2	37.1
	Luna	5	18.5	1.7
	McKinley	18	25.0	3.3
	Mora	8	157.5	4.1
	Otero	15	23.1	2.3
	Quay	7	76.7	2.4
	Rio Arriba	26	61.6	4.4
	Roosevelt	4	21.2	1.6
	Sandoval	4	3.6	1.1
	San Juan	16	12.6	2.9
	San Miguel	87	286.3	18.4
	Santa Fe	41	28.4	21.5
	Sierra	12	94.3	2.8
	Socorro	33	181.5	5.0
	Taos	31	87.9	14.0
	Torrance	5	29.7	1.5
	Union	6	162.6	1.6
	Valencia	11	16.1	10.3

Data Source: National Register of Historic Places

	County	Number of Sites	Sites per 1,000 County Residents	Sites per 1,000 sq. Miles
Utah	Beaver	110	1793.0	42.8
	Box Elder	35	76.1	5.2
	Cache	70	69.8	59.4
	Carbon	14	71.2	9.4
	Daggett	1	99.5	1.4
	Davis	47	16.9	73.7
	Duchesne	2	13.0	0.6
	Emery	15	137.8	3.4
	Garfield	19	442.8	3.6
	Grand	17	191.7	4.6
	Iron	14	36.9	4.3
	Juab	18	187.6	5.3
	Kane	11	170.9	2.7
	Millard	17	137.5	2.5
	Morgan	3	37.7	4.9
	Piute	2	138.5	2.6
	Rich	2	91.4	1.9

Data Source: National Register of Historic Places

	County	Number of Sites	Sites per 1,000 County Residents	Sites per 1,000 sq. Miles
Utah	Salt Lake	291	30.0	361.8
	San Juan	13	89.9	1.6
	Sanpete	70	288.6	43.6
	Sevier	21	103.6	10.9
	Summit	102	279.1	54.2
	Tooele	18	33.2	2.5
	Uintah	12	43.5	2.7
	Utah	156	37.1	72.8
	Wasatch	36	184.1	29.9
	Washington	77	62.5	31.8
	Wayne	16	637.2	6.5
	Weber	56	25.8	84.9
Wyoming	Albany	21	67.5	4.9
	Big Horn	9	77.0	2.9
	Campbell	0	0.0	0.0
	Carbon	22	147.5	2.8
	Converse	10	79.4	2.4

Data Source: National Register of Historic Places

	County	Number of Sites	Sites per 1,000 County Residents	Sites per 1,000 sq. Miles
Wyoming	Crook	7	116.6	2.4
	Fremont	11	30.4	1.2
	Goshen	4	32.6	1.8
	Hot Springs	6	134.2	3.0
	Johnson	11	141.7	2.7
	Laramie	38	44.0	14.2
	Lincoln	7	43.0	1.7
	Natrona	22	31.5	4.1
	Niobrara	6	262.0	2.3
	Park	22	82.2	3.2
	Platte	4	46.5	1.9
	Sheridan	14	51.8	5.5
	Sublette	7	98.5	1.4
	Sweetwater	18	47.2	1.7
	Teton	37	192.3	8.8
	Uinta	8	41.0	3.8
	Washakie	2	25.2	0.9
	Weston	3	46.0	1.2

Data Source: National Register of Historic Places

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Rockies Snapshot:

Incarceration and Crime

By John MacKinnon and Chris Jackson

The 2009 Colorado College State of the Rockies Report Card

Justice and Prisons in the Rockies

On the afternoon of June 24, 1896, Butch Cassidy and three members of his "Wild Bunch" entered the San Miguel County Bank in Telluride, Colorado, drew pistols on the bank teller, robbed the bank of nearly $20,000, and then fled town on horseback. Sheriff James A. Beattie and a posse took up the chase but lost the gang when they switched their horses for fresh mounts at a pre-arranged location in the nearby Mancos Mountains. Adding insult to the injury, it was later discovered that the gang had bribed Telluride Town Marshall Jim Clark to "be out of town" the day of the robbery. The Telluride heist was the first of many bank robberies for Cassidy and his cohorts, whose prolific criminal careers included bank and train robberies in each of the eight Rocky Mountain states. Not every job went as smoothly as the San Miguel County Bank, however, and the gang of outlaws did not always elude pursuing lawmen or the famed Pinkerton private security firm that had been hired to track down outlaw gangs in the West. During their crime spree in the late 1800's and early 1900's, members of the Wild Bunch were jailed in the Idaho, New Mexico, and Utah state prisons, and Cassidy himself was convicted as a horse thief and sentenced to a two-year term in the Wyoming State Prison. But prison was not always the outcome of scrapes with lawmen and Pinkerton agents—numerous gang members were killed in shootouts, and at least one captured outlaw was sentenced to death and hanged.

The exploits of the Wild Bunch and other outlaw gangs have since been immortalized as relics of a romanticized period of "frontier justice." Today, the relative chaos of the Old West has been replaced by a more industrialized system. As large numbers of criminals are incarcerated, entire communities, such as Cañon City, Colorado, specialize in prison employment. Some of the nation's most nefarious criminals, including Ted Kaczynski (the "Unabomber") and former Gambino crime family underboss "Sammy the Bull" Gravano, as well as many convicted international terrorists, are housed in the supermax prison in Florence, Colorado, (Administrative Maximum Unit Prison-ADX) the so-called "Alcatraz of the Rockies." Even as the general tenor of justice in the West has changed, vestiges of frontier justice remain; just as the Pinkerton Agency was hired to assist state lawmen, today private corrections companies are contracted to run private prisons that house state criminals. Also reminiscent of the Old West are the tactics of Sheriff Joe Arpaio of Maricopa County, Arizona, the self-titled "toughest Sheriff in America," whose policies have included chain gangs at tent prisons and assembling posses for midnight raids to round up suspected illegal immigrants. In general however, the Rockies region reflects the national trend of high incarceration rates and must similarly deal with its ramifications.

Trends in Crime and Incarceration

In early 2008, The Pew Center on the States reported that the U.S. prison population exceeded 2.3 million, meaning that more than 1 out of every 100 U.S. adults is in prison. Of those 2.3 million inmates, 1.6 million are in state and federal prisons for long-term confinement (typically over one year), and the remaining

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700,000 are in local jails (serving shorter sentences, usually under one year). The U.S. has by far both the highest incarcerated population and highest incarceration rate in the world.[1] The European nations with the next highest prison rates are the Russian Federation followed by Belarus, Georgia, and the Ukraine. In terms of total inmates, the United States has a larger prison population than that of the 26 largest European nations combined.[2]

There are myriad factors that contribute to the exceptionally high rate of incarceration in the U.S. The first and most obvious reason is the high rate of violent crime in the U.S., particularly gun-related crime. In 2004, the homicide rate in the U.S. was nearly 3.5 times greater than the western European average;[3] in 2001, the rate of homicides involving a firearm was over five times the western European average.[4] It makes sense that a high crime rate translates to more arrests and jail terms, but that alone cannot explain the high prison population in the U.S.

A second major contributor to high jail populations is the relatively harsh sentences that have become the standard in the U.S. As argued by one researcher:

> *Only the United States uses life-without-possibility-of-parole sentences; elsewhere, even murderers sentenced to life terms are eligible for parole or executive-branch commutation, and they are typically released after 8 to 12 years. Only in the United States are prison sentences longer than 1 or 2 years common; in most countries, fewer than 5 percent of sentences are for a year or longer.*[5]

In 2004, the average felony sentence for those serving in a state prison was nearly 5 years.[6] Two crimes that have similar definitions regardless of country and are therefore appropriate to compare internationally are burglary (breaking in and entering) and robbery (seizing property through violence).[7] A 2004 U.S. Bureau of Justice Statistics report revealed the average sentence for burglary in the U.S. was 51.5 months, compared to 19.3 months in England and Wales. The average sentence for robbery in the U.S. was 85.5 months, while the same crime in England and Wales typically yielded a 40-month sentence. Comparisons with other European countries show the same disparity.[8]

Stiff sentences are partially the result of a wave of federal and state anticrime laws passed over the last three decades. Many of these laws included strict sentencing guidelines, including federal mandatory minimums for drug crimes that emerged from the "war on drugs," as well as the notorious "three strikes you're out" laws in California and similar state laws passed across the nation.[9] Since the 1990's, many of these rigid guidelines have been eased, and many past supporters of strict crime laws are rethinking their position. But in general, the public continues to encourage judges, prosecutors, and politicians to demonstrate a record of being "tough on crime."[10] Notably, the U.S. is one of only a few countries that elect public prosecutors and state court judges, subjecting them to the whims of public opinion.

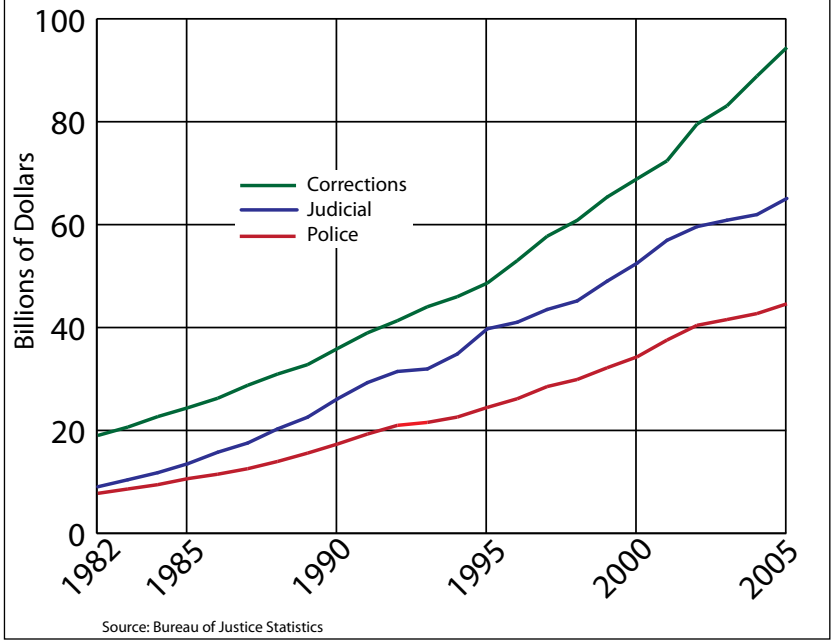
In a 1998 article, Eric Schlosser suggested another cause for the incarceration rate in the U.S.—the prison industrial complex.[11] The corrections industry is big business in America; new prisons mean income for construction companies, employment for prison guards and business for vendors who supply correctional facilities with everything from food to pay phones. Data from 1982 to 2005 demonstrate the growth of the prison industry, showing expenditures for police, corrections facilities, and judicial expenses growing 396 percent, 619 percent, and 474 percent,

Table 1: State Corrections Funding, 2007

	State Employees in Corrections Workforce, 2006	Millions of Dollars	Percent of State General Fund
50 state total	11%	$44,062	7%
Arizona	15%	$895	9%
Colorado	10%	$599	9%
Idaho	8%	$179	7%
Montana	6%	$142	8%
Nevada	14%	$222	6%
New Mexico	8%	$241	4%
Utah	7%	$324	7%
Wyoming	7%	$82	4%

Source: "One in 100: Behind Bars in America 2008," Pew Center on the States, 2008.

Figure 1:
Direct Expenditures by Criminal Justice Function, All Levels of Government, United States, 1982-2005. In Billions of Dollars



Source: Bureau of Justice Statistics

Table 2:
Average Length of Imprisonment by Offense Category, United States, 2007

Primary Offense	Mean Months	Weight for Grading
Murder	258.3	14.1
Sexual Abuse	97.3	5.31
Robbery	86.5	4.73
Assault	37.4	2.04
Burglary/B&E	20.7	1.13
Larceny	18.3	1.00
Auto Theft	69.7	3.81
Arson	83.5	4.56

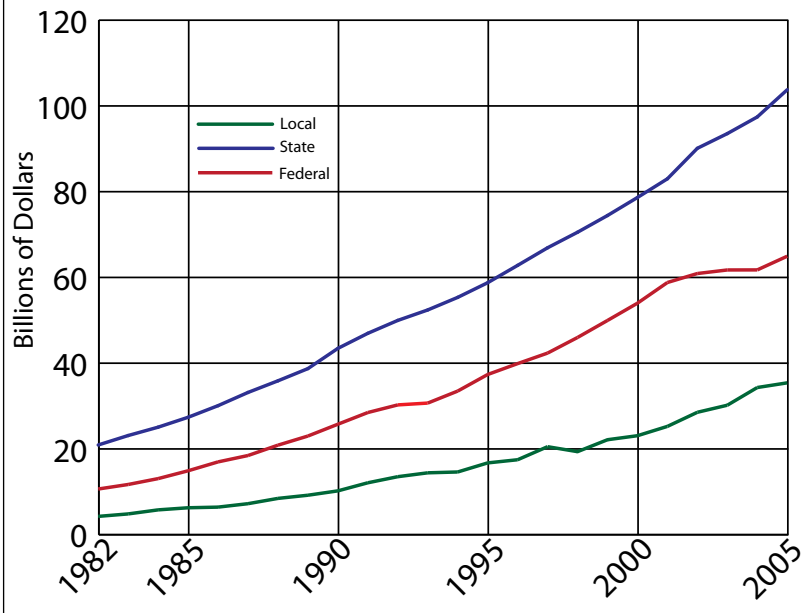
Source: Table 7, United States Sentencing Commission Statistical Information Packets FY 2007

respectively.[12] Increasingly, the prisons themselves are operated by private entities, which states and the federal government pay by the inmate, thus encouraging maximum capacity. Just as profit-seeking behavior among military vendors encourages continued growth in military spending, consequently fueling the military industrial complex, Schlosser has suggested that lobbyists, politicians, and businesspeople work together to ensure that the prison business continues to flourish.

While the correctional industry means profit for some, the Pew Center report mentioned earlier suggested that the costs are cripplingly high for already cash-strapped states. According to the report, states must spend on average $23,000 per inmate per year, and collectively, states spend 6.8 percent of their general funds on corrections operations. Table 1 summarizes the Pew Center findings on incarceration data for each state in the Rockies region, as well as the 50-state totals.[13] Figure 1 illustrates the growth of direct expenditures on criminal justice in the US at all levels of government and Figure 2 shows the breakdown of such expenditures on police, corrections, and judicial functions.

Critics of the Pew Center report have claimed the analysis is incomplete, as it presents the costs of incarceration, but not the benefits. A 2004 report by economist Steven Levitt concluded that high prison populations are one of four factors that had a positive correlation with the decrease in crime throughout the 1990's (the others were the increased police force, the receding crack epidemic, and the legalization of abortion). Levitt's findings controlled for other possible inputs, including tougher gun control laws, innovative policing strategies, an aging population, and economic prosperity. Strict sentencing, according to Levitt, has the duel effect of deterring would-be offenders, and locking up criminals and preventing them for continued infractions. According to social scientist James Q. Wilson, "the typical criminal commits from 12 to 16 crimes a year (not counting drug offenses). Locking him/her up spares society those crimes."[14] Levitt's study, and others, have suggested that the high incarceration rate alone may have been responsible for up to 25 percent of the fall in crime throughout the 1990's.[15] The analysis concludes that even taking into account the exorbitant cost of locking up criminals, the benefits outweighs the costs.[16][17]

Figure 2:
Direct expenditure on criminal justice (police, corrections, judicial) by level of government, United States, 1982-2005. In Billions of Dollars



Source: Bureau of Justice Statistics

Table 3:
Crime Index Score, Top Ten Rockies Counties, 2007

County, State	Murder and No Negligent Manslaughter	Forcible Rape	Robbery	Aggravated Assault	Burglary	Larceny-Theft	Motor Vehicle Theft	Arson	Composite Index
Pima, AZ	18	88	214	463	2,643	9,237	1,794	121	22,291
Maricopa, AZ	25	30	94	701	1,734	3,936	1,028	69	12,517
Sevier, UT	0	1	0	8	33	6,371	970	56	10,380
Pinal, AZ	11	39	42	206	1,067	3,176	836	24	8,659
Adams, CO	6	41	74	316	796	1,907	680	45	6,901
El Paso, CO	2	57	35	922	784	1,607	354	35	6,383
Jefferson, CO	2	55	27	166	983	2,445	365	30	5,872
Mohave, AZ	9	4	22	169	1,165	1,559	387	26	5,067
Douglas, CO	2	60	25	97	526	2,100	120	29	3,948
Salt Lake, UT	3	86	88	401	1,697	230	11	0	3,927

Source: Calculated From FBI Uniform Crime Report, Table 10 and United States Sentencing Commission Statistical Information Packets FY 2007, Table 7
Note: Calculation of Composite Index explained in text

Hot Spots In the Rockies

Despite the lofty debate over crime policy, the reality remains—the U.S. has the highest prison population in the world.[18] What does this mean for the Rockies? Here is a snapshot of the prison system in the American West, including crime rates, prison populations, and law enforcement employees at the county level.

severity of each crime, we generated a composite crime index for each county.

Table 2 shows the national average sentences and corresponding weights used in this method. Table 3 and Table 4 identify the Rockies counties with the highest overall per capita crime index and total crime index. Table 5, Table 6 and Table 7 depict the ten Rockies counties with the highest total numbers of law enforcement employees, employees per county square mile, and employees per 100,000 county residents.

Table 4:
Per Capita Crime Index Score, Top Ten Rockies Counties, 2007

County, State	Murder and No Negligent Manslaughter	Forcible Rape	Robbery	Aggravated Assault	Burglary	Larceny-Theft	Motor Vehicle Theft	Arson	Composite Index	Per Capita Index
Esmeralda, NV	0	0	0	3	1	740	61	8	1,016	1.32
Clark, ID	0	0	0	2	3	401	26	2	516.6	0.59
Sevier, UT	0	1	0	8	33	6,371	970	56	10,370	0.51
Daggett, UT	0	0	0	0	7	398	20	0	482.1	0.48
Harding, NM	0	0	0	0	2	215	18	0	285.8	0.35
Storey, NV	0	0	0	0	17	475	190	29	1,350	0.33
Sweet Grass, MT	1	1	0	6	2	769	94	6	1,188	0.31
Beaver, UT	0	0	2	9	17	360	327	26	1,771	0.29
Granite, MT	0	0	0	3	7	281	52	2	502.2	0.18
Eureka, NV	0	1	0	5	9	87	18	3	195.0	0.16

Source: Calculated From FBI Uniform Crime Report, Table 10 and United States Sentencing Commission Statistical Information Packets FY 2007, Table 7
Note: Calculations for Composite Index and Per Capita Index explained in text

Table 5:
Law Enforcement Employees, Top Ten Rockies Counties, 2006

County, State	Total Employees	Officers	Civilians
Maricopa, AZ	3,302	736	2,566
Pima, AZ	1,338	496	842
Salt Lake, UT	1,179	330	849
Washoe, NV	773	418	355
Jefferson, CO	751	533	218
El Paso, CO	584	416	168
Arapahoe, CO	573	396	177
Adams, CO	498	348	150
Pinal, AZ	444	186	258
Douglas, CO	417	272	145

Source: FBI Uniform Crime Report, Table 80

Table 6:
Law Enforcement Employees by Area, Top Ten Rockies Counties, 2006

County, State	Total Employees	Officers	Civilians	County Area, Square Miles	Employees per 1000 Square Miles
Salt Lake, UT	1,179	330	849	808	1,460
Jefferson, CO	751	533	218	778	965
Carson City, NV	139	94	45	156	893
Arapahoe, CO	573	396	177	806	711
Weber, UT	379	120	259	660	575
Douglas, CO	417	272	145	843	495
Boulder, CO	318	202	116	751	423
Adams, CO	498	348	150	1,198	416
Davis, UT	228	99	129	634	360
Maricopa, AZ	3,302	736	2,566	9,225	358

Source: FBI Uniform Crime Report, Table 80

Table 7:
Law Enforcement Employees per 100,000 County Residents, Top Ten Rockies Counties, 2006

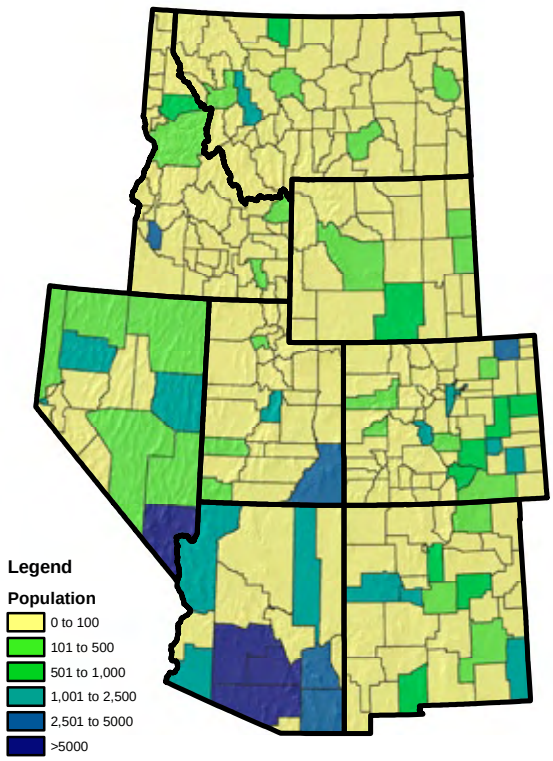
County, State	Total Employees	Officers	Civilians	2006 County Population	Employees per 100,000 County Residents
Daggett, UT	28	9	19	1,005	2,786
Esmeralda, NV	15	11	4	771	1,946
Eureka, NV	18	12	6	1,218	1,478
Washington, CO	49	14	35	4,452	1,101
Beaver, UT	56	14	42	6,135	913
Clark, ID	7	3	4	872	803
Gilpin, CO	38	25	13	4,920	772
Hot Springs, WY	34	29	5	4,471	760
Dawson, MT	59	6	53	8,406	702
Clear Creek, CO	60	27	33	8,795	682

Source: FBI Uniform Crime Report, Table 80

Crime data and law enforcement employment data were gathered from the FBI Uniform Crime Report, made up of data collected from over 17,000 law enforcement agencies annually. However, because reporting is not mandatory, the data set is not comprehensive. Of Rockies counties, 214 of 281 (76 percent) are represented in the report. Using data from the U.S. Sentencing Commission to indicate the relative

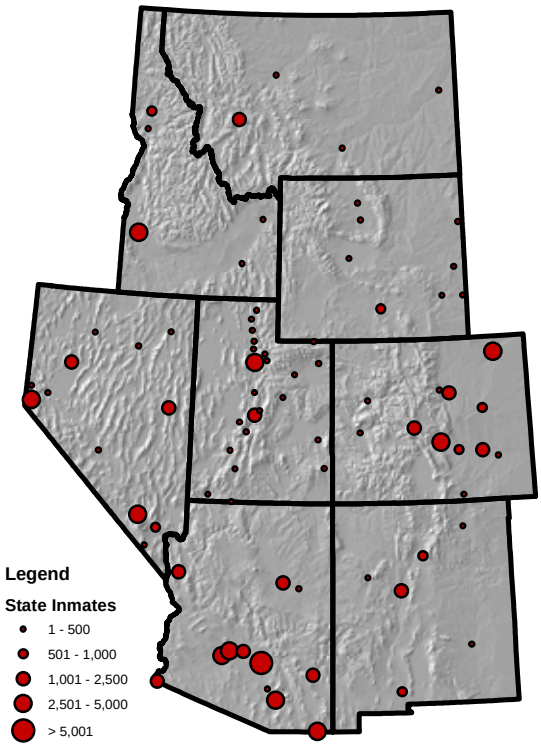
The prison population for each county in the West was gathered from the respective state departments of corrections. This data set includes not only the total population of each facility, but also information on whether the state or federal government or a private entity runs the institution. Figures 3 illustrates the phenomenon of some counties "exporting" their incarceration activities

Figure 3: Rockies Prison Population by County, 2008



Source: Compiled from individual state Department of Corrections population reports

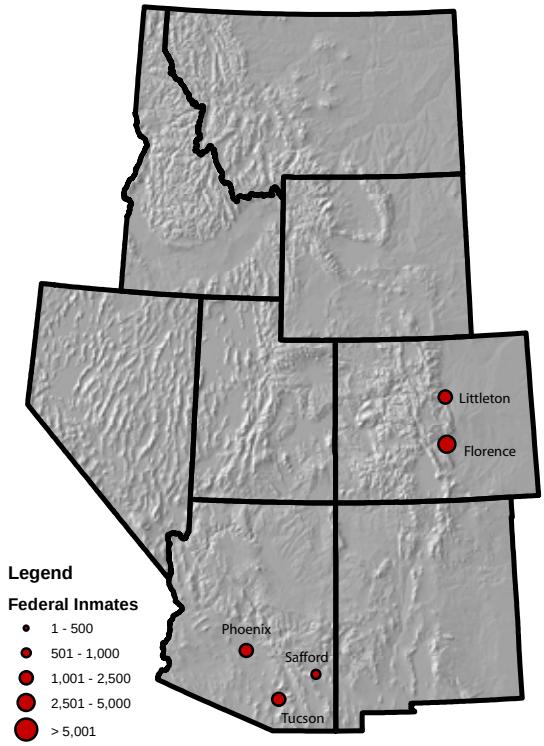
Figure 4: State Inmate Populations in the Rockies, 2008



Source: compiled from individual state Department of Corrections population reports, 2008

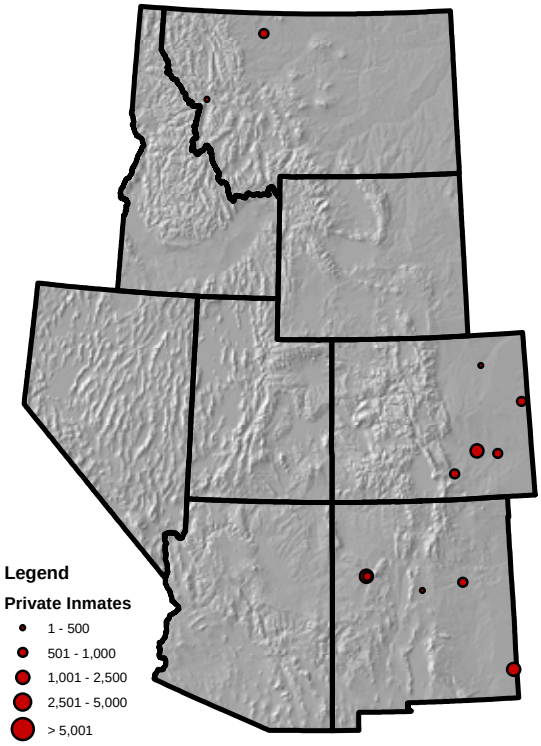
Note: prison populations here include county facilities that have been contracted by the state and facilities operated by the respective Department of Corrections.

Figure 5: Federal Inmate Populations in the Rockies, 2008



Source: U.S. Bureau of Prisons, 2008

Figure 6: Private Prison Inmate Populations in the Rockies, 2008



Source: compiled from individual state Department of Corrections population reports, 2008

to those counties "specializing" in prisons. Figures 4, 5, and 6 show locations of state, federal and private prisons and the approximate size of their respective inmate populations. It is clear from these maps where in the Rockies incarceration activities represent significant economic drivers for local economies.

What Next for Rockies Sentencing and Incarceration?

Crime and incarceration policies continue to be fiercely debated issues nationwide, but discussion at the state and regional level is also important. States must explore the relationship between high incarceration and crime rates, and the cost of accommodating inmates in both state and private prisons. The West has come a long way since the times of frontier lawlessness, posses, and hanging judges that now only occupy history books, the silver screen, and our imaginations. But that does not mean the issue of justice in the Rockies is settled; policies continue to evolve every time state laws change and judges and prosecutors are elected. Ultimately, the state of crime and punishment in the West reflects the prevailing opinion of the region's citizens.

[1] Warren, Jennifer, et al., "One in 100: Behind Bars in America 2008," The Pew Center on the States, 2008.
[2] *Ibid.*
[3] "International Homicide Statistics," UN Office on Drugs and Crime, http://www.unodc.org/documents/data-and-analysis/IHS-rates-05012009.pdf. Accessed 2/9/09.
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[5] Tonry, Michael, "Why Are U.S. Incarceration Rates so High?" *Crime & Delinquency* Vol. 45 No. 4, October 1999, p. 419-437; 419-420.
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[7] Farrington, David P., et al. "Cross-National Studies in Crime and Justice." Bureau of Justice Statistics, September 2004, pg. viii.
[8] *Ibid.*
[9] Cannon, Carl M., "Petty Crime, Outrageous Punishment," *Readers Digest*, available at http://www.rd.com/your-america-inspiring-people-and-stories/petty-crime-outrageous-punishment/article28714.html. Accessed 2/9/09.
[10] Liptak, Adam, "Inmate County Dwarfs other Nations,'" *New York Times* 4/23/08.
[11] Schlosser, Eric, "The Prison Industrial Complex," *The Atlantic* December 1998. http://www.theatlantic.com/doc/199812/prisons. Accessed 2/9/09.
[12] Bureau of Justice Statistics, Expenditure and Employment Summary Findings. http://www.ojp.usdoj.gov/bjs/eande.htm. Accessed 2/9/09.
[13] Warren, Jennifer, et al., "One in 100: Behind Bars in America 2008," The Pew Center on the States, 2008.
[14] Wilson, James Q., "Do the Time, Lower the Crime," *LA Times*, 3/30/08.
[15] *Ibid.*
[16] Levitt, Steven D., "Understanding Why Crime Fell in the 1990: Four Factors that Explain the Decline, and Six Factors that Do not," *Journal of Economic Perspective* 18(1), Winter 2004.
[17] For a study opposing Levitt's study, see Mitchell B. Chamlin, Andrew J. Myer, Beth A. Sanders, & John K. Cochran, "Abortion as Crime Control: A Cautionary Tale," *Criminal Justice Policy Review* 19 (2008), 135-152.
[18] Roy Walmsley, *World Prison Population List (seventh edition)*, King's College International Centre for Prison Studies. London (2007).

Prison Data by Rockies County

Source: individual State Department of Corrections Population Reports (2008); FBI Uniform Crime Report, Table 80 (2006); and FBI Uniform Crime Report, Table 10 and United States Sentencing Commission Statistical Information Packets FY 2007, Table 7.

" - " indicates no data available

	County	Total Law Enforcement Employees	Prison Population May/June 2008	Violent Crime	Property Crime	Index Composite	Adjusted for Population
Arizona	Apache	68	-	-	-	-	-
	Cochise	195	2,738	0	1,531	2,420	0.02
	Coconino	249	-	-	-	-	-
	Gila	136	-	100	559	1,062	0.02
	Graham	59	2,572	243	203	784	0.02
	Greenlee	27	-	-	-	-	-
	La Paz	91	-	84	417	746	0.03
	Maricopa	3,302	10,938	850	6,698	12,517	0.00
	Mohave	234	1,523	204	3,111	5,067	0.03
	Navajo	126	1,909	61	661	1,155	0.01
	Pima	1,338	6,228	783	13,674	22,291	0.02
	Pinal	444	10,688	298	5,079	8,659	0.04
	Santa Cruz	79	-	8	368	602	0.01
	Yavapai	354	-	354	1,703	3,212	0.02
	Yuma	311	2,422	215	1,577	2,911	0.01

	County	Total Law Enforcement Employees	Prison Population May/June 2008	Violent Crime	Property Crime	Index Composite	Adjusted for Population
Colorado	Adams	498	-	437	3,383	6,901	0.02
	Alamosa	35	-	8	64	95	0.01
	Arapahoe	573	-	246	1,740	3,461	0.01
	Archuleta	45	-	29	116	234	0.02
	Baca	11	-	2	2	6	0.00
	Bent	7	1,162	3	28	50	0.01
	Boulder	318	-	87	753	1,299	0.00
	Broomfield	-	-	-	-	-	-
	Chaffee	41	1,183	9	90	144	0.01
	Cheyenne	10	-	0	11	11	0.01
	Clear Creek	60	-	18	92	162	0.02
	Conejos	20	-	-	-	-	-
	Costilla	14	-	-	-	-	-
	Crowley	9	2,483	1	1	3	0.00
	Custer	18	-	11	42	76	0.02

	County	Total Law Enforcement Employees	Prison Population May/June 2008	Violent Crime	Property Crime	Index Composite	Adjusted for Population
Colorado	Delta	56	463	15	150	265	0.01
	Denver	-	1,271	-	-	-	-
	Dolores	7	-	0	31	46	0.03
	Douglas	417	-	184	2,746	3,948	0.01
	Eagle	83	-	38	487	642	0.01
	Elbert	36	-	-	-	-	-
	El Paso	584	-	1,016	2,745	6,383	0.01
	Fremont	70	7,732	17	216	319	0.01
	Garfield	110	187	62	311	580	0.01
	Gilpin	38	-	6	2	14	0.00
	Grand	49	-	16	201	264	0.02
	Gunnison	26	-	14	33	76	0.01
	Hinsdale	5	-	0	3	3	0.00
	Huerfano	20	754	9	110	145	0.02
	Jackson	8	-	1	6	11	0.01
	Jefferson	751	1,188	250	3,793	5,872	0.01
	Kiowa	5	-	-	-	-	-
	Kit Carson	19	784	-	-	-	-
	Lake	17	-	21	22	84	0.01
	La Plata	114	-	25	285	419	0.01
	Larimer	398	-	104	1,347	2,186	0.01
	Las Animas	37	477	-	-	-	-
	Lincoln	19	936	-	-	-	-
	Logan	47	2,512	12	56	115	0.01
	Mesa	206	-	58	1,580	2,459	0.02
	Mineral	7	-	-	-	-	-
	Moffat	37	-	10	31	62	0.00
	Montezuma	56	-	28	189	301	0.01
	Montrose	100	-	20	189	339	0.01
	Morgan	58	189	0	78	116	0.00
	Otero	22	-	27	87	186	0.01
	Ouray	8	-	-	-	-	-
	Park	76	-	23	57	162	0.01
	Phillips	3	-	-	-	-	-
	Pitkin	39	-	11	147	220	0.02
	Prowers	32	-	9	38	66	0.00
	Pueblo	278	736	45	1,519	1,871	0.01
	Rio Blanco	24	-	-	-	-	-
	Rio Grande	24	-	4	30	51	0.00
	Routt	42	-	26	78	141	0.01
	Saguache	18	-	3	23	35	0.00

	County	Total Law Enforcement Employees	Prison Population May/June 2008	Violent Crime	Property Crime	Index Composite	Adjusted for Population
Colorado	San Juan	4	-	4	22	33	0.06
	San Miguel	37	-	2	42	58	0.01
	Sedgwick	8	-	3	24	45	0.02
	Summit	74	-	14	552	626	0.02
	Teller	87	-	18	103	196	0.01
	Washington	49	-	7	37	63	0.01
	Weld	255	-	137	1,186	2,140	0.01
	Yuma	16	-	2	18	25	0.00
	Ada	339	4,345	-	-	-	-
Idaho	Adams	14	-	3	40	13	0.00
	Bannock	71	301	19	222	165	0.00
	Bear Lake	12	-	1	31	215	0.03
	Benewah	16	-	9	19	64	0.01
	Bingham	51	-	-	-	-	-
	Blaine	32	-	12	51	65	0.00
	Boise	15	-	4	114	88	0.01
	Bonner	57	-	61	575	451	0.01
	Bonneville	81	-	-	-	-	-
	Boundary	18	-	5	72	609	0.06
	Butte	10	-	2	9	58	0.02
	Camas	5	-	0	5	12	0.01
	Canyon	143	-	74	773	511	0.00
	Caribou	14	-	2	50	886	0.12
	Cassia	51	-	48	532	266	0.01
	Clark	7	-	2	18	517	0.59
	Clearwater	26	533	10	93	54	0.01
	Custer	14	-	-	-	-	-
	Elmore	39	-	9	93	162	0.01
	Franklin	12	-	3	38	106	0.01
	Fremont	24	220	10	92	79	0.01
	Gem	23	-	9	32	138	0.01
	Gooding	18	-	23	56	182	0.01
	Idaho	31	399	26	75	173	0.01
	Jefferson	28	-	19	177	179	0.01
	Jerome	21	-	16	117	304	0.02
	Kootenai	134	-	102	1,060	778	0.01
	Latah	38	-	20	185	1,092	0.03
	Lemhi	6	-	5	23	172	0.02
	Lewis	11	-	4	24	48	0.01
	Lincoln	7	-	5	11	49	0.01
	Madison	32	-	10	93	72	0.00

	County	Total Law Enforcement Employees	Prison Population May/June 2008	Violent Crime	Property Crime	Index Composite	Adjusted for Population
Idaho	Minidoka	25	-	19	126	187	0.01
	Nez Perce	36	-	8	83	186	0.00
	Oneida	13	-	3	31	78	0.02
	Owyhee	19	-	25	129	150	0.01
	Payette	33	-	16	51	197	0.01
	Power	18	-	7	54	97	0.01
	Shoshone	31	-	29	141	161	0.01
	Teton	17	-	8	54	201	0.03
	Twin Falls	62	-	28	226	226	0.00
	Valley	27	-	28	133	344	0.04
	Washington	17	-	8	33	162	0.02
Montana	Beaverhead	8	-	8	42	54	0.01
	Big Horn	27	-	56	232	136	0.01
	Blaine	11	-	16	35	86	0.01
	Broadwater	26	-	12	181	351	0.08
	Carbon	12	-	1	33	54	0.01
	Carter	3	-	-	-	-	-
	Cascade	129	151	-	-	-	-
	Chouteau	18	-	3	19	220	0.04
	Custer	7	-	-	-	-	-
	Daniels	5	-	-	-	-	-
	Dawson	59	143	8	74	67	0.01
	Deer Lodge	17	-	34	102	128	0.01
	Fallon	3	-	-	-	-	-
	Fergus	23	-	6	36	99	0.01
	Flathead	112	-	-	-	-	-
	Gallatin	81	-	51	401	287	0.00
	Garfield	4	-	-	-	-	-
	Glacier	16	-	24	43	793	0.06
	Golden Valley	2	-	-	-	-	-
	Granite	9	-	3	33	502	0.18
	Hill	27	-	23	179	119	0.01
	Jefferson	21	-	20	46	102	0.01
	Judith Basin	5	-	-	-	-	-
	Lake	51	-	75	340	459	0.02
	Lewis and Clark	68	-	45	374	256	0.00
	Liberty	10	-	-	-	-	-
	Lincoln	23	-	29	238	513	0.03
	McCone	4	-	-	-	-	-
	Madison	15	-	6	57	450	0.06
	Meagher	4	-	-	-	-	-
	Mineral	20	-	27	25	325	0.08
	Missoula	162	139	-	-	-	-

	County	Total Law Enforcement Employees	Prison Population May/June 2008	Violent Crime	Property Crime	Index Composite	Adjusted for Population
Montana	Musselshell	7	-	-	-	-	-
	Park	15	-	20	77	154	0.01
	Petroleum	1	-	-	-	-	-
	Phillips	10	-	8	69	67	0.02
	Pondera	15	-	-	-	-	-
	Powder River	8	-	-	-	-	-
	Powell	16	1,400	15	155	128	0.02
	Prairie	3	-	-	-	-	-
	Ravalli	60	-	-	-	-	-
	Richland	13	-	-	-	-	-
	Roosevelt	12	-	7	30	96	0.01
	Rosebud	24	-	19	44	250	0.03
	Sanders	21	-	20	151	102	0.01
	Sheridan	7	-	1	17	52	0.01
	Silver Bow	95	-	149	992	681	0.02
	Stillwater	7	-	3	24	35	0.00
	Sweet Grass	6	-	8	30	1,188	0.31
	Teton	9	-	9	52	48	0.01
	Toole	19	508	18	64	96	0.02
	Treasure	2	-	-	-	-	-
	Valley	16	-	-	-	-	-
	Wheatland	12	-	-	-	-	-
	Wibaux	3	-	-	-	-	-
	Yellowstone	158	170	36	666	316	0.00
Nevada	Churchill	48	-	52	295	281	0.01
	Clark	-	7,252	-	-	-	-
	Douglas	122	-	87	1,008	1,911	0.04
	Elko	69	270	19	192	421	0.01
	Esmeralda	15	-	3	6	1,016	1.32
	Eureka	18	-	6	24	195	0.16
	Humboldt	39	138	51	49	132	0.01
	Lander	29	-	43	104	204	0.04
	Lincoln	27	214	4	46	75	0.02
	Lyon	110	75	85	728	530	0.01
	Mineral	20	-	7	46	116	0.02
	Nye	143	141	124	936	1,455	0.04
	Pershing	20	1,638	73	64	276	0.04
	Storey	22	-	0	65	1,350	0.33
	Washoe	773	102	199	1,631	1,188	0.00
	White Pine	26	1,258	39	202	233	0.03
NM	Carson City	139	1,619	195	1,247	1,560	0.03
	Bernalillo	316	0	821	2,556	3,517	0.01
	Catron	10	-	-	-	-	-

	County	Total Law Enforcement Employees	Prison Population May/June 2008	Violent Crime	Property Crime	Index Composite	Adjusted for Population
New Mexico	Chaves	50	300	35	425	328	0.01
	Cibola	14	2,021	50	130	3,344	0.12
	Colfax	12	129	-	-	-	-
	Curry	14	-	-	-	-	-
	De Baca	-	-	-	-	-	-
	Dona Ana	-	690	-	-	-	-
	Eddy	56	-	63	382	663	0.01
	Grant	74	-	7	96	201	0.01
	Guadalupe	-	588	-	-	-	-
	Harding	-	-	0	2	286	0.35
	Hidalgo	-	-	-	-	-	-
	Lea	-	1,244	58	416	418	0.01
	Lincoln	-	-	-	-	-	-
	Los Alamos	-	-	-	-	-	-
	Luna	32	-	-	-	-	-
	McKinley	42	-	117	299	399	0.01
	Mora	10	-	6	16	375	0.07
	Otero	44	-	-	-	-	-
	Quay	8	-	-	-	-	-
	Rio Arriba	29	-	44	85	182	0.00
	Roosevelt	14	-	-	-	-	-
	Sandoval	50	-	29	164	226	0.00
	San Juan	110	-	269	1,074	1,131	0.01
	San Miguel	-	-	-	-	-	-
	Santa Fe	-	981	199	1,005	2,435	0.02
	Sierra	15	-	7	63	146	0.01
	Socorro	12	-	25	68	409	0.02
	Taos	22	-	-	-	-	-
	Torrance	11	207	-	-	-	-
	Union	3	-	-	-	-	-
	Valencia	-	1,200	145	1,329	1,208	0.02
Utah	Beaver	56	351	11	76	1,771	0.29
	Box Elder	82	28	6	221	76	0.00
	Cache	142	57	26	509	246	0.00
	Carbon	40	6	7	166	284	0.01
	Daggett	28	63	0	13	482	0.48
	Davis	228	101	-	-	-	-
	Duchesne	51	94	6	141	221	0.01
	Emery	41	-	8	107	71	0.01
	Garfield	28	85	-	-	-	-
	Grand	30	2	8	100	211	0.02
	Iron	80	-	17	158	180	0.00

	County	Total Law Enforcement Employees	Prison Population May/June 2008	Violent Crime	Property Crime	Index Composite	Adjusted for Population
Utah	Juab	24	4	-	-	-	-
	Kane	24	10	4	40	140	0.02
	Millard	48	45	20	304	368	0.03
	Morgan	13	-	-	-	-	-
	Piute	3	-	-	-	-	-
	Rich	10	-	1	50	31	0.01
	Salt Lake	1,179	-	578	9,038	3,927	0.00
	San Juan	35	67	3	32	53	0.00
	Sanpete	24	1,379	-	-	-	-
	Sevier	62	65	9	159	10,380	0.51
	Summit	95	31	18	642	208	0.01
	Tooele	83	-	14	184	268	0.00
	Uintah	49	31	57	259	881	0.03
	Utah	357	-	32	524	429	0.00
	Wasatch	40	51	12	191	395	0.02
	Washington	151	124	9	201	615	0.00
	Wayne	5	-	11	148	222	0.09
	Weber	379	53	48	1,056	623	0.00
Wyoming	Albany	62	-	6	60	1,044	0.03
	Big Horn	52	18	-	-	-	-
	Campbell	21	-	46	290	174	0.00
	Carbon	20	541	1	41	71	0.00
	Converse	59	-	1	43	325	0.03
	Crook	34	-	5	45	67	0.01
	Fremont	19	212	9	183	128	0.00
	Goshen	13	18	37	83	141	0.01
	Hot Springs	34	-	0	29	191	0.04
	Johnson	16	-	3	30	105	0.01
	Laramie	13	-	50	516	314	0.00
	Lincoln	13	-	9	133	77	0.00
	Natrona	39	-	15	416	694	0.01
	Niobrara	14	192	1	10	122	0.05
	Park	52	-	28	71	402	0.02
	Platte	10	4	2	25	31	0.00
	Sheridan	25	-	12	101	105	0.00
	Sublette	37	-	31	234	146	0.02
	Sweetwater	40	-	22	238	245	0.01
	Teton	41	-	7	125	300	0.02
	Uinta	36	-	7	172	263	0.01
	Washakie	10	3	8	7	127	0.02
	Weston	15	237	1	8	204	0.03

Repopulating the Rockies

Highlighting the Megapolitans and Rural Economic Clusters of the Region

By Porter Friedman

The 2009 Colorado College State of the Rockies Report Card

Key Findings

• The Rockies region contains six Megapolitans spanning seven states.

• 82.5 percent of people in the Rockies live in urban areas. Nationwide, 79 percent of people live in urban areas.

• In the Rockies' rural service clusters, 67 percent of the economy is comprised of the service sector without the leisure and hospitality industries.

• On average, the mining industry occupies 19 percent of the economy in rural resource extraction clusters.

• In 18 of the region's rural recreation clusters, leisure and hospitality services account for more than 25 percent of the area's economy.

About the author: Porter Friedman (Colorado College '09) is a student researcher for the 2008/09 State of the Rockies Project.

Introduction

The eight-state Rockies region is the fastest growing region in the country. This once empty area is now teeming with people drawn to the region's natural beauty and booming metropolitan areas. Historically, the population of the Rockies region was distributed across small frontier towns serving ranches or mines. These towns, scattered across the West, created the cowboy image that the region still holds. Supporting these frontier towns were urban hubs such as Denver, Salt Lake City, and Phoenix.

Today, two developing trends in population distribution are occurring in the Rockies region: mega-regions and rural economic clusters. These two classifications are the urban and rural growth patterns of the region's future. While the general layout of urban centers supplying mountain towns remains, much has changed. These urban centers have grown to become booming metropolises still supplying mountain towns, but are also major players in both the national and global economies. The rapid growth of these metropolitan areas has created vast urban corridors called mega-regions, defined as areas where large cities have begun to merge together to become one continuous urban region.

Frontier towns of the old West have also grown to include more modern services and amenities. These towns, defined in this Report as "rural economic clusters," provide residents and visitors with the small mountain town feel of the Wild West while providing convenient services and amenities to surrounding towns and rural areas.

As population continues to grow in the Rockies region, these two development trends will largely direct the region's growth. Essentially the urban and rural manifestations of similar dynamics, cities will continue to grow together into mega-regions, and the rural centers will continue to attract people as small, comfortable places to live. This Rockies report first takes a detailed look at the megapolitan phenomenon in the region, reviewing both the existing classifications and the State of the Rockies Project classification developed specifically for the Rockies region. Our classification identifies six growing mega-regions in the eight-state Rockies region: the Front Range of Colorado; the Wasatch Front of Utah; the Valley of the Sun in Arizona; greater Las Vegas, Nevada; the Enchanted Corridor in New Mexico; and the Treasure Valley in Idaho (See Table 1). We then examine the rural economic clusters of the Rockies region. For this report, we developed a classification to describe three types of rural economic clusters; rural service clusters, rural resource extraction clusters, and rural recreation clusters. Each of these rural classifications identifies the small towns with well developed and semi-diversified economies out of the array of Rockies towns and small cities not associated with the megapolitan trend.

Rockies Region Mega-regions

The once "Wild West" is today no more. The long cattle drives, outlaws, and ghost towns made famous by the likes of Clint Eastwood and John Wayne have largely been replaced by SUVs, tech geeks, urban centers, and expansive suburbs. The 2000 Census reported that 82 percent of Westerners lived in an urban setting, a value 4 percent higher than the national average (See Figure 1).[1] Historically, the population of the West was more spread out, on farms and ranch lands as well as in small towns, with minor cities serving as outposts connected to urban East coast centers. Most of the urbanization of the West once had its roots in supporting mining and energy as well as agriculture, which at one time dominated the regional economy. Now, however, human capital and services dominate the economies of Rockies urban areas.

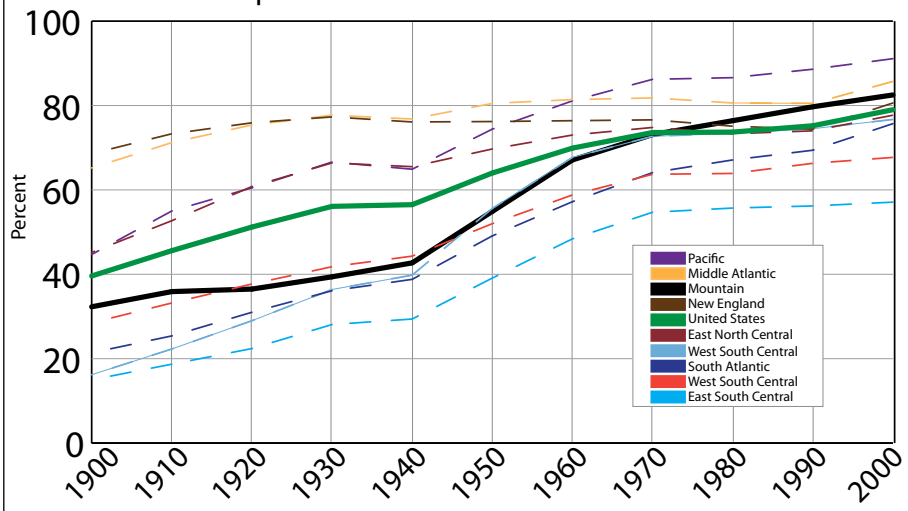
From 2000 to 2005 the Rockies region population grew nine percent - 4.5 times the national rate.[2] Astoundingly this may be only a harbinger of changes to come. Projected population growth 2000 to 2030 shows the Mountain states growing another 65 percent, faster than any other Census Division (See Figures 2 and 3). Most existing population growth in the Rockies and projected additional expansion is concentrated in and around urban centers, where in some places urban sprawl has created suburbs larger than many cities.

Table 1: Megapolitan Region Population Growth

Megapolitan Area	2000 Population (U.S. Census)	2060 Population Estimate (Geolytics)	Population Added Per Year	Percent Annual Growth Rate
Front Range (Denver)	3,734,897	6,646,045	48,519	1.3%
Valley of the Sun (Phoenix)	4,608,190	14,923,267	171,918	3.7%
Enchanted Corridor (Santa Fe)	886,316	1,558,717	11,207	1.3%
Wasatch Front (Salt Lake City)	2,049,934	5,396,443	55,775	2.7%
Snake River Valley (Boise)	502,950	1,603,238	18,338	3.6%
Greater Las Vegas (Las Vegas)	1,456,714	3,700,564	37,398	2.6%

2000 population values are taken from the U. S. Census Bureau.
2060 population estimates are provided by Geolytics, Inc.
Note: population estimates here include all census tracts located within the megapolitan boundaries, not tracts above a specified population density.

Figure 1:
Urban Population Percent



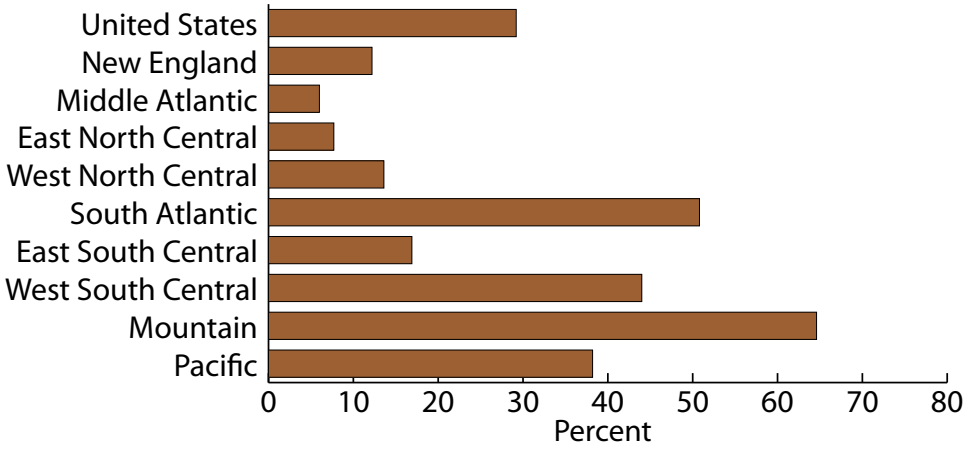
Source: Collected from American Fact Finder (2000)
and the 1990 Census of Population and Housing (1900-1990)

Robert Lang of the Metropolitan Institute at Virginia Tech has coined the term "boomburb" to describe the phenomenon of rapidly growing suburbs. According to Lang, boomburbs are places with more than 100,000 people that have maintained double-digit population growth rates in the past decades and are not the largest cities in their respective metropolitan areas.[3] One example is the Phoenix suburb of Mesa, which had almost 500,000 residents in 2006.[4] In fact, Phoenix has seven suburbs each with more than 100,000 people.[5] These boomburbs are a major indicator of sprawl. A study done by Alan Berube and Benjamin Forman used 1990 census data to divide the 100 largest US cities into three "rings" according to distance from the central business district. They found that more people lived in the outer ring neighborhoods than the middle ring or inner core, and that when looking at population change between 1990 and 2000, 60 percent of population growth occurred in the outer ring neighborhoods compared to 11 percent in the inner ring neighborhoods.[6] These suburban areas represent the urban growth of the twentieth century, dominated by car commuting and master-planned community development. Most of America's boomburbs exist in the Southwest as a result of master-planned community development and the need to form large water districts.[7]

As cities continue to expand outward in the Rockies region, they are coalescing into what are known as "mega-regions," formed when once-separate cities, suburbs, and towns merge together along transportation corridors. These mega-regions show economies growing past traditional city, county, and even state boundaries to form economic zones that house most of the region's productivity and talent, and share commuters, businesses, and economies.[8] Because mega-regions span established boundaries, it can be difficult for planners and elected officials to coordinate and facilitate their growth and development.

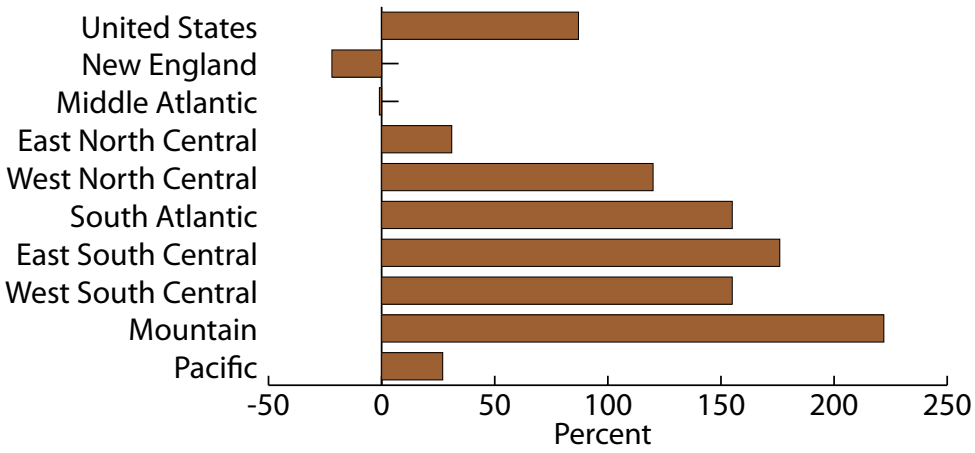
Mega-regions often occur in linear form along transportation corridors such as the I-25 corridor through the Front Range and I-10 through Phoenix and Tucson. Interstate corridors facilitate the flow of goods

Figure 2:
Projected Population Percent Increase, 2000-2030, by Nation and Census Division



Sources: United States Census Bureau, United States Department of Commerce, 2000
(2000 population);
and Geolytics, Inc., 2008, (2030 and 2060 population estimates)

Projected Population Percent Increase, 2000-2060, by Nation and Census Division

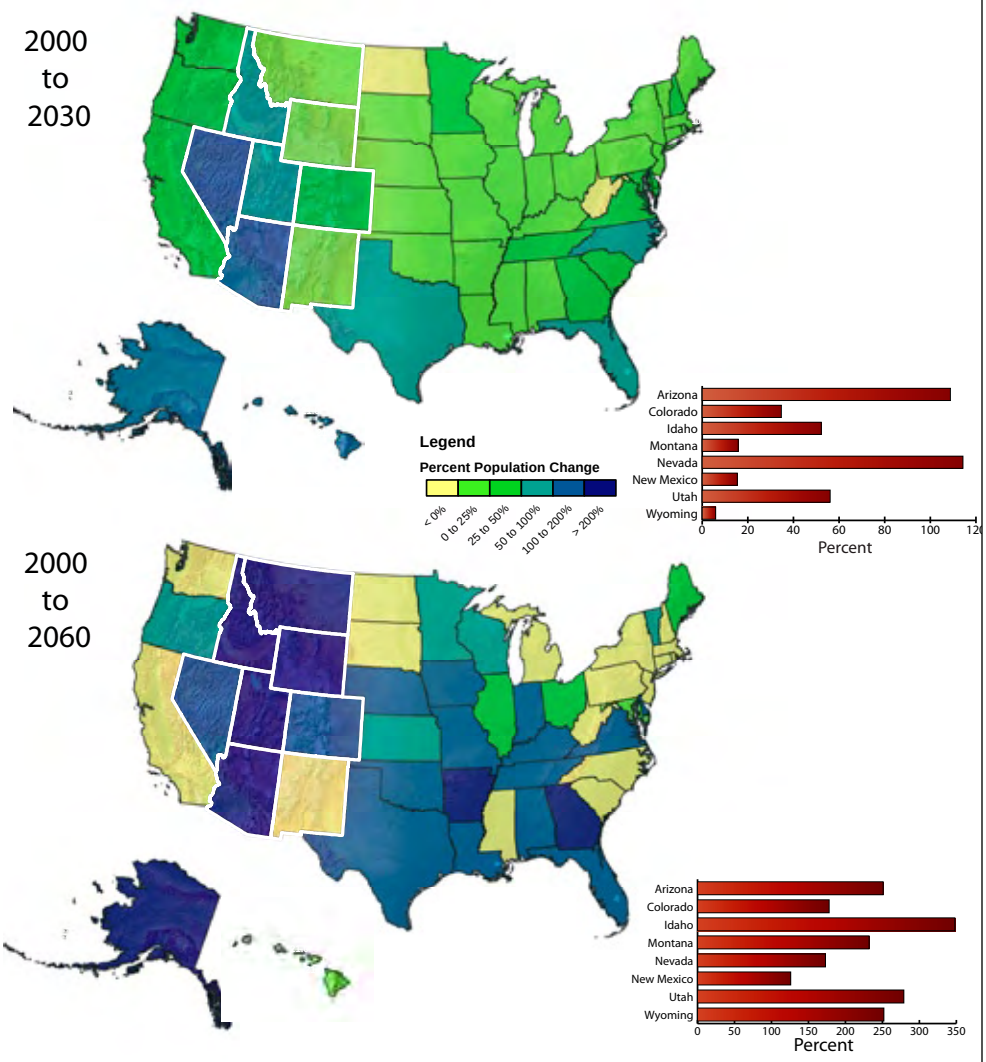


Sources: United States Census Bureau, United States Department of Commerce, 2000

and commuters, encouraging the mega-region to share resources. As the individual areas of developing mega-regions grow and interact, they demand more connectivity, to ease the strain of increased traffic on the interstates. In response, many mega-regions are investing in regional transit systems. In the Rockies region, Denver's and Salt Lake's investments in their light rail systems rank first and second among American metropolitan areas.[9]

These areas grow because they are attractive to certain demographics. It is through the tech industries of the Front Range or the aerospace industries of Phoenix and Tucson, that the mega-regions pull in professionals seeking jobs and attractive places to live, where opportunities for productivity and returns are highest.[10] Additionally, the mega-regions of the Rockies provide their residents with exceptional natural amenities, including good climates and natural beauty.[11] According to a report by David McGranahan and Calvin Beale of the U.S. Department of Agriculture's Economics Research Service, the Rockies region offers some of the highest natural amenities in the country.[12]

Figure 3: Estimated Population Change in the United States, 2000 to 2060



Sources: United States Census Bureau, United States Department of Commerce, 2000 (2000 population);
and Geolytics, Inc., 2008, (2030 and 2060 population estimates)

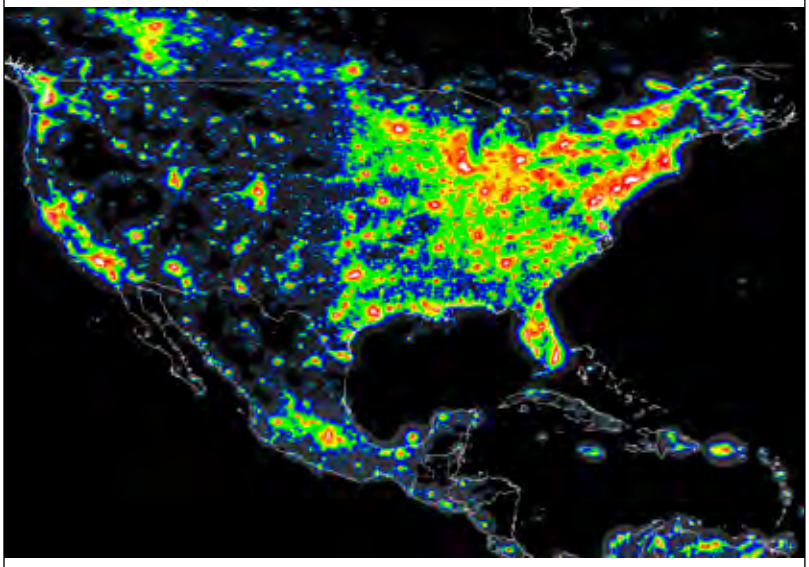
Defining a Mega-Region

The definitions of a mega-region vary. The concept started in 1961 with Jean Gottmann and his book *Megalopolis*, which described the agglomerated urban region stretching from Boston to Washington DC, or the "Bos-Wash corridor."[13] According to Richard Florida, this region is home to some 54.3 million people, more than 18% of the population of the United States, and generates $2.2 trillion in regional product; more than all national economies except those of the US and Japan.[14] Importantly, Gottmann noted that modern cities should not be viewed in isolation, but as parts of "city systems," or participants in urban networks.[15]

Gottmann's initial classification of the Bos-Wash corridor spawned myriad classifications of the megapolitan phenomenon. Perhaps the chief definition is that of the Metropolitan Institute at Virginia Tech, which defines such areas by the following criteria: at least two metropolitan areas, derived from contiguous metropolitan and micropolitan areas, projected to have a population of over 10 million by 2040, and with linked centers through major transportation networks.[16] This classification identifies ten megapolitans in the United States. Although this classification is useful, its population requirement filters out smaller regions that exhibit the mega-region characteristics but do not quite reach the population requirement.

Richard Florida, at the Martin Prosperity Institute of the University of Toronto, used satellite images of the world at night to classify mega-regions. Florida pieced together the lit regions of the world and combined them with estimates of national GDP and population data to estimate regional productivity (See Figure 4).[17] This interesting classification uses light "pollution", a standard byproduct of cities, as a measure of urbanization. However, the results by this method are not easily assessed or very accurate. Estimation based on satellite imagery of light pollution is not as simple or constant as using data provided through the US Census Bureau.

Figure 4:
Artificial Night Sky Brightness in the United States



Source: Cinzano, P., F. Falchi, C. D. Elvidge, 2001, The first World Atlas of the artificial night sky brightness, Mon. Not. R. Astron. Soc. 328, 689–707

The Brookings Institution recently released a study on the megapolitans of the Rockies region; the principal author, Robert Lang at Virginia Tech, is the co-director of the Metropolitan Institute. In the Brookings study, Lang adapted the previous classification of the Metropolitan Institute to fit the smaller regions of the Rockies. This new classification reduces the population requirement of 10 million by 2040 to 1 million and outlines five clear megapolitans of the Rockies region. [18]

With the exception of Florida who used light pollution to define mega-region boundaries, megapolitan classifications are based on county level census data. The county level has historically been the base level of US planning because the Census Bureau records all demographic data at the county level during each census.[19] Thus, the Office of Management and Budget (OMB), which establishes standards used by the Census Bureau, creates most designations based upon the county level of geography. These designations include the metropolitan and micropolitan statistical areas, combined statistical areas, and non-core areas.[20] These designations, which are used by the Census Bureau, are based on an economic integration of neighboring counties. For example, the Census Bureau scores commuting data at the county level, and a high degree of commuting within and between counties means a high degree of economic integration.[21] However, the use of county-level data can present problems, particularly in the West where some counties are bigger than some entire eastern states. In such counties, claims made for towns and cities based on county-level data would be broad and inexact. Still, most planners use county-level data to classify mega-regions because of the availability and depth of these data, and because county-level data are a standard unit in the planning community.

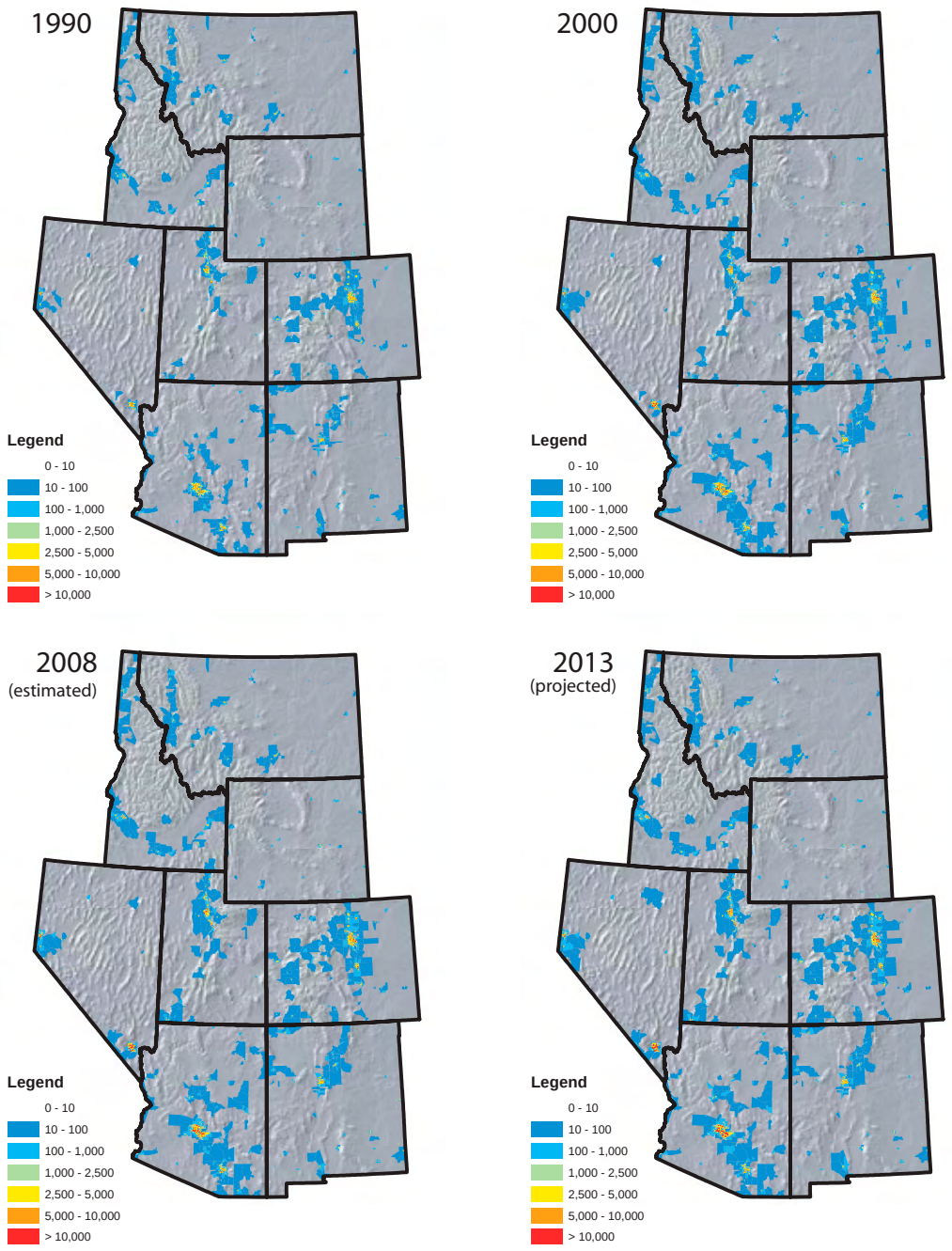
The principal indicator of a megapolitan area is a connection between metropolitan areas via commuters. These commuters live in one city and work in another, effectively beginning to bridge the economies of the cities involved. Because commuting data is only available at the county level, most planners base their mega-region classification on them. This presents problems when drawing a picture of the mega-regions on a map because many counties are only partially involved in megapolitan regions. This is best illustrated in the counties of Arizona. Those counties involved with the Sun Corridor mega-region are large and sparsely populated; the mega-region is occupying portions of otherwise rural counties. Although using counties as the basic building block for classifying megapolitans is convenient, data at this level cannot accurately depict the megapolitan phenomenon. County-level data are not precise enough throughout the Rockies to show house-by-house, development-by-development growth in an area.

The classification developed by the Colorado College State of the Rockies Project goes a step further than the alternatives by using tract-level US Census data to show only the parts of counties involved in the regions (See Appendix A: State of the Rockies Mega-Region Classification). This eliminates the vast empty spaces included in other classifications and also shows a higher resolution picture of the region itself (See Figure 5). Additionally, we use population data predicted to 2060 to show the regions growing together over time. With this feature, we can show individual tracts being added to a megapolitan area as it spreads through counties. The State of the Rockies Project classification accurately shows the size of these regions while simultaneously demonstrating their growth and expansion (See Figures 6, 7, 8, 9, 10, and 11).

Mega-Regions in the Rockies

According to Richard Florida's light-based regions, the world's ten biggest mega-regions house only six percent of the world's population, but 43 percent of its economic activity.[22] Florida reports that both Denver-Boulder and Phoenix-Tucson each generated about $140 billion in regional product in 2000.[23] On average, mega-regions outpace the average national population growth rate, and the Valley of the Sun is the fastest growing mega-region in the country.[24] In terms of population growth, it will take an estimated $33 trillion to fund residential and nonresidential structures in America's megapolitan areas by 2040 according to the Lincoln Institute of Land Policy.[25] America's mega-regions are massive in scale and economic importance, mostly growing without long-range foresight or planning for the region as a whole. These population levels and projections should indicate the importance of planning for such a phenomenon before it is too late logically and efficiently to plan organized expansion and add effective infrastructure.

Figure 5: Population Density in the Rockies by Census Tract, 1990-2013

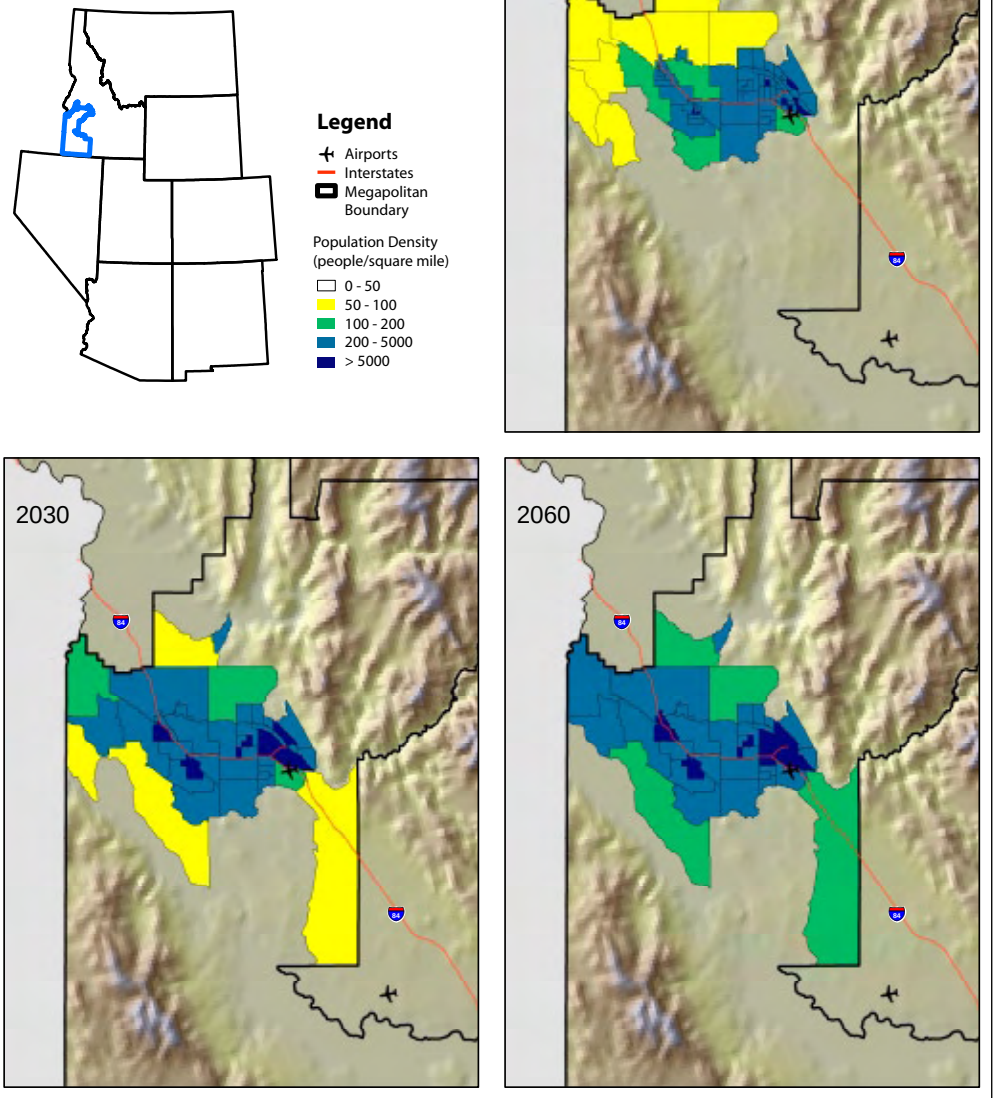


Note: population density is shown as the number of individuals per square mile.
Source: U. S. Census Bureau, 1990, 2000; Geolytics, Inc.., 2008 and 2013 Estimates and Projections

Currently in the United States regional planning refers almost entirely to metropolitan planning.[26] If the US Census Bureau were to adopt the mega-region classification it would be the largest Census designation in terms of both land area and population available.[27] Creating such a classification would encourage policy makers and planners to start thinking on a broader, more realistic level.[28] With two out of three Americans currently living in a mega-region, the implications of the growth and development of these areas are profound. Currently, no strategies exist to anticipate and manage the future growth and economic prosperity of America's mega-regions.[29] Planning for mega-regions is most important for policies that cross political boundaries, thus solving environmental, economic, and transportation problems for the entire region instead of each individual metropolitan area.[30]

For regional transportation, the Intermodal Surface Transit Efficiency Act of 1991 requires regions to form metropolitan planning organizations in order to receive federal money for projects.[31] The megapolitan scale is essential for planners to map transit systems and to acquire federal funding for infrastructure construction. Problems like securing water for growing mega-regions is much easier solved at the megapolitan scale than at the individual metropolitan scale, since large

Figure 6: The Treasure Valley Megapolitan Area Population Density Projections, 2000 to 2060



Source: Geolytics Inc., 2008

incorporated places are much better positioned to secure and develop water supplies than are smaller towns and cities.[32] Planning for mega-regions does not require new governments or authorities; it only requires strategic partnerships across regional and state boundaries.[33] Broad, regional planning commissions should be created and charged with responsibilities for facilitating the growth and development of these mega-regions. Overall, long-term planning for mega-regions can create a healthy and organized infrastructure to promote a better quality of life for people within the regions.[34]

This report identifies six growing megapolitans in the Rockies Region, The Front Range of Colorado, the Wasatch Front in Utah, the Valley of the Sun in Arizona, Greater Las Vegas in Nevada, The Enchanted Corridor in New Mexico, and the Treasure Valley in Idaho. Our population projection estimates through 2060 show these regions slowly growing together over time at the individual census tract level. This is not surprising considering that the Rockies region has had almost double the population growth of the national average in recent decades, and many of the cities in the Rockies region are among the fastest growing cities in America.[35] While the current economic crisis is slowing growth around the country, these mega-regions will still overall see a large population increase in the long term. After this recession is overcome, the housing market will resume, and the potential of the Rockies region will again be realized. As this region has been the fastest growing in the country and will likely continue to be in the future, it is beginning to experience some significant growing pains. These regions will have to address a number of issues when planning for their future development, including securing water rights, developing regional transit systems, and obtaining federal funding to cope with rapid growth.

Water

The Rockies region is a notoriously dry place. Receiving an average of only 30 inches of rain per year, water is a valuable resource.[36] Most water demand in the Rockies region is solved by the Colorado River, which was initially divided under the Colorado River Compact in 1922.[37] The compact allocated the river between all the states in the Rockies region except for Idaho and Montana. Currently Arizona, Colorado, and Utah all receive fairly large allocations of the Colorado River.[38] The Front Range and the Wasatch Front obtain additional water from winter snowpack in the nearby mountain ranges and Idaho gets plenty of water from snow pack and ground water storage[39] The Enchanted corridor receives an allocation of the Colorado River, supplemented by water from the Rio Grande.[40] Las Vegas, Nevada, however, only receives a small amount of the Colorado River, and nearby Lake Mead sends most its water to California and Arizona.[41] Rapid growth and climate change will likely have a large effect on water availability for the region in the future.[42] Watersheds

rely on plenty of snowfall in the mountains of Colorado, Utah, Idaho and Wyoming during the winter, and if snow fall decreases, so do the levels of the region's rivers and storage reservoirs.[43]

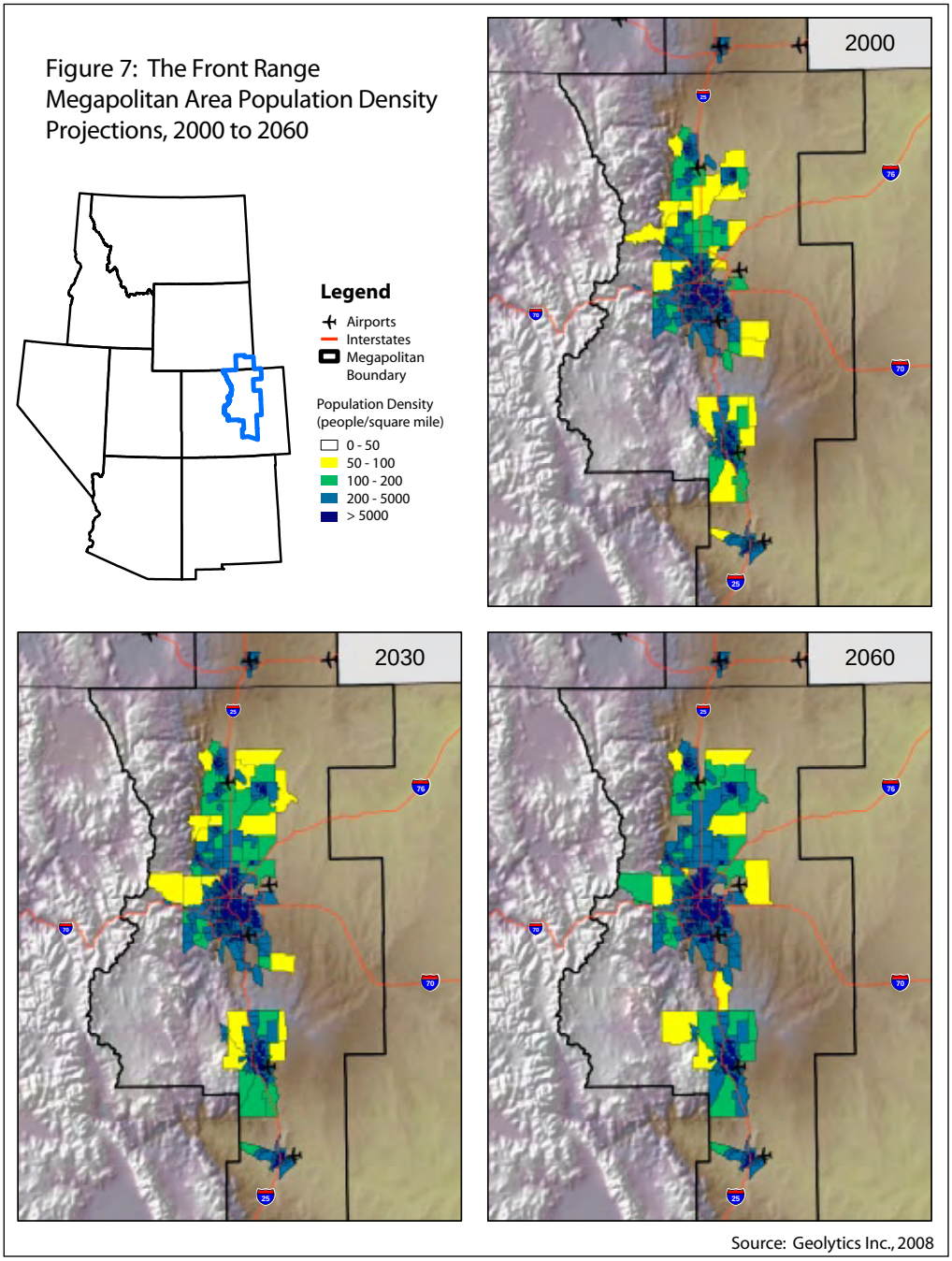
The increased water demand of the growing mega-regions will likely be met by a variety of conservation efforts. Southern Nevada encourages conservation by charging higher rates as water use increases.[44] Conservation can also come from changing the outdoor water use habits of residents.[45] Currently the Southern Nevada Water Authority is paying homeowners $2 per square foot to convert their lawns to xeriscaping.[46] Since Denver introduced water conservations efforts in 2000, water use has been lowered by 20 percent, with a ten-year goal of another 20 percent.[47] Conservation can also come in the form of repairing antiquated delivery systems. The American Society of Civil Engineers estimates water authorities loose six billion gallons of water a day just to leaks in the existing infrastructure.[48] An unfortunate result of urban expansion is the conversion of farmland to residential housing. This, however, can also help to conserve water since an area covered with housing often uses less water than displaced crops.[49] This can, however, present serious drought-related problems for growing urban areas; land used for farms and ranches can forgo a crop year, but municipal systems serving built housing developments cannot just cut back or shut down without serious consequences to the community.[50]

Overall, the mega-region areas in the Rockies region need to seriously consider their future water availability. Conservation will surely play a role in meeting growing water demand. In the Rockies region, the days of green lawns and leaky faucets are quickly vanishing.

Transportation

Cars allow people to live away from dense urban areas, have a house with a yard, and still maintain the big city job in the urban center.[51] Cars operate on a point-to-point model, connecting a commuter's house and job directly and providing a speedy, individualized commute.[52] Public transit, on the other hand, uses a hub-and-spoke model where commuters have to walk to and from the train or bus stop to their job.[53] This explains why public transit on average takes 48 minutes, twice the time of the average car commute.[54] Expansive urban areas enabled by automobiles have created a land-use model only more cars and highways can fill. People wanting to ride regional transit to work every day often remain in their cars for part or all of their commute, because rail and bus lines simply cannot service every house in every development.[55] Sustained high gas prices push people to sell their gas guzzling SUVs in favor of fuel efficient compacts and hybrids.[56] With the previous high gas prices or the current economic slump, people looking to dispose of their Ford Excursions or Explorers are left stranded with their vehicles going unsold even when priced below blue-book value.[57] While gas prices

Figure 7: The Front Range Megapolitan Area Population Density Projections, 2000 to 2060



Source: Geolytics Inc., 2008

Case Study: The Sprawling Valley of the Sun

The Valley of the Sun mega-region is largely made up of metropolitan Phoenix and Tucson and their surrounding suburbs. These two cities, 150 miles apart from each other, have been connected by US Interstate 10 since 1963.[1] At that time, they had a combined population of 929,170, which accounted for 71 percent of Arizona's population.[2] Since then, these two formerly independent cities have slowly merged together.

The growth of mega-regions occurs along transportation corridors. In this case it is I-10 which runs north south through the region from Flagstaff in Yavapai County down to Nogales in Santa Cruz County. As metropolitan areas develop near each other they begin to interact along these transportation corridors. Interaction begins with sharing commuters and eventually comes to sharing economies. These interactions are facilitated by the metropolitan areas growing closer and closer to each other through the growth and development of suburbs and small towns in between. Eventually, as the metropolitan areas grow, a continuous region of urban development extends between the two areas, cementing an economic link between them and, in doing so, creating a mega-region.

In 2006 Metro Phoenix and Tucson had grown to 4,985,544 people, accounting for 80 percent of Arizona's population and 88 percent of its economy. As their suburbs have expanded, these cities have slowly been growing together along the interstate corridor. In fact, Phoenix alone has seven suburbs with more than 100,000 people, each having had double-digit population growth rates since 1990, and the Tucson metropolitan area grew 26 percent between 1990 and 2000.[3] The Valley of the Sun is the only Rockies mega-region which qualifies under the Metropolitan Institute's classification, as it is projected to break the 10 million person threshold by 2040.[4] By 2060 the area between Phoenix and Tucson will have reached a minimum population density of 50 people per square mile by the State of the Rockies Project mega-region classification, creating an urban corridor covering the 150 miles between the two cities.[5]

[1] Morrison Institute for Public Policy, "Megapolitan: Arizona's Sun Corridor." Phoenix, Arizona State University (May 2008).
[2] *Ibid.*
[3] U.S. Census Bureau, U.S. Department of Commerce, American Fact Finder Basic Counts/Population, http://factfinder.census.gov. Accessed July 15, 2008.
[4] Lang, Robert E. and Dawn Dhavale, "Beyond Megalopolis: Exploring America's New "Megapolitan" Geography," July 2005.
[5] Rockies analysis of our classification and U.S. Census Bureau, U.S. Department of Commerce, American Fact Finder Basic Counts/Population, http://factfinder.census.gov. Accessed July 15, 2008.

have recently receded, they will inevitably rise again, and likely take a toll on megapolitan development. These areas are based on their suburbs, since low gas prices pushed people further away from city "centers". Phases of high gas prices push people closer to the regional transit of the denser urban cores, which results in slower growth in the outer regions. As gas prices climb back up to previous highs we will see pressure to modify land use patterns toward regional transit systems and local governments will see the need to establish solid, integrated regional public transportation.

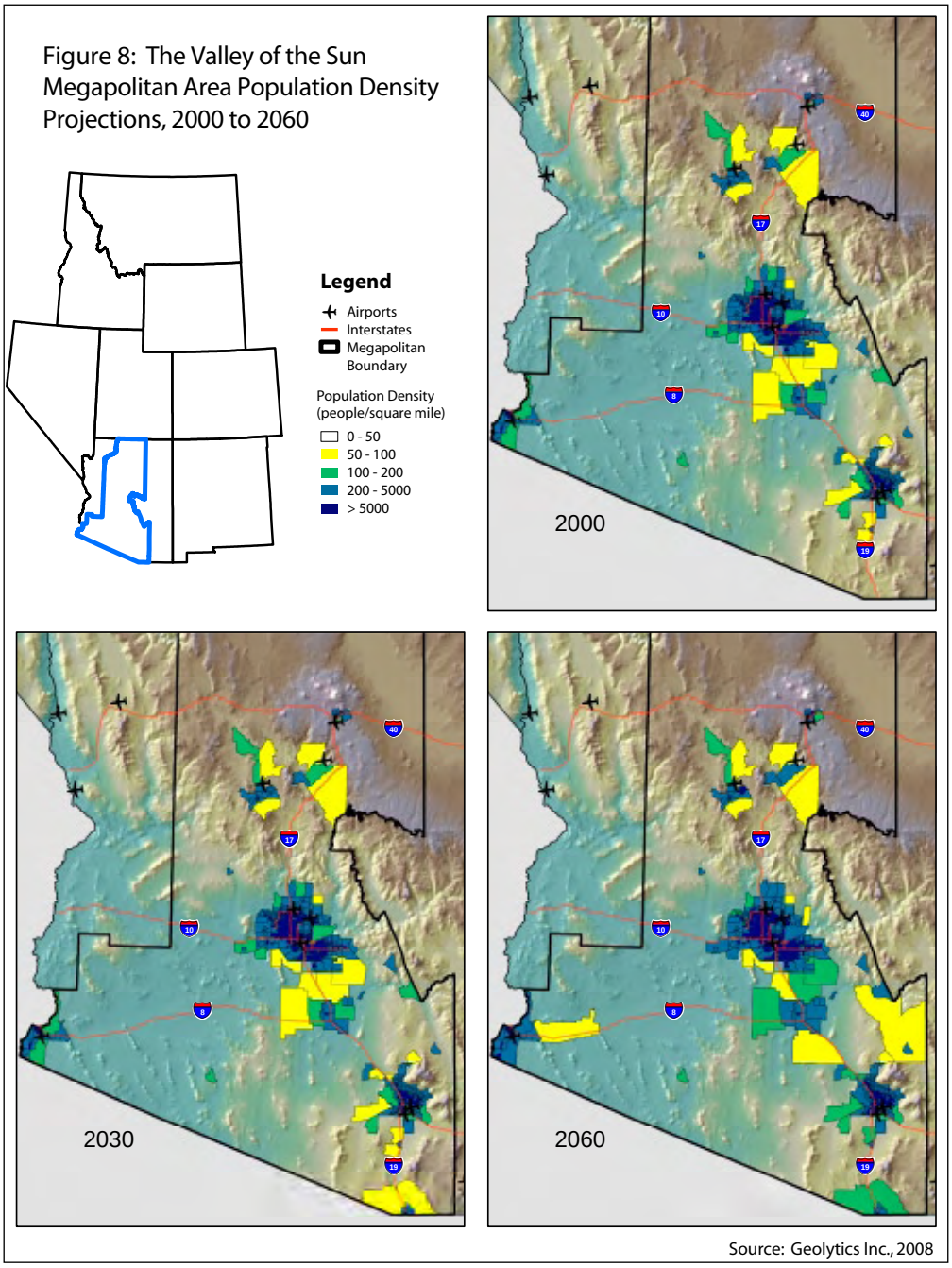
Four of the six Rockies mega-regions have established versions of light rail-based public transit systems (Las Vegas and the Treasure Valley do not). If high gas prices pressure commuters out of their cars, these systems will be crucial to maintaining growth and fluidity of the mega-regions. These metropolitan rail transportation systems need to be extended throughout the regions as a whole. Albuquerque, NM, has the Rail Runner regional transit system, which takes commuters along the I-25 corridor, extending north to Santa Fe. This will save commuters an estimated $360 per month on fuel alone for their cars, and help to relieve the projected congestion for 2025 on I-25 by an estimated 72,000 fewer vehicles per day.[58] Installing regional transit is a huge investment. Denver's investment in expanding its FasTracks system has already reached an estimated $6.1 billion, all coming from the city and private investors.[59] The Front Range's plans to extend rail service north to Fort Collins and south to Pueblo would cost the region up to one million dollars per mile of track.[60] An effect of higher gas prices, however, may be that commuters abandon their cars and start taking public transit systems, thus leading to a change in land use patterns as people move from suburban houses to apartments near rail or bus stations or city centers.[61] Such a trend is suggested in recent real estate markets, in which suburban homes have lost value, while homes and apartments in central urban areas have kept their value.[62]

Mega-regions can also greatly benefit from the installation of high speed rail (HSR). People in the Rockies mega-regions often travel within the region, and HSR is perfectly suited for travel between 200 and 500 miles.[63] Our rail systems need to be redesigned and rebuilt. As noted by the U.S. Secretary of Transportation, Norman Mineta in 2005, "The 34 year partnership between the government and Amtrak has failed. Far from yielding a vibrant and growing passenger system, it has produced one that limps along on life support from year to year."[64] The concentrated populations and corridor form of the Rockies' mega-regions make them excellent geographic

units around which Amtrak could be reorganized.[65]

Additionally, taking people off the interstates and putting them on HSR would reduce dependency on oil and reduce interstate congestion for the trucking industry. Electric trains will have the opportunity to run on renewable energy as the region shifts away from coal-fired power plants to wind, geothermal, and solar sources. Currently, all of the mega-regions have fairly well developed civic infrastructures, but largely underdeveloped public transportation systems.[66] For these regions to grow smoothly and operate efficiently, huge investment in both regional rail and high speed rail is necessary.

Figure 8: The Valley of the Sun Megapolitan Area Population Density Projections, 2000 to 2060



Source: Geolytics Inc., 2008

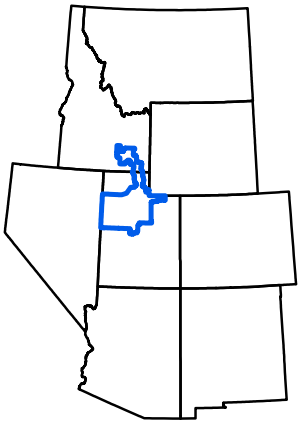
Federal Funding for the Mega Regions

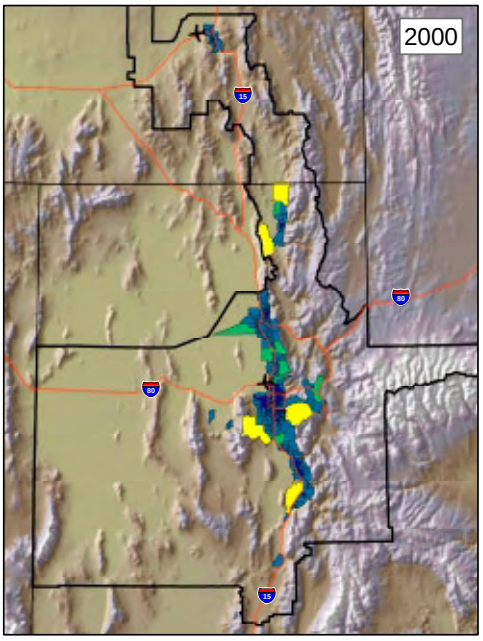
In terms of development, the Rockies region is still young. During the second half of the last century the U.S. Government built the Dwight D. Eisenhower Interstate System to include major metropolitan areas and cities.[67] Unfortunately for the Rockies region, many cities were still small and largely overlooked during the years federal aid was offered to build the interstates. Today, these regions are booming; largely without beltways or direct connections to each other. For example, Las Vegas and Phoenix, two of the Rockies region's largest mega-regions and the fastest growing cities in America, each have populations over two million, but are left without any direct interstate connection.[68] In fact, they are only connected by the two-lane highway, U.S. 93, which at one point even crosses the Hoover Dam. This section of highway is also the largest bottleneck in the CANAMEX freight corridor which connects Mexico and Canada.[69] Denver has also felt the repercussions of growing too late by having to use its own money to build its beltway, E470, as it grew into a major metropolis.[70]

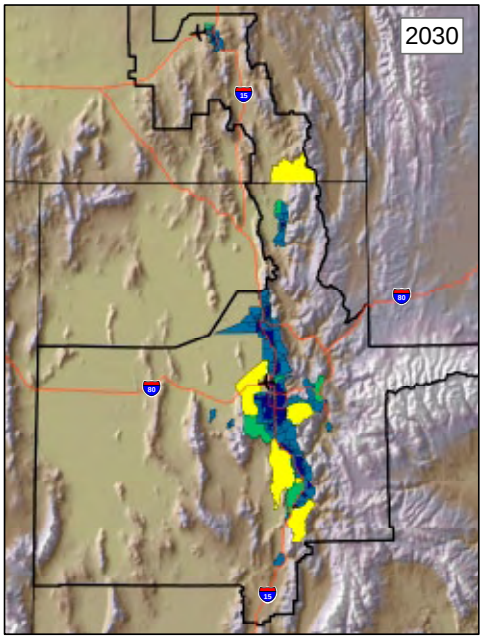
Though the West has a history of disdain for the federal government, the Rockies region needs financial support from Washington D.C. Many of the looming problems of the Rockies mega-regions are simply too large to be financed by the regions themselves. It may be too late to lay down more interstates to connect major Western cities, but corridors can be strengthened. The CANAMEX corridor, especially between Phoenix and Las Vegas, needs to be turned into an interstate and a bridge needs to be built over the Colorado River so traffic can be taken off Hoover Dam. Similarly, though Denver ranks first among metropolitan areas in its investment in light rail systems, it cannot afford to go much further by itself, especially if 2009's economic problems continue into 2010.[71]

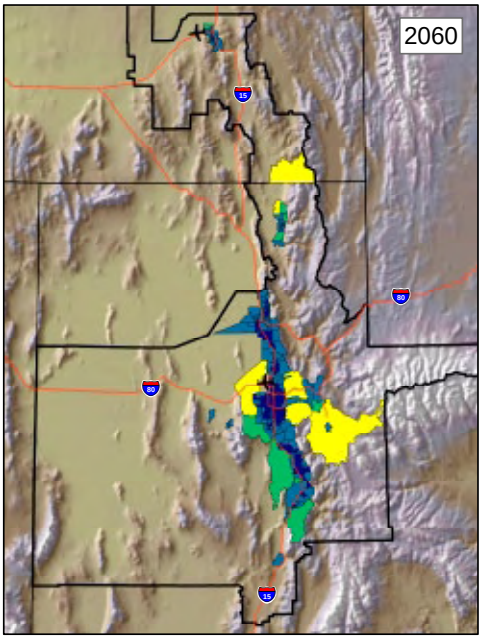
As Robert Lang and Mark Muro explain in "Mountain Megas", the Rockies region, and the mega-regions within it, cannot afford to update its old, inefficient infrastructure without federal assistance.[72]

Figure 9: The Wasatch Front Megapolitan Area Population Density Projections, 2000 to 2060









Source: Geolytics Inc., 2008

Rockies Region Rural Economic Clusters

While the urban areas of the Rockies region grow into mega-regions, the rural areas of the region will continue evolving into economic clusters. These two growth trends represent the future of the Mountain West as it shifts from the old to the new and becomes a region focused on services and technology.

The Wild West was made famous by one-road towns of saloons, general stores, and banks that provided services and facilities needed by ranchers and farmers throughout the area. During the 19th century the amenities and luxuries people desired were basic compared to modern lifestyles. As desired amenities change, people in the once "Wild West" are gathering into rural service clusters. These are mid-size towns that offer the amenities desired by modern consumers, such as a variety of restaurants, stores, good medical care, and high-speed internet. People in the Rockies region may want to live in quaint isolated mountain towns, but do not want to commute long distances to the grocery store, doctor, or lumber yard. They find compromise in towns just large enough to supply these luxuries while still small enough to provide the small-town feeling. These rural economic clusters of the new West are replacing the mountain towns of the old West.

Many people seek out areas that have a high degree of natural amenities such as warmer sunny winters, temperate dry summers, bodies of water, and varied topography.[73] The Natural Amenities Scale (NAS) was designed by the Economic Research Service of the U.S. Department of Agriculture and ranks counties on a scale from one to seven based on their level of natural amenities.[74] The eight-state region as a whole is very highly rated for the abundance of natural amenities.[75] Population increase in rural areas rich in natural amenities is far higher than in areas based on agriculture or natural resource extraction where natural amenities are typically much lower.[76] People who are "foot-loose" in choosing where they live and work are drawn to areas with plenty of recreational opportunities, such as towns near national parks, national forests, and rivers. Illustrating this, populations in counties with a high percentage of federally owned land grew from 1990 to 2000, while populations in counties dependant on agriculture or mining declined.[77] Counties that had both a high degree of natural amenities and a strong service-based economy grew the most during the 1990's.[78]

Whether people are coming to these clusters from smaller mountain towns or big cities, from the east or west, they are moving to places that provide the quality of life they desire. This quality of life is enhanced by ready access to services such as schools, stores, restaurants, and doctors.[79] Largely, nonmetropolitan growth is fueled by people coming from metropolitan areas, with natural increase accounting for only a third of population increase between 1990 and 2000.[80] Urbanites are looking for a simpler life away from the

Case Study: Front Range Regional Transportation

Denver is the principal city of the Front Range mega-region and is leading the way for regional connectivity in the Rockies region. It is currently building a huge addition to its existing light rail system and also funding feasibility studies on establishing high-speed rail along the I-25 and I-70 corridors. If all goes as planned, Denver will prove to be a shining example in efficient local and regional public transit systems.

Denver's Regional Transportation District (RTD) currently operates a light rail and bus system known as "TheRide," which includes 170 fixed bus routes and 35 miles of light rail track, servicing 40 municipalities in the Denver area.[1] While Denver already has a better public transit system than many cities, its citizens voted in 2004 to approve a sales tax to fund a projected $4.7 billion dollar addition called Fastracks.[2] This project will add 122 miles of light and commuter rail, 18 miles of bus rapid transit, and 57 new stations to the current transportation network.[3] Budget setbacks remain, however. The price tag on the expansion has risen to $6.1 billion and could rise again to $7.9 billion if commodity prices continue to rise in 2009, creating many questions on how the city will cover the deficit.[4] While some people are calling for a decrease in stations and lines, Denver mayor John Hickenlooper has said he plans to deliver the entire project as originally promised to voters.[5]

Regardless of its price, Fastracks could be a huge addition to the region's transportation. As 2008's rising gas prices funneled commuters into public transit, systems like Fastracks are seeing huge increases in riders. Denver's RTD reported that ridership was up ten percent in the first four months of 2008 compared to 2007, reaching the highest mark in its history.[6] Once the Fastracks addition is finished, transit riders will have a much greater access to Denver and its surrounding areas.

In addition to increasing the local public transit of Denver, the Front Range mega-region can expect an increase in regional connectivity. Denver and Wyoming have funded feasibility studies on establishing high speed rail (HSR) along the I-25 corridor from Wyoming to New Mexico, possibly between Cheyenne and Casper and Albuquerque.[7] This HSR system would interface with local transportation networks such as Fastracks to provide Front Range residents with seamless and efficient regional transportation.

Denver has provided $1.5 million and Wyoming has provided $200,000 for each of their studies.[8] These studies will not only lay out prospective plans for lines and station locations, but will make the project eligible for federal funding.[9] The Wyoming study has initially found that costs could be as high as 1 million dollars per mile of track which would require a hefty investment from the region and a most likely a helping hand from the federal government.[10]

While many people argue that train travel is unrealistic in the United States, experts explain that it is only our outdated personal car-based system that is to blame. As Norman Y. Mineta, the secretary of transportation has noted, "The problem is not that Americans don't use trains, it is that Amtrak has failed to keep up with the times, stubbornly sticking to routes and service, even as they lose money and attract few users."[11] Additionally, HSR has shown to be an excellent substitution to air travel for distances of 200 to 300 miles, which would perfectly suit travel between the mega-regions of the Rocky Mountain West.[12]

With Denver's expanding public transit system and a HSR line possibly in the future, the Front Range is poised to become an icon for Western regional transportation. Hopefully in the near future a resident in Colorado Springs can take a bus to a HSR station, get on a train to Denver, transfer to Fastracks, and end up at Denver International Airport in time to catch a flight to Europe or Asia.

[1] Regional Transportation District, "Transit Planning History." http://www.rtd-denver.com/History/index.html (accessed Mar. 15, 2009).
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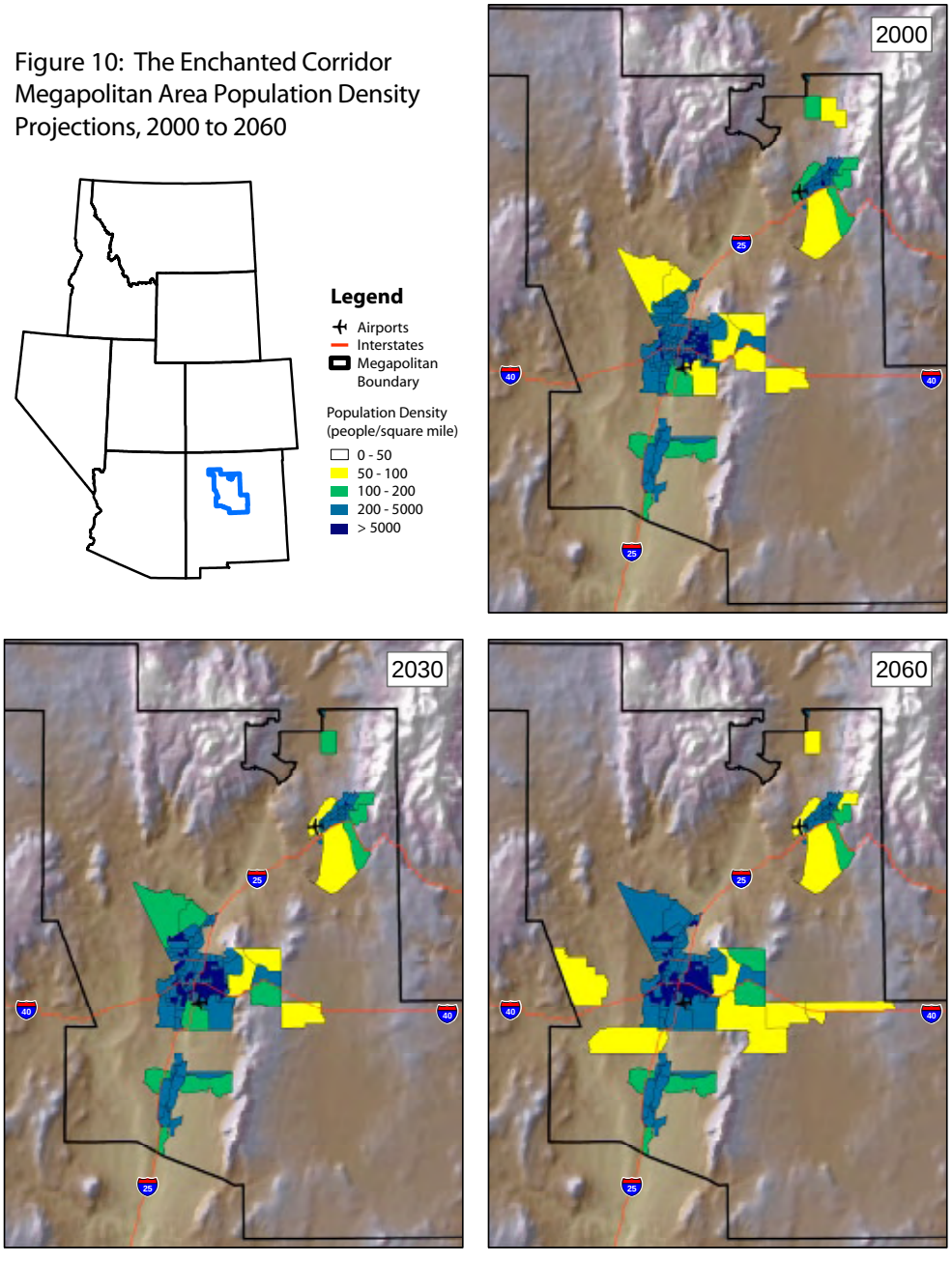
[7] Miller, Jared, "Report Sheds Light on Commuter Rail Plan," *Caspar Star Tribune*, July 25, 2008.
[8] Miller, Jared, July 25, 2008, and McGhee, Tom, "Rapid Rail Eyed Along I-25, I-70 Corridors," *Denver Post*, Aug 13, 2008.
[9] McGhee, Tom, "Rapid Rail Eyed Along I-25, I-70 Corridors," *Denver Post*, Aug 13, 2008.
[10] Miller, Jared, "Report Sheds Light on Commuter Rail Plan," July 25, 2008.
[11] Mineta, Norman Y., "Starving Amtrak to Save It," *New York Times*, Feb 23, 2005.
[12] Lang, Robert E., Andrea Sarzynski, and Mark Muro, July 2008.

Figure 10: The Enchanted Corridor Megapolitan Area Population Density Projections, 2000 to 2060



Source: Geolytics Inc., 2008

crime, pollution, and poor schools of the cities.[81] Rural areas with population increases are generally places with high education levels and employment opportunities.[82]As these places grow through an influx of new residences, their economies grow, which further encourages existing residents to stay.[83] This process creates rural economic clusters.

Today different types of services have consolidated into larger units, causing people to expect greater specialization and choice.[84] With the advent of shopping malls and Wal-Marts, people are looking more and more for one-stop shops where all their needs can be met at once. With an increase in shopping choices, consumers now get to choose specialized products or services. Most people want to be close to a good hospital in case of an emergency and in a good school district to provide their children with a strong education. They move to areas that can provide these amenities along with a variety of shopping and dining options. And, with the advent of high-speed internet many people moving from metropolitan areas can continue their desk jobs from their rural homes in the Rockies region.[85]

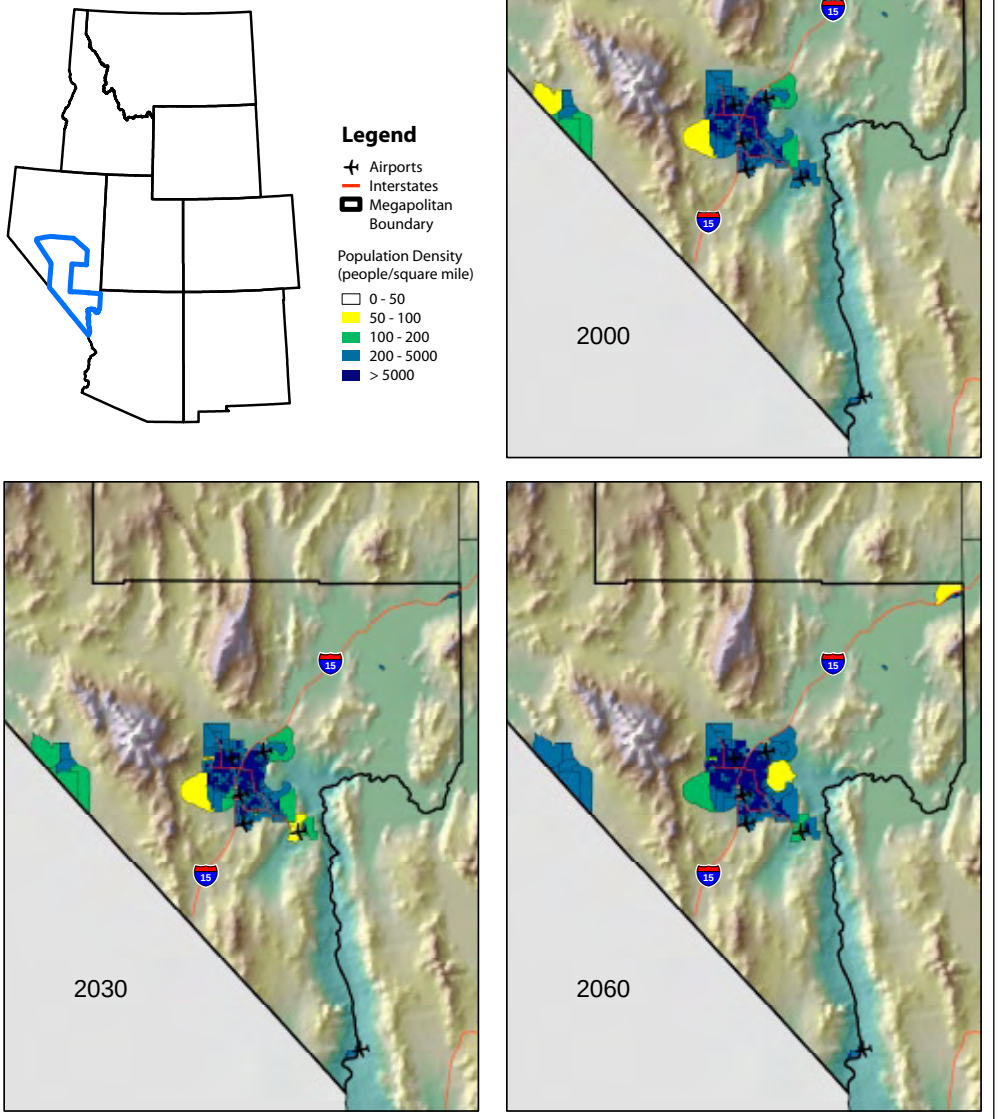
Identifying Rural Economic Clusters

To begin describing the rural economic clusters of the Rockies region we need a classification system to distinguish them from the many small towns and cities of the region (See Appendix B for the State of the Rockies Project classification). These clusters will be smaller cities and towns that provide a local community feel while still having modern services. They will attract people not just by attractions such as ski resorts or as job magnets such as coal, oil, and natural gas operations, but as nice places to live. A service cluster will be based on no single industry; employment will span the economy. While population attractants such as major resorts and big industry pull populations in and develop economies around them, rural service clusters are places that lure people in through their own comprehensive mix of attractions.

In this paper we identify three different types of rural economic clusters. First is the *rural service cluster*, which has an economy based mostly on the service industry. These are the small towns and cities that offer modern day services while still maintaining a community feel. Second are the *rural resource extraction clusters* which have well-rounded economies with strong service and mining industries. These are towns with large natural resource extraction industries that still maintain a diverse economy. Finally are the *rural recreation clusters* which also show well-rounded economies with both strong service and recreation sectors.

The rural resource extraction and rural recreation clusters identified with our classification are places that have developed stable economies not based on any one industry. These clusters differ greatly from the many individual mining and recreational towns in the West that have developed solely around an industry, with population flows following commodity boom-bust

Figure 11: The Las Vegas Megapolitan Area Population Density Projections, 2000 to 2060



Source: Geolytics Inc., 2008

cycles. Mining towns will develop, thrive for a while, and then die out completely because they never established functional economies. Pinedale, Wyoming, has recently experienced a huge wave of workers coming to its natural gas fields. Though it has had a large increase in population, it still has only a small grocery store and minimal services, and its economy is dominated by the mining industry.[86] Similarly, towns based completely on recreation follow seasonal and cyclical tourist flows. They are empty and dead in the fall and spring and thriving in the summer and winter. Poor weather conditions and droughts present cyclical challenges. Restaurants and shops shut down in the low seasons awaiting the resurgence of customers in the next season. The economy of Buena Vista, Colorado, waits most of the year for the spring and summer rafting season. When there are no tourists waiting to float the nearby rivers, the town's economy slumps.

Our classification requires resource extraction and recreation clusters to have a significant service industry. These places are unlikely to experience the boom and bust waves of typical mining and leisure towns and will likely maintain stable economies.

Rural Economic Cluster Breakdown

Rural Service Clusters
(See Figure 12 and Table 2)

Within the identified rural service clusters, 67 percent of the economy is comprised of the service sector without the leisure and hospitality industries.[87] These places have strong service industries, the biggest sectors of which are trade services such as retail, utilities, and transportation. On average, wholesale and retail trade services occupy almost ten percent more of a rural service cluster's economy than the next highest sector: education and health services.[88] The importance of these two sectors in a service cluster's economy and a relatively high retail service index indicate an established service-based economy which can provide for the needs of its population.[89] While the average rural service cluster's economy is mainly based on the service industry, these areas still exhibit some minor reliance on the goods producing industry and leisure and hospitality sector, each taking up 17.6 percent and 15 percent, respectively, of the average economy.[90] While these service clusters have some reliance on these two industries, since goods production and hospitality comprise a small percentages of the economy, these communities should not experience major swings in economic activity, thus helping to provide a well-rounded economy.

Rural Resource Extraction Clusters
(See Figure 13 and Table 3)

Like the other rural economic cluster types, resource extraction clusters rely heavily on the service industry (which make up an average of 65 percent of their local economies), but they have a much higher percentage of industry based on the goods producing sector. For

example, the mining industry in these communities is six times larger than mining-based industry in an average rural service cluster.[91] On average, mining occupies 19 percent of the economy in the rural resource extraction cluster,[92] while service sectors, such as trade (23 percent), education and health services (10 percent), and leisure and hospitality (13 percent), make up a larger total portion. Economic activities are thus spread out among sectors, suggesting that the economies are relatively stable and not dominated by any one industry. The relatively high retail service index represents an ability to satisfy the needs of the population.[93] Because of their well-rounded economies, these rural resource extraction clusters are unlikely to follow the worst extremes of the boom and bust population waves of many mining towns.

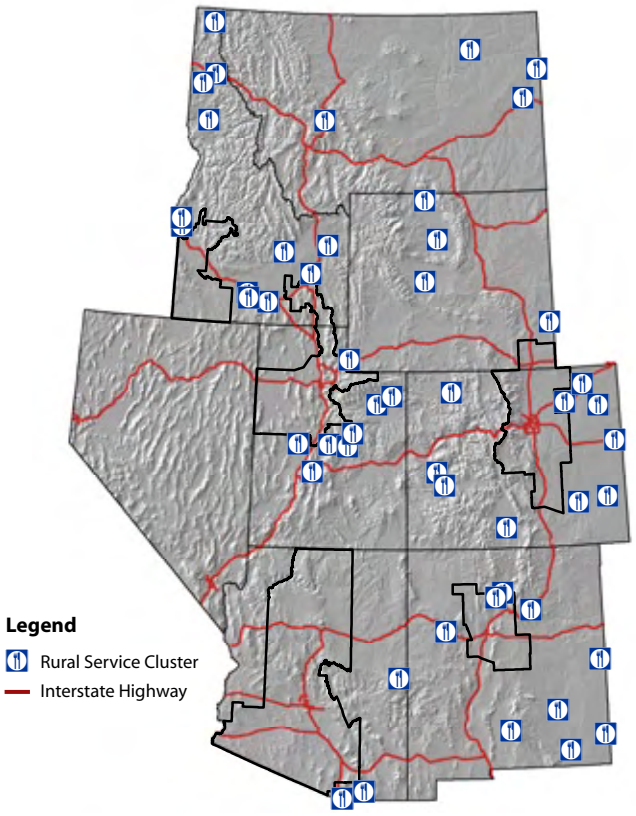
Rural Recreation Clusters
(See Figure 14 and Table 4)

Within a list of 50 identified rural recreation clusters, communities showed a wide range of values for the importance of the leisure and hospitality sector. Although the lowest percentage did not drop below the ten percent, as with rural resource extraction clusters, values ranged from 50 to 14 percent.[94] This makes the average percentages for each sector breakdown a little less descriptive. The overall trends in the average percentages of the goods producing and service industries closely follow the averages for the rural service cluster, with differences of only approximately three percent.[95]

However, differences are revealed when looking at the breakdown of the service industry. Leisure and hospitality services make up 15 percent of the economy in an average rural service cluster and 23 percent in rural recreation clusters. In 18 of the rural recreation clusters, however, leisure and hospitality services account for more than 25 percent.[96] These areas are less based on services such as retail, transportation, and utilities and more focused on the tourism industry of leisure and hospitality. This is reflected by a relatively low average retail service index when compared to the other two types of clusters.[97] In terms of the goods producing industry, rural recreation clusters are dominated by the construction sector; on average rural recreation clusters are twice as reliant on the construction sector (11.9 percent) than either the natural resources and mining sector (3.8 percent) or the manufacturing sector (4.8 percent).[98] Additionally, rural recreation clusters have an average natural amenity index of 5.3, which is higher than average amenity values for both the rural service clusters (4.6) and rural resource extraction clusters (4.7).[99] The average rural recreation cluster thus has an abundance of outdoor recreation possibilities; usually located in scenic areas near mountain ranges, rivers, and lakes.

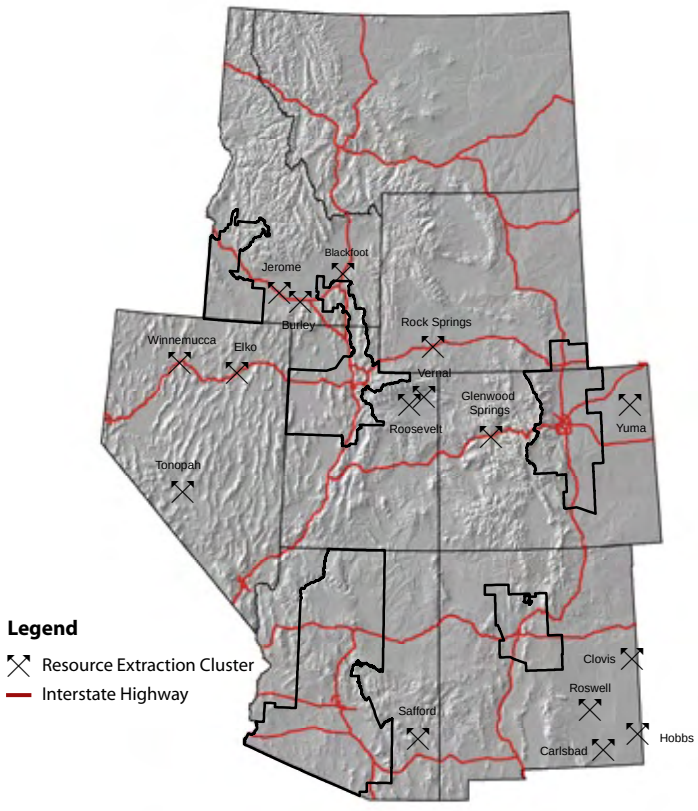
For the rural resource extraction and rural recreation clusters, requiring a minimum of a 50 percent service based economy creates a list of places that not only offer seasonal jobs and tourism, but the ability to support a community. Such places can offer their residents grocery

Figure 12: Rural Service Clusters in the Rockies



Source: Bureau of Economic Analysis, U.S. Department of Commerce, NAICS, 2006

Figure 13: Rural Resource Extraction Clusters in the Rockies



Source: Bureau of Economic Analysis, U.S. Department of Commerce, NAICS, 2006

stores, hospitals, and restaurants. These are places like Taos, New Mexico, or Montrose, Colorado, which are primarily small towns with distinct cultural identities and secondarily tourist attractions (e.g., ski resorts) or job attractors (e.g., large oil fields). Because the list of rural service clusters is ranked by service sector without leisure and hospitality, it indicates places that are likely to be year-round, stable communities, not those that primarily follow the swings of seasonal tourism.

Conclusion

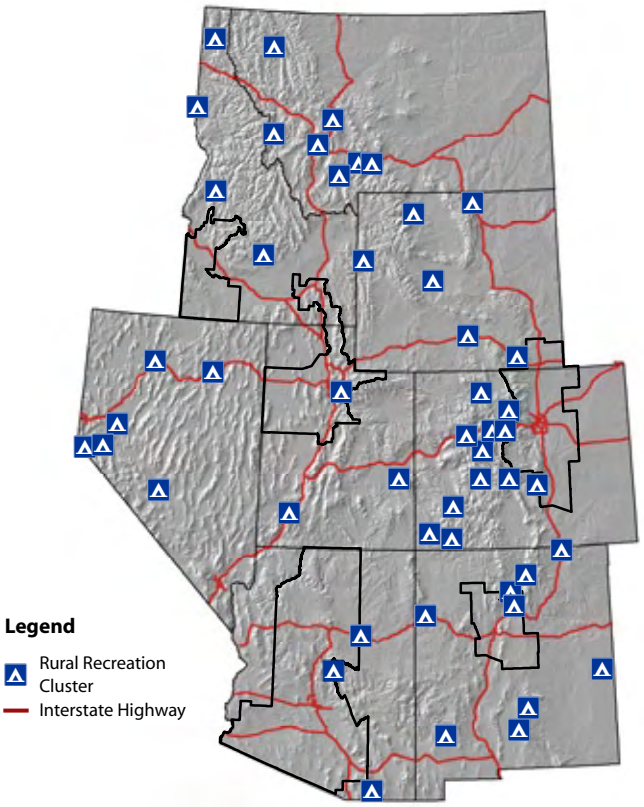
The Rockies region houses some of the fastest growing states and cities in the country. People are flooding into the area's mega-regions and rural economic clusters. These two "urban" classification categories represent the population distribution patterns of the Rockies region's future and provide a basis for analyzing what these changing areas need to grow successfully.

Several different classifications for mega-regions have been developed, but the one developed for this report goes a step further than those prior. We have created a fine-grained classification which accurately portrays the region itself and its growth over time. Our classification provides a high definition classification of the Rockies region mega-regions through time. Hopefully in the future one of the mega-region classifications will be adopted by the US Census Bureau so that planners and law makers can start creating a future for the regions as a whole and not for each individual city within them. The success of these regions relies on teamwork and sharing of resources between the areas within them. Overall, the mega-regions here in the Rockies region will need to address issues of regional and local connectivity, securing water, and ways to draw government assistance to implement these plans.

The rural economic clusters of the region show the future small town development of the region. Our classification identifies the small towns that have stable and well rounded economies. It separates these places from the boom and bust towns of the region which rely on tourism or mining. People are drawn to these beautiful small towns with high education rates, access to services, and nearby recreational opportunities.

Combined, these two phenomena depict population movements that are occurring throughout the Rockies region. They are important for understanding the growth and development of the urban and rural areas and can provide guidance on future development. Ideally these two classifications will take hold in the future and jointly provide insight as to how each of these phenomena works and interacts. The result can be an enhanced "repopulation" of the Rockies region that does not despoil the area's natural beauty and abundant natural resources.

Figure 14: Rural Recreation Clusters in the Rockies



Source: Bureau of Economic Analysis, U. S. Department of Commerce, NAICS, 2006

Appendix A: State of the Rockies Mega-Region Classification

The classification developed for this report aims to improve upon those currently available first by only including land area involved in the mega-regions and second by showing these regions growing together over time. This is accomplished by going below the county level down to tract level population density data which provides a much higher resolution picture of these regions. Additionally, by using projected 2060 population data, our classification will effectively show the formation of population "islands" and "continents" that are expected to grow together in coming decades.[100]

There are three basic requirements for our classification. First, the region must have a population of at least one million people by 2060. This assures that the identified regions will be important economic and cultural players in the nation. Second, the region must contain at least two metropolitan areas. Without this requirement, regions could exist as urban sprawl from one large city, not by connecting separate entities. Third, the metropolitan areas must be connected by a transportation corridor such as an interstate. This guides and facilitates the growth and expansion of the region, creating the urban corridors.

In terms of land area, this classification starts at the county level and includes all counties in a region that are classified as metropolitans. We then go down to tract level Census data and exclude any tracts in the metropolitan

counties that have a population density of less than 50 people per square mile. This eliminates all of the empty/sparsely populated space in many megapolitan counties and depicts only the actual mega-region itself. Projected 2060 population data is then used to project the growth of these regions. As these regions grow in population, any connected tracts that surpass 50 people per square mile or areas that surpass the population requirement to become a metropolitan are added to the region. If an adjacent county becomes a metropolitan area, the tracts in its county with more than 50 people per square mile are also added.

The use of tract level data and projected population data are what make this classification unique. Our classification illustrates the megapolitan phenomenon itself as urban and metropolitan areas slowly grow together over time and is not simply just a snapshot in time. This classification helps people to understand that mega-regions are dynamic entities that form over time and are not just "places" that exist here and now. This refined approach will allow planners to foresee the growth and development of up and coming mega-regions before that have totally grown together.

Appendix B: Defining Rural Economic Clusters

We developed a classification based on county- and place-level Census data and the North American Industry Classification System's (NAICS) 11 supercategories to extract service clusters out of the Rockies Region's many towns and cities.[101] The county- and place-level census data are first used to identify the counties of the Rockies region and the largest cities or towns in them. For the purpose of this classification, we only look at the largest town or city in each county; such towns have the main base of population and are assumed to have the largest influence on the county's economy. This is useful because most counties of the Rockies region have only one major town or city. Also, the NAICS industry data are on the county level, and the biggest town or city should exert the most influence on county-level data. Census data were also used to eliminate any counties involved in a metropolitan area. This creates a list of small towns and cities uninvolved in the mega-regions and urban centers of the region. The NAICS data provide an industry-level break down of each county's economy based on its 11 supercategories which range from mining to education. The NAICS information makes it possible to determine how much the economy of each county relies on any one industry.

In addition to census and NAICS data, we added a retail index to describe the existence of specific service amenities and the NAS ranking of natural amenities. However, these two indices are only used as references. They do not affect the actual classification of the different rural economic clusters and only provide an illustration of the available natural and service amenities. Our retail index rates towns and cities on a scale from one to nine by the existence of Wal-Marts, Starbucks, Home Depots, hospitals, and airports. These facilities are weighted so that hospitals are most important and Starbucks and Home

Table 2: Top 25 Rural Service Clusters

Rank	County and State	Major City or Town	Percent Service	Percent Service Without Lesiure	Percent Mining	Percent Recreation	Retail Index (1-9)	Natural Amenity Index (1-7)
1	Butte, ID	Arco	99%	98%	0%	1%	5	4
2	Los Alamos, NM	Los Alamos	98%	93%	0%	4%	6	5
3	Dawson, MT	Glendive	93%	76%	3%	16%	5	3
4	Santa Cruz, AZ	Nogales	90%	76%	1%	14%	8	6
5	Apache, AZ	Eagar	89%	76%	1%	13%	0	5
6	Cibola, NM	Grants	88%	74%	3%	14%	7	5
7	Lewis and Clark, MT	Helena	89%	73%	1%	16%	9	5
8	Custer, MT	Ismay	92%	73%	3%	19%	0	3
9	Valley, MT	Glasgow	88%	73%	3%	15%	5	3
10	San Miguel, NM	Las Vegas	89%	72%	2%	17%	7	5
11	Roosevelt, MT	Wolf Point	91%	72%	2%	19%	5	2
12	Hill, MT	Havre	89%	71%	3%	18%	7	3
13	Otero, NM	Alamogordo	86%	71%	1%	15%	8	5
14	Madison, ID	Rexburg	81%	71%	3%	10%	7	4
15	Silver Bow, MT	Walkerville	88%	71%	3%	17%	0	4
16	Otero, CO	La Junta	83%	71%	4%	13%	7	4
17	Cochise, AZ	Sierra Vista	85%	70%	3%	15%	8	7
18	Rio Arriba, NM	Espanola	84%	68%	2%	16%	7	6
19	Huerfano, CO	Walsenburg	85%	68%	2%	16%	5	6
20	Santa Fe, NM	Santa Fe	87%	68%	1%	20%	9	5
21	Goshen, WY	Torrington	78%	67%	3%	11%	5	4
22	Logan, CO	Sterling	80%	67%	6%	13%	8	4
23	McKinley, NM	Gallup	86%	67%	3%	19%	8	5
24	Alamosa, CO	Alamosa	82%	67%	8%	15%	7	4
25	Twin Falls, ID	Twin Falls	76%	67%	6%	9%	9	4

This table shows the top 25 rural service clusters along with the county and state they are in. Additionally listed is the percentage that their economy is based on service, service without the leisure and hospitality industry, mining, and recreation. For reference the retail index, natural amenity index are also listed.

Source: Calculated by the State of the Rockies from County and Place level Census data and the North American Industry Classification System (NAICS), 2007.

Depots are least important. This index provides a general idea of the availability of retail, health, and transportation services offered by each place. We use the index only as an indicator, however, because many places have strong service economies without the existence of big-box type commercial stores. There are many places in the West that pride themselves on existing without Wal-Marts and Starbucks, alternatively supporting local businesses. Additionally, the NAS rankings provide a number value for the available natural amenities of each county. This will show the typical beauty and natural resource availability for each type of rural economic cluster.

To create a list of rural service clusters we ranked all of the micropolitan and rural counties of the region by the percentage of their economies that is based on the service industry, excluding the leisure and hospitality sector. This created a list of places which have strong service industries that are not largely based on tourism and recreation. We then filtered out the towns with less than 1,000 people working in the service industry. This leaves only places with strong economies and eliminates any small towns that rely solely on one or two restaurants or shops. We then selected the top 50 places as rural service clusters. This leaves a list of 50 places with economies largely built on the service industry, and leaves out places in which service industries are either too small or largely based on recreation.

Rural resource extraction clusters are classified in much the same way as rural service clusters. They are first based on counties with at least a 50 percent service-based economy. This establishes a strong service industry and indicates a well-rounded economy. From that list, the remaining places are ranked by the percentage their economies are based on mining and resource extraction. Again, the top 50 towns with at least 1,000 people working in the mining and resource extraction sector are then classified as rural resource extraction clusters. The minimum of 1,000 people leaves places with fairly strong mining economies, not constituting small mom-and-pop operations. While the classification calls for the top 50 to be identified as resource extraction clusters, the requisite 50 percent economy based on the service sector caused the dependency on mining to run low. We created a cut off at a minimum of ten percent mining economy to represent the places with a significant impact from the industry.

The classification for the rural recreation cluster follows the rural resource extraction classification. These places are defined as having at least 50 percent of industry based on the service sector. We then rank them by the percentage of their economies based on the leisure and hospitality sector. The top 50 places with at least 1,000 people working in the leisure and hospitality field are then classified as rural recreation clusters.

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Table 3: Top 16 Rural Resource Extraction Clusters
note: only 16 resource clusters were identified

Rank	County and State	Major City or Town	Percent Service	Percent Service Without Lesiure	Percent Mining	Percent Recreation	Retail Index (1-9)	Natural Amenity Index (1-7)
1	Yuma, CO	Yuma	57%	48%	35%	10%	5	4
2	Uintah, UT	Vernal	58%	49%	31%	8%	7	5
3	Lea, NM	Hobbs	60%	50%	29%	9%	8	4
4	Humboldt, NV	Winnemucca	61%	41%	28%	19%	7	5
5	Sweetwater, WY	Rock Springs	56%	44%	27%	12%	9	5
6	Jerome, ID	Jerome	51%	46%	27%	6%	7	4
7	Duchesne, UT	Roosevelt	59%	51%	23%	8%	5	5
8	Eddy, NM	Carlsbad	68%	57%	20%	11%	7	6
9	Graham, AZ	Safford	69%	55%	19%	14%	7	6
10	Cassia, ID	Burley	63%	56%	18%	6%	7	4
11	Elko, NV	Elko	77%	41%	14%	36%	9	4
12	Bingham, ID	Blackfoot	56%	48%	13%	8%	7	4
13	Curry, NM	Clovis	76%	63%	12%	13%	7	4
14	Nye, NV	Tonopah	77%	57%	11%	20%	5	6
15	Garfield, CO	Glenwood Springs	67%	53%	11%	14%	8	5
16	Chaves, NM	Roswell	76%	62%	10%	14%	8	5

This table shows the top rural resource extraction clusters along with the county and state they are in. Additionally listed is the percentage that their economy is based on service, service without the leisure and hospitality industry, mining, and recreation. For reference the retail index, natural amenity index are also listed.

Source: Calculated by the State of the Rockies from County and Place level Census data and the North American Industry Classification System (NAICS), 2007.

Table 4: Top 25 Rural Recreation Clusters

Rank	County and State	Major City or Town	Percent Service	Percent Service Without Lesiure	Percent Mining	Percent Recreation	Retail Index (1-9)	Natural Amenity Index (1-7)
1	Madison, MT	Ennis	78%	29%	6%	49%	5	5
2	Summit, CO	Silverthorne	90%	45%	0%	44%	0	7
3	Grand, CO	Granby	81%	38%	2%	43%	2	7
4	Douglas, NV	Gardnerville Ranchos	79%	36%	1%	43%	0	7
5	Teton, WY	Jackson	84%	43%	0%	41%	5	6
6	Grand, UT	Moab	87%	46%	3%	41%	5	4
7	Pitkin, CO	Aspen	90%	53%	0%	38%	6	6
8	Elko, NV	Elko	77%	41%	14%	36%	9	4
9	Eagle,CO	Avon	81%	46%	0%	35%	4	5
10	Valley, ID	Mccall	77%	43%	3%	33%	5	5
11	Gunnison, CO	Gunnison	73%	41%	12%	33%	7	6
12	San Miguel, CO	Telluride	73%	41%	4%	32%	2	6
13	Chaffee, CO	Salida	83%	53%	1%	30%	7	6
14	Taos, NM	Taos	84%	55%	5%	29%	7	5
15	Lincoln, NM	Ruidoso	84%	56%	2%	28%	8	5
16	Park, MT	Livingston	80%	52%	3%	28%	5	5
17	Colfax, NM	Raton	83%	54%	3%	28%	5	5
18	Routt, CO	Steamboat Springs	74%	49%	4%	25%	8	6
19	Blaine, ID	Hailey	75%	51%	2%	24%	3	5
20	Roosevelt, NM	Portales	66%	43%	20%	24%	7	4
21	Wasatch, UT	Midway	74%	51%	2%	23%	0	6
22	Park, WY	Cody	76%	54%	8%	22%	7	5
23	Latah, ID	Moscow	84%	63%	4%	21%	8	4
24	Nye, NV	Tonopah	77%	57%	11%	20%	5	6
25	Santa Fe, NM	Santa Fe	87%	68%	1%	20%	9	5

This table shows the top 25 rural recreation clusters along with the county and state they are in. Additionally listed is the percentage that their economy is based on service, service without the leisure and hospitality industry, mining, and recreation. For reference the retail index, natural amenity index are also listed.
Source: Calculated by the State of the Rockies from County and Place level Census data and the North American Industry Classification System (NAICS), 2007.

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Case Study: Helena, MT

Helena, Montana, is the principal city of Lewis and Clark County and is another example of a rural service cluster. Helena, which had 27,885 residents in 2006, was established as a gold camp during the gold rush and housed 50 millionaires in 1889, per capita more than any other city on earth.[1] The town itself is home to a beautiful mansion district with original period homes, a magnificent cathedral, and the state capitol building. In addition to the town's rich history is it's fondness for the arts. Helena houses a theatre, an acting company, two dance companies, an art museum, and a regional art auction.[2] Helena also ranks very highly on the natural amenities scale, as it is near many lakes and rivers, the continental divide trail, the 1.5 million acre Bob Marshall Wilderness Complex, and located between Glacier and Yellowstone national parks.

With 73 percent of Lewis and Clark County's economy based on services other than leisure and recreation, Helena is town full of retail and service based industry.[3] As the state capital, Helena provides much government-related employment. After government, retail and services such as health and legal services and businesses are the largest employers.[4] The beauty and history of Helena have apparently not gone un-noticed. Lewis and Clark County had a 75 percent increase in the population from 1970 to 2000, higher than the state and national averages.[5] The number of jobs in Lewis and Clark County has increased with the population, providing jobs for newcomers, and boasts an unemployment rate below the state and national averages.[6] Adding to these factors is Helena's desirability as a place to live; Lewis and Clark county shows a very high percentage of people 25 and over with a college education and a low percentage of people 25 and over without a high school diploma.[7] A somewhat high per capita income and average earnings combined with a roughly average rich-to-poor ratio suggest a balanced county where the median family can afford the median house.[8]

When compared to the average rural service cluster, Helena shows a slightly increased dependence on service providing industry and slightly decreased dependence on goods producing industry.[9] While 73 percent of its economy is based on services other than leisure and hospitality, 11 percent is based on goods producing (construction, manufacturing, and resource extraction), and 15.6 percent is based on leisure and hospitality.[10] Construction ranks the highest in the goods producing sector at seven percent, and is a necessary industry for a growing town with historic buildings and old infrastructure.[11] Leisure and hospitality still have a strong influence on the economy and take advantage of the abundant nearby outdoor recreation opportunities and tourism. Helena also earns the highest ranking on the retail service index, indicating the existence of Wal-Marts, Home Depots, Starbucks, hospitals, and airports.[12]

Helena accurately depicts the Rockies region rural service cluster. It is a small city that provides a unified community feel and is drawn together through its history and culture. With an economy largely based on the service sector and plenty of nearby recreational opportunities, Helena accurately depicts a new age Rockies mountain town that provides a small mountain town feel while providing the services that a modern population desires.

Photo from Wikipedia

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Case Study: Las Vegas, NM

Las Vegas, New Mexico is a beautiful little town in San Miguel County that ranks high on the list of rural service clusters. Founded in the 1800's, Las Vegas was first made famous as a town of outlaws.[1] Doc Holliday had an office downtown and Billy the Kid was often seen hanging around.[2] Today Las Vegas' 13,889 residents take pride in their town's history and scenic beauty.[3] There are current projects to revitalize the main street and foster regional art and culture.[4] Las Vegas has many natural amenities, including the Gallinas River that runs through town and many nearby recreational activities such as a National Wildlife Refuge, a box canyon, and the Sangre de Cristo Mountains.[5] With 72 percent of its economy based on services other than leisure and hospitality, Las Vegas supports a strong service industry and has a high retail index, providing a Wal-Mart, hospital, and airport.[6] In San Miguel County, of which Las Vegas is the principal city, the two biggest industries in 2000 were retail trade, which occupied 16 percent of the workforce, and services such as health, business, and legal which occupied 25.8 percent of the workforce.[7] These two industries are only outnumbered by government jobs (San Miguel County has a disproportional amount of government workers compared to the national average).[8] The size of these two industries shows the significance of Las Vegas as a rural service cluster.

Between 1970 and 2005 San Miguel County showed a relatively stable population and employment growth rate that demonstrates an ability to quickly return from recessions.[9] Since 1970, the annual population growth rate of 0.8 percent has been outpaced by the employment growth rate of 2.3 percent, showing that the population gains are welcomed by industry in need of workers.[10] Both employment and population growth rates in San Miguel County have been higher than those of New Mexico and the nation when recovering from the last economic downturn in 2001.[11] While per capita income has increased over $10,000 from 1970 to 2005, it still remains a little low at $22,074 compared to the national average of $34,471.[12] Further, while housing affordability shows that the median-income family can afford the median-priced house, the overall affordability is low when compared to the national averages.[13] These two statistics are understandable in the rural West, in a place far from urban centers and big businesses.

When compared to the other identified rural service clusters, Las Vegas has a greater percentage of its economy based on the service sector, half as much based on mining, and little less than average based on recreation.[14] The data on San Miguel County show Las Vegas to be a perfect example of a rural service cluster. It is a small town with a stable population and employment based on services. It offers shopping and dining options as well as health services for its residents.

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Photo from Wikipedia

Case Study: Jackson, WY

Jackson, Wyoming, is a good example of a rural recreation cluster. Popularly known for its proximity to Yellowstone National Park, the Teton mountain range, and ski resorts, Jackson attracts residents and visitors interested in outdoor recreation. Jackson is the largest town in Teton County and had a population of about 9,215 in 2006.[1] First occupied by trappers and Indians, the Jackson Hole area was later home to cattle ranchers and finally established itself as an outdoor recreation center.[2] Jackson represents both a tourism hotspot and a small community based around the town square.

Jackson has a high natural amenity index value and attracts many outdoor enthusiasts.[3] In addition to its location near two national parks (Yellowstone and Grand Teton) it is home to the National Elk Refuge and lies on the Snake River. Summer activities include rafting, rock climbing, hiking, biking, and exploring, while winter opportunities include downhill and cross-country skiing, snowmobiling, snowshoeing, and wildlife watching. It is no surprise that 40 percent of Teton County's economy is based on leisure and recreation.[4] The rest of the county's industry is largely divided among the construction, trade, and business sectors which together make up another 40 percent of the economy.[5] With Teton County having a growth rate faster than the state and national averages, it is no surprise that a large part of industry is taken up by these three sectors.[6] New residents need places to live, eat, shop, and work and this is additionally reflected by the high employment growth rate which also outpaces both the state and nation.[7]

Though housing affordability and the rich-to-poor ratio are both fairly low for Teton County, Jackson has a highly educated population with an extremely high percentage of adults with a college education and high school diploma.[8] These factors make it an attractive place to live. Statistically speaking, towns with high rates of education tend to grow while towns with low

rates tend to shrink.[9] The quality of life in Jackson is further enhanced by high per capita income and average earnings per job.[10] Jackson does not have a high score on the retail index because it has tried to fend off big boxes and keep its stores local. It still, however, maintains a hospital and regional airport.

Jackson is not simply a resort or ski town; it supports an extensive service industry that is independent of the seasonal changes in tourism many resort towns experience. Jackson typifies a rural recreation cluster because it supports both a tourism industry based on its extensive recreational possibilities and a fully functioning town that offers its residents services and amenities.

2007/08 Rockies Researchers in Jackson, WY

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Case Study: Winnemucca, NV

Rural resource extraction clusters have strong reliance on the mining industry while still supporting a diverse economy. Winnemucca, Nevada, has these features. Located in northern Nevada's Humboldt County, Winnemucca is home to almost 8,000 people.[1] The town was established by President Lincoln's mapmakers in the 1880's and since has been a home to ranchers, farmers, and prospectors.[2] Currently mining companies searching for gold, silver, and other precious metals employ the largest numbers of people in Humboldt County.[3] While the town's economy is largely based on the mining industry, it still remains fairly diverse and largely service oriented with 60 percent of its workforce devoted to the service providing industry.[4] Winnemucca is not the typical boom and bust western mining town whose population flows with the resources being extracted, but instead a small town with a developed history and culture that has enjoyed the fortunate presence of precious metals.

Since 1970, Humboldt County has grown by 10,793 people, representing a 170 percent increase in population.[5] This fast population growth was met by a fast employment growth rate, mostly in the service sector.[6] While mining employs almost 30 percent of the county workforce, 24 percent comes from the trade sector which includes retail trade, utilities, and transportation, and almost 20 percent comes from the leisure and hospitality sector which includes hotels, restaurants, and recreation.[7] Humboldt County enjoys a very low average unemployment rate, an average per capita income, and high average earnings per job.[8] These factors, along with average rates of adults with a high school diploma and college degrees, provides the residents of Humboldt County a high quality of life.[9]

Though the mining industry is a large part of Humboldt County's economy today, Winnemucca has established a diverse economy to last through the decades. A high retail service index indicates the existence of basic amenities; the town also has a hospital, Wal-Mart, and good public school system. Winnemucca's location at the crossroads of I-80 and U.S. Highway 95, daily Amtrak service, and a municipal airport capable of handling up to Boeing 737s provide excellent connection to the rest of the country.[10] Additionally, Winnemucca enjoys a high natural amenities ranking, reflecting its many outdoor recreational activities. The hills and deserts around the town provide plenty of opportunities for hiking, mountain biking, off-roading, and hunting.

Winnemucca embodies the classification of a rural resource extraction cluster. With an economy largely devoted to the mining industry, it still supports a strong service sector with plenty of retail, restaurant, and tourism income.

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Wild and Scenic Rivers

The Importance of Federal River Protection in the Rockies

By Sarah Turner

THE 2009 COLORADO COLLEGE STATE OF THE ROCKIES REPORT CARD

Key Findings:

• Nationwide, 2.3 percent of river miles are protected under the Wild and Scenic Rivers Act.

• 33 States, including Idaho, have state river protection programs similar to the National Wild and Scenic Rivers System.

• The Rockies contains 16 percent of the nation's major dams.

• The Rockies region ranks 4th of 8 census divisions in percentage of river miles designated as Wild and Scenic.

• Among Rockies states, Idaho contains the most river miles designated as Wild and Scenic (562 miles).

About the author: Sarah Turner (Colorado College '09) is a student researcher for the 2008/09 State of the Rockies Project.

Introduction

Water in the western United States is a scarce and precious resource. Receiving an annual average of between 20 and 40 inches of precipitation,[1] most of the eight-state Rockies region is considered to be a semi-arid climate with areas of climatic variability. Due to dry conditions, water is a primary focus of natural resource management and urban planning, and many residents of the region have a vested and growing interest in water issues.[2] Between 2000 and 2008, the population of the Rockies grew by 160%.[3] Daily water withdrawals for public supply also grew, with average per capita daily consumption of 131 gallons by 2004.[4] How to maintain water supplies for growing municipalities without drying up the region's agricultural water rights is, so far, an unanswered question. While municipalities, irrigators, and governments compete for a limited resource, we must also consider the fate of natural waterways and river ecosystems and must find a way to strike a balance between them.

This report looks at the role of river protection in the context of the realities of western water law. The first section of the paper reviews the basics of western water law and instream flows to set the stage for a more detailed look at the National Wild and Scenic Rivers Act and the river protection policies of individual states and agencies. Implementation of these government policies helps to assure that the needs of the natural environment are balanced with society's other water needs.

Western Water Law and Instream Flow

In order to understand the place of, potential for, and challenges facing river protection in the Rockies region, it is important to first understand the basics of existing water law and instream flow. The settling of the western United States by non-Native Americans was possible due largely to the development of water resources.[5] Although people originally settled where water was readily available, improved technology and methods of transporting and storing water soon allowed for development of cities and farms in some of the driest parts of the region.[6] With these changes, a system of water rights developed, known as the prior appropriation doctrine.

This complex doctrine has three main tenets. First, water rights are allocated based on a "first in time, first in right" provision; those holding water rights with an earlier priority date are permitted to fulfill their full allocation before those with junior rights can fulfill any of theirs. The priority date of a water right is historically defined as the date on which the water was first diverted and put to beneficial use. This provision serves to provide certainty to existing water rights holders.

The second primary aspect of the prior appropriation doctrine is commonly known as "use it or lose it." After a certain period of time, if a diverter fails to use their full allocation of water, they can be forced to forfeit a portion or all of that water right.[7] This provision acts as a major disincentive to leave water in the stream from the point of view of the water user.[8]

The third major requirement of the prior appropriation doctrine is beneficial use. Beneficial use is often defined as the basis and limit of any water right;[9] beneficial use dictates what is considered to be appropriate uses of diverted water.[10] Historically, western water law has placed a higher value on commercial, domestic, industrial, and agricultural off-stream diversions.[11] However, over the last few decades, states in the Rockies Region have recognized the importance of maintaining instream flows in the region's rivers and establish

Rio Chama near Abiqui, NM

mechanisms for protecting instream flows. The principle of beneficial use allows for flexibility in the accepted uses of the region's water resources as public values change.

In a region where natural waterways were once thought to exist solely for human consumption, recognizing the importance of instream flows represents a shift in a long-held belief.[12] Instream flow can be defined most simply as the water that remains in the riverbed for the sake of ecosystems and species.[13] An instream flow water right is a non-diversion right to a specific quantity of water, guaranteed within the context of the prior appropriation doctrine to remain in the riverbed. The limitation of using instream flows to maintain ecosystems

and species is that historically no value was recognized for water left in streambeds, and now instream flow rights are primarily junior rights. As a result, instream flows are fulfilled only after senior rights on the waterway have been filled. As water resource management is primarily a state responsibility, each of the eight Rockies states currently has its own instream flow program. Since water laws differ from state to state, state instream flow programs show some variation across the region. For specific information on the instream flow programs in each Rockies state, see Table 1.[14]

The interplay between human water consumption through diversion and instream flows for recreation and ecosystem maintenance is best understood through the lens of water sustainability. The United States Geologic Survey (USGS) defines "water sustainability" as the need to sustain water supplies for present and future generations while striking a balance between consumptive water use and water for ecosystems and species maintenance.[15] To achieve this balance, the needs of consumers and ecosystems must be quantified and identified so that resources can be allocated in accordance with state law.[16] How best to strike this balance is a point of some contention.

River Networks

The United States contains around 456,000 miles of perennial stream and rivers.[17] With an estimated 60,000 large and small dams nationwide,[18] many miles of rivers and streams have been altered and harnessed for consumptive uses. Of the 456,000 miles of perennial waters, the expansive eight-state Rockies region contains around 62,000 miles of streams, or about 13% of the total mileage.[19] In addition to 13% of the nation's perennial waters, the Rockies region also contains 16% of the major dams in the U.S.[20] including Nevada's Hoover Dam, Utah's Glen Canyon Dam, and Colorado's Blue Mesa Dam (See Figure 1).

With the rapid population growth currently taking place in the region, the pressure on natural resources is steadily increasing. Average total water withdrawals in the Rockies since 1990 have remained about constant, having experienced a decrease from the 1980s. What has seen a steady increase is the percentage of the water withdrawals for public supply for consumptive uses. Public supply withdrawals have increased from around 2,800 million gallons a day in 1985 to approximately 4,000 million gallons a day in 2000.[21] Not surprisingly, this trend in public supply withdrawals correlates with increasing population. Although public supply withdrawals represent a relatively small percentage of the total withdrawals in the region (only six percent in 2000), increases in public supply withdrawals is indicative of decreases in withdrawals by other sectors.[22] Rising demand for public supply and demographic projections for further population increases in the region have sparked renewed interest in dam and reservoir construction in certain areas of the region to meet these growing needs. The contention over the proposed NISP (Northern Integrated Supply Project) project on Colorado's Cache la Poudre River is a good example of the public divide between water consumption and waterway preservation.

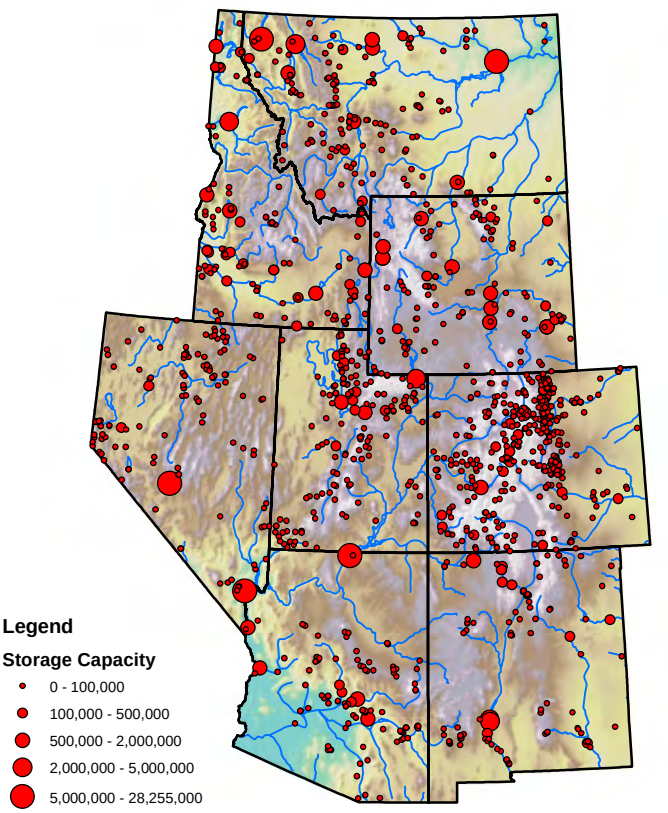
Federal land protections such as Wild and Scenic Rivers and National Parks are designed to protect and preserve those areas of the United States that are considered to possess outstanding values of national importance. Of the 456,000 miles of perennial streams and rivers nationwide, about 10,000 miles, or 2.3%, of these are protected by the federal government under the Wild and Scenic Rivers Act. In other words, 97.7% of these rivers, or about 445,000 miles are not protected under the NWSRS.[23] Of the Rockies region's 62,000 miles of perennial waters, about 1,200 miles or about 2% of the total are afforded protection under the NWSRS. While it may seem like a low percentage of rivers are protected, water resources are predominately a state responsibility so low levels of federal river protection are to be expected (see Figures 2, 3, 4 and Table 2).

Table 1: Instream Flow Program Summary for States in the Rockies Region

State	Ownership	Year	Means of Appropriation	Recognized Beneficial Use
Arizona	Public or Limited Private	1941	New appropriation or transfer	Wildlife, Fish, Recreation
Colorado	Colorado Water Conservation Board	1973	New appropriation or transfer	"to preserve and improve the natural environment to a reasonable degree"
Idaho	Public or Limited Private	1974	New appropriation or transfer	Fish and wildlife habitat, Aquatic life, Recreation, Aesthetic beauty, Navigation, Transportation, Water Quality
Montana	Public or Limited Private	1969	New appropriation or transfer	Fisheries, Water Quality
Nevada	Public or Private	1988	New appropriation or transfer	Wildlife, Recreation
New Mexico	Public or Private	1998	Transfer only	Fish and Wildlife habitat, Recreation
Utah	Divisions of Wildlife Resources and Parks and Recreation	1986	Transfer only	Propagation of fish, Public Recreation, Preservation or Enhancement of the Natural Stream Environment
Wyoming	State of Wyoming	1986	New appropriation or transfer	Only fisheries

Adapted from "Western States Instream Flow Summary" Table in Western States Water Laws: A Summary for the Bureau of Land Management, 2001

Figure 1: Major Dams and Normal Reservoir Storage Capacity



Note: storage capacity is given in volume units of acre-feet.

Source: National Atlas of the United States, USGS, 2006

National Wild and Scenic Rivers System

The passage of the Wild and Scenic Rivers Act of 1968 was an outgrowth of the environmental movement of the 1960's. For decades, dam construction had been seen as a symbol of national progress[24] and thus was largely unquestioned by the American public. As the age of dams reached its apex in the 1950s and 1960s,[25] public sentiment began to shift toward protecting certain of the nation's naturally flowing rivers. In his 1965 State of the Union address, President Johnson called for the creation of a river bill, declaring "We will continue to conserve the water and power for tomorrow's needs with well-planned reservoirs and power dams, but the time has also come to identify and preserve free-flowing stretches of our great rivers before growth and development have made the beauty of the unspoiled waterway a memory."[26]

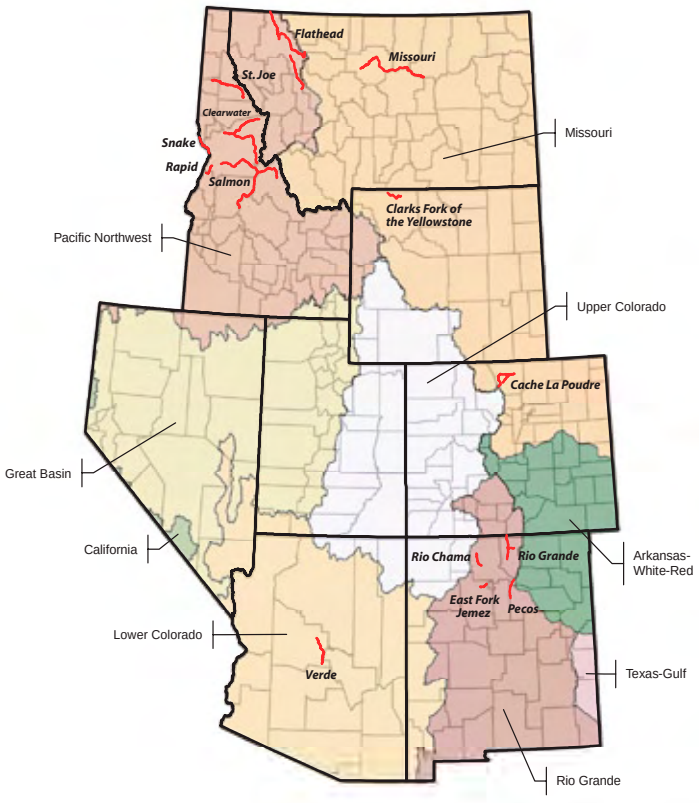
Signed into law on October 2, 1968, the Wild and Scenic Rivers Act declares that the United States will protect, for current and future generations, select rivers with "outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, and other similar values" in free-flowing condition.[27] "Other similar values" can include botanical, hydrological, paleontological, scientific, or heritage values.[28] Designating 12 rivers and tributaries into the National Wild and Scenic Rivers System (NWSRS) at the time of its passage, the Act addresses and outlines all aspects of the NWSRS, including eligibility criteria for inclusion in the system, the addition of components to the system, and the management of designated segments and the protection afforded to them.

Eligibility and Suitability

To be eligible for inclusion in the NWSRS, rivers and river segments must meet certain criteria. First, the river or segment must be free-flowing, which is defined in the Act as "existing or flowing in a natural condition without impoundment, diversion, straightening, rip-rapping, or other modifications of the waterway."[29] Second, the river or segment must possess one or more of the outstandingly remarkable values (ORVs) listed above or in Table 3.[30] Once a river or river segment is deemed eligible for designation, a determination of suitability is undertaken.

The suitability determination asks the following question: "Even if the stream is good enough to be a national river, is it in the public interest to designate it?"[31] Typically, determining the suitability of a particular river or segment takes several factors into account, including the status of land ownership along the river, the presence of minerals, the existing uses of the river corridor, the potential uses of the adjacent lands and the river, the federal, state, local, tribal, public, and other interests, the cost of properly administering the designated segment, the ability of the agency to manage the river area, and the historical or existing water and land rights.[32] Any river or river segment in free-flowing condition that possesses one or more outstanding values is a potential candidate for

Figure 2: Wild and Scenic Rivers by River Basin



Source: U.S. Fish and Wildlife Service, 2008; National Atlas of the United States, USGS, 2006

Table 2: Wild and Scenic River Summary by Rockies State

State	Reaches of Wild and Scenic Rivers	Miles of Wild and Scenic Rivers	Total Perennial Stream Miles	Percent Wild and Scenic by River Miles
Arizona	1	69	1,928	3.6%
Colorado	3	76	10,802	0.7%
Idaho	11	562	9,008	6.2%
Montana	5	384	14,409	2.7%
Nevada	0	0	4,213	0.0%
New Mexico	6	133	3,569	3.7%
Utah	0	0	6,734	0.0%
Wyoming	1	32	11,189	0.3%

Source: Calculated from GIS data provided by the U. S. Fish and Wildlife Service, 2008; and the National Atlas of the United States, USGS, 2006

designation as a wild and scenic river.

The Nationwide Rivers Inventory (NRI), maintained by the National Park Service in partial fulfillment of Section 5(d) of the Wild and Scenic Rivers Act, lists free-flowing river segments possessing one or more ORV (See Figure 5 and Table 4). Inclusion in the NRI does not guarantee a river either eligibility or inclusion in the NWSRS; the inventory simply acts as "a register of river segments that potentially qualify as national wild, scenic, or recreational river areas."[33] Other potential NWSRS candidates are identified by federal agencies during planning for use and development of water and associated land resources.[34] It is through these two avenues that potential additions to the NWSRS are identified.

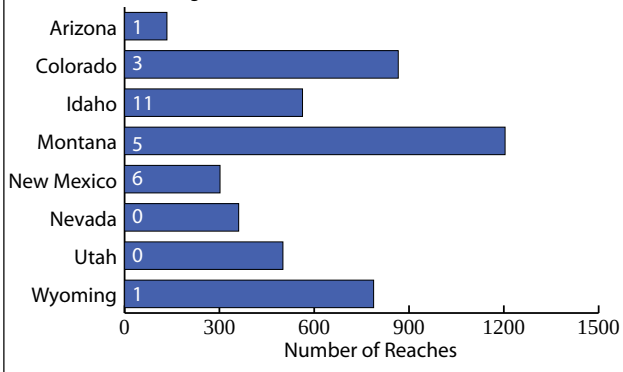
River Study Process

Most rivers added to the NWSRS first undergo a study process by one or more federal administering agencies such as the National Park Service, National Forest Service, or the Bureau of Land Management. Rivers are identified for study by one of two methods. The first is by a Congressional authorization initiated at the request of local residents, river conservation organizations, user groups, or an individual Congressional delegate having an interest in a particular river.[35] Congress identifies the agency responsible for conducting the study and may provide direction for the study's scope.[36] The second way to identify a river for study is through the regular land use planning processes of federal agencies.[37]

Studies of congressionally identified rivers typically take several years to complete. Before the study begins, Congress convenes an interdisciplinary study team, composed of members of federal agencies and contracted personnel, which is responsible for conducting the study.[38] While this study team leads the research, input from the public and interest groups is vital to the study process.[39] The team then identifies and assesses the qualities and resources of the particular river segment, eventually determining the river's eligibility.[40] The study process for agency-identified rivers is similar in many ways to the congressional identification process. The agency process also employs an interdisciplinary study team of specialists and typically takes from two to five years to complete.[41] Determinations of eligibility and suitability by a federal agency are reviewed during the regular land planning process of that agency, which typically occurs every 10 to 15 years.[42]

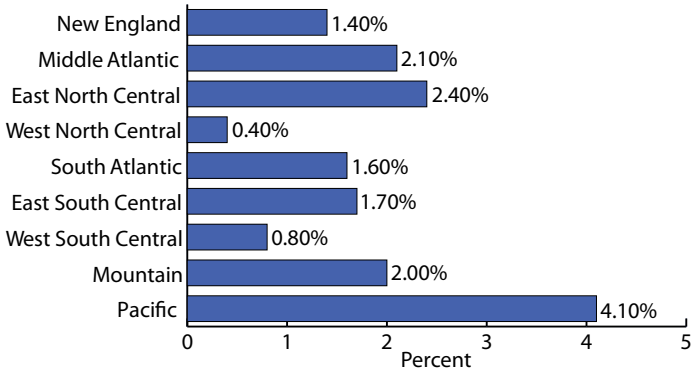
The river study process is designed to identify and evaluate the eligibility, classification, and suitability of the river in question. As discussed in a previous section, to be eligible for inclusion in the NWSRS, a river must be free flowing and must possess one or more ORV (Outstandingly Remarkable Values). Determination of free-flowing condition is based on the river's hydrology, including the

Figure 3:
Number of Stream Reaches, Total (bars, blue)
and Number Designated Wild and Scenic (number, white)



Source: calculated from GIS data provided by the U. S. Fish and Wildlife Service, 2008; and the National Atlas of the United States, USGS, 2006

Figure 4:
Wild and Scenic Percent of River Miles by Census Division



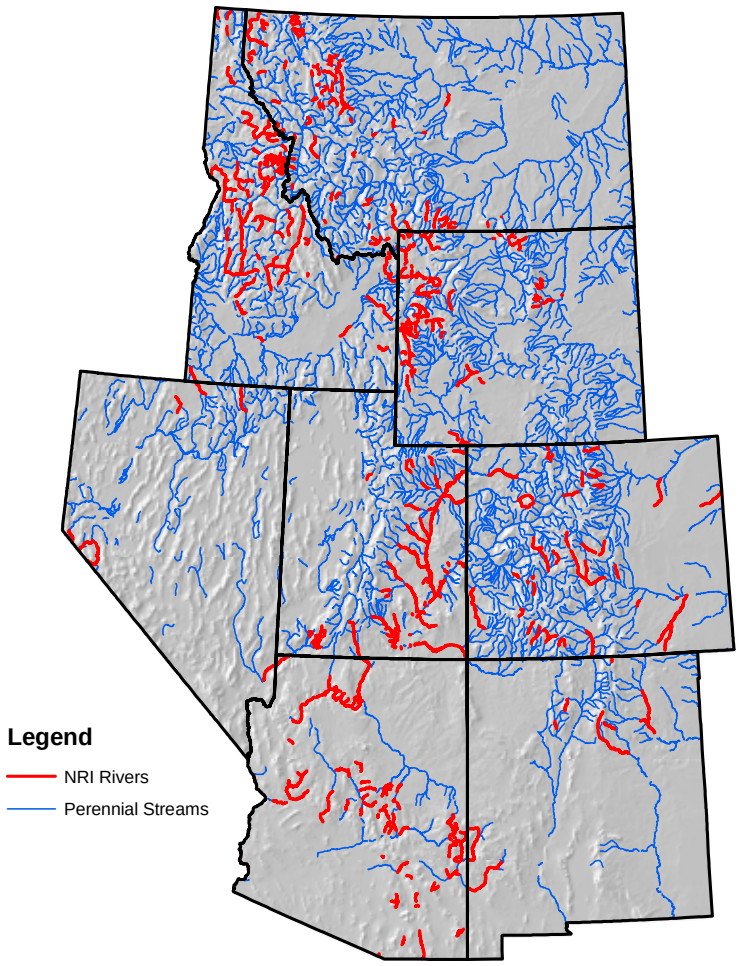
Source: calculated from GIS data provided by the U. S. Fish and Wildlife Service, 2008; and the National Atlas of the United States, USGS, 2006

presence and effects of any human-made alterations to the river's natural course.[43] After determining the free-flowing status, several methods can be used to determine whether a particular river's values and resources are unique, rare, or exemplary enough to be considered "outstandingly remarkable."[44]

Determining what is remarkable on a comparative national and regional scale is based on objective, scientific analysis by the study team.[45] Although the potential resource spectrum of ORVs is broad, the values must be river related; they must be located in the river or along its banks, contribute substantially to the functioning of the river ecosystem, and owe their existence to the presence of the river.[46] For each value constituting eligibility for the NWSRS, minimum thresholds for each relevant value must be met for the values to be considered outstandingly remarkable (See Table 3).[47] The final step is to determine the suitability of the segment in question. To do so, the study team considers many environmental and social factors not considered in the eligibility study.[48] While guidelines for determining suitability exist, suitability is more influenced by the unique values and characteristics of a particular river.[49]

After a river is determined to be both eligible and suitable for inclusion in the NWSRS, the next step is to recommend the river segment for designation. For congressionally identified river studies, a formal Wild and Scenic River Study Report serves as a formal recommendation for designation.[50] The formal study report must comply with the provisions of the National Environmental Policy Act (NEPA) by including an impact analysis of wild and scenic designation as well as alternatives for protection.[51] Following a 90-day comment period from federal officials, the final study report is submitted to Congress, at which point Congress must decide whether or not to designate the river.[52] For agency-identified study rivers, the recommendation for designation appears in an Environmental Impact Statement's Record of Decision, after which there is a 90-day public comment period. Once this comment period is over and the agency makes the necessary responses or changes to the proposal, the administering agency may submit the proposal to Congress for review.[53]

Figure 5: Rivers Designated Within the Nationwide Rivers Inventory



Source: U.S. Department of the Interior, 1997

Congressionally identified and agency-identified study rivers are afforded different levels of protection during the study period. Under the Wild and Scenic Rivers Act, congressionally authorized study rivers are protected from the following: the licensing and construction of water resource projects that could adversely affect the river, the sale of public land within one-quarter mile of the river corridor, and mineral leasing.[54] These protections last throughout the study process and then for three years following the submission of the final study report to Congress. Unless a

Table 3: Minimum Requirements for Outstanding Recreational Values (ORVs)

Value	Minimum Requirements
Scenery	Landscape elements of landform, vegetation, water, color and related factors result in notable or exemplary visual features or attractions
Recreation	Recreation is or has the potential to be popular enough to attract visitors from throughout or beyond the region or are rare within the region. Could include sightseeing, wildlife observation, camping, photography, hiking, fishing, hunting, and boating.
Geology	The river area must contain one or more example of a geologic feature, process, or phenomenon that is unique or rare within the region
Fish	May be judged on the merits of population, habitat, or a combination.
Wildlife	May be judged on the merits of either terrestrial or aquatic wildlife populations, habitat, or a combination
Prehistory	The river corridor must contain a site where there is evidence of occupation or use by Native Americans
History	The river corridor contains a site or feature associated with a significant event, person or cultural activity of the past that was a rare one of a kind in the region. Typically 50 years or older.
Other Values	May include additional river-related values including hydrology, paleontology, and botany resources.

Source: Adapted from information in The Wild and Scenic River Study Process, p.13 – 15, 1999.

Table 4: Nationwide River Inventory Category Mileage										
	State	Scenic	Wildlife	Fish	Recreational	Geologic	Cultural	Historic	Other	Total
Miles	Arizona	1,264	1,167	1,042	911	690	562	449	561	6,645
	Colorado	2,176	1,527	1,593	1,622	1,530	771	533	350	10,102
	Idaho	1,250	892	1,605	1,033	923	8	178	576	6,465
	Montana	655	95	541	535	290	174	130	45	2,465
	Nevada	186	35	128	124	62	56	0	62	654
	New Mexico	465	249	337	375	238	195	241	85	2,185
	Utah	1,482	1,030	716	1,345	1,204	669	94	154	6,695
	Wyoming	955	796	415	762	498	130	539	286	4,382
Percent	Arizona	19%	18%	16%	14%	10%	9%	7%	8%	100%
	Colorado	22%	15%	16%	16%	15%	8%	5%	4%	100%
	Idaho	19%	14%	25%	16%	14%	0%	3%	9%	100%
	Montana	27%	4%	22%	22%	12%	7%	5%	2%	100%
	Nevada	28%	5%	20%	19%	10%	9%	0%	10%	100%
	New Mexico	21%	11%	15%	17%	11%	9%	11%	4%	100%
	Utah	22%	15%	11%	20%	18%	10%	1%	2%	100%
	Wyoming	22%	18%	10%	17%	11%	3%	12%	7%	100%

Source: U. S. Department of the Interior, 1997

river is added to the NWSRS, usually by a formal vote of Congress, after those three years the river is removed from federal protection.[55] Agency-identified study rivers are not protected during the study process, but may instead be temporarily protected by the administering federal agency.[56]

Addition to the NWSRS

After the river study process is complete and a river segment is determined both eligible and suitable for designation as a wild and scenic river, there are two ways it can be added to the NWSRS. The first and most common way is by an act of Congress. By this method, a federal agency submits to Congress a proposal recommending the designation of a particular river under the NWSRS. Congress reviews the necessary study reports and environmental assessments and either designates or turns down the segment's designation.

Once designated, Congress places management of a river segment under the federal agency that owns and manages its shorelines.[57] The federal agencies most commonly charged with management of wild and scenic rivers are the U.S. Forest Service, the National Park Service, the Bureau of Land Management, and the U.S. Fish and Wildlife Service. The second, and much less commonly employed method of adding rivers to the system, is designation by the Secretary of the Interior at the request of a state. Under this method, the governor or governors of a state or states through which a river passes may submit a proposal to the National Park Service recommending the river's designation. A river must meet three requirements to be designated in this manner. First, the river must already be protected under the state's river protection program. Second, the river must meet the eligibility criteria set forth in the WSR Act. Lastly, the state, or a political subdivision of the state, must be able to bear the cost and management requirements of adequately protecting the segment.[58] Management of these segments falls totally on the state except where federally owned public lands are involved.[59] To date, only 18 river segments, representing 12% of the NWSRS, have been designated in this way.[60]

Classification

Every river designated under the NWSRS must be classified by Congress or the Secretary of the Interior in one of three categories; wild, scenic, or recreational.[61] These classifications are based on the degree of access along each section and the amount of existing development within the river area[62] and therefore do not reflect the outstanding values for which each segment was designated. For instance, a river classified as *recreational* does not necessarily possess outstanding recreational opportunities. *Wild* rivers are considered to be "vestiges of primitive America" that are free of impoundments, accessible only by trail, with essentially primitive watersheds and shorelines, and unpolluted waters.[63] *Scenic* rivers are those sections that are free of impoundments, with shorelines and watersheds largely undeveloped, and accessible in some places by road.[64] *Recreational* rivers are easily accessible by road or railroad, have some development along their shorelines, and may have had some past impoundment or diversion.[65] Classification as wild, scenic, or recreational defines the appropriate level of future development and guides management plans to maintain the conditions for which the river was designated.[66]

Management

Upon designation of a river segment, the federal agency responsible for managing the segment has three years from the date of designation to devise and implement a comprehensive management plan (CMP).[67] The management plan must provide protection of the values for which the segment was designated and should address the following issues: "resource protection, development of lands and facilities, user capacities, and other management practices necessary or desirable to achieve the purpose of this Act."[68] As mentioned in the previous section, classification of a river as wild, scenic, or recreational helps guide the administering agency in their management.

The Wild and Scenic Rivers Act declares that components of the NWSRS shall be managed "in such

Case Study: The Cache la Poudre River

Northern Colorado's Cache la Poudre River leads a double life. The first 76 miles of the river from its source in the mountains of Rocky Mountain National Park is protected in its free-flowing condition as Colorado's only Wild and Scenic River. Once the river exits Poudre Canyon, however, it takes on new meaning. The lower 45 miles of the river (all but seven miles are outside the Poudre Canyon) are designated as a National Heritage Area, the first of such designations west of the Mississippi. This designation recognizes the lower Cache Poudre as the "best example of a working river in the western United States" as it has historically met the many water needs of the area including agriculture, municipal, industry, power, and recreation.


© Save the Poudre

The designation of a segment of the Cache in 1986 as Wild and Scenic brought with it specifications and definitions for where future water projects could be located along the Poudre River. By prohibiting future water development of the upper Cache la Poudre, this designation ensured the protection, forever, of these first 76 miles. At the same time, however, it left open the lower Cache la Poudre to further water resource development and diversions.

This nationally and regionally significant river is now the center of a heated debate over whether or not a new water resource project should be constructed just below the Poudre Canyon. Headed by the Northern Colorado Water Conservancy District (NCWCD), the proposed project is known as the Northern Integrated Supply Project, or NISP. NISP is important for meeting the municipal and industrial water needs of 15 northern Colorado communities. With the construction of NISP, NCWCD plans to provide 40,000 acre-feet of water annually to meet growing municipal water needs. To do this, the NCWCD proposes to build 170,000 acre-foot Glade Reservoir and to use an existing diversion point near the mouth of Poudre Canyon to divert water out of the river and pump it into Glade Reservoir. The projected cost of the entire project is $426 million that will be split between the 15 participant communities and water districts. With a priority date of 1980, the reservoir will only be filled during wet years once senior water rights have been met.

On the other side of this debate are those who do not want to see the project carried through due to the fear that flows on the lower stretch of the Cache, which makes its way through several towns including Fort Collins, will be diminished. Several environmental advocacy groups have joined together in the Save the Poudre Coalition to rally against the construction of the proposed project.

This is the sort of debate facing the Rocky mountain region in the years to come. Only time will tell whether new water supply projects that meet human needs while protecting the environment can be built, and whatever happens, whether the National Heritage segment of the river will continue to live up to its name as an excellent example of a working river.

[1] Cache la Poudre National Heritage Area. http://www.fortnet.org/PRHerCor/index.htm. Accessed January 29, 2009.
[2] "Glade Reservoir/Poudre River Panel Discussion," Online Video, April 7 2008. http://atlas.fcgov.com/GladeReservoirForum/msh.htm. Accessed January 29, 2009.
[3] *Ibid.*
[4] *Ibid.*
[5] "NCWCD Feature Projects," Northern Colorado Water Conservation District. http://www.ncwcd.org/. Accessed January 29, 2009.
[6] "Northern Integrated Supply Project," Northern Colorado Water Conservation District. http://www.gladereservoir.org/most-economical.aspx. Accessed January 29, 2009.
[7] "Glade Reservoir/Poudre River Panel Discussion," Online Video, April 7 2008. http://atlas.fcgov.com/GladeReservoirForum/msh.htm. Accessed January 29, 2009.

manner as to protect and enhance the values which caused (them) to be included in said system without limiting other uses that do not substantially interfere with public use and enjoyment of these values."[69] As noted in the section *Additions to the NWSRS,* the four federal agencies charged with administration of wild and scenic rivers are the Bureau of Land Management (BLM), the National Park Service (NPS), the National Forest Service (NFS), and the Fish and Wildlife Service (FWS).[70] In some cases, two or more agencies may manage land along the river corridor of a designated river. When this is the case, the two agencies split the management of the segment. An example of this in the Rockies occurs on the Cache la Poudre River in northern Colorado. The designated segment (a total of 76 river miles) courses through both Rocky Mountain National Park and Roosevelt National Forest, placing administration of these segments in the hands of the National Park Service and the U.S. Forest Service, respectively. Management of designated rivers deals with recreation and uses of the waterway as well as land uses in the surrounding area.

The past few decades have seen an overall increase in river recreation.[71] Although no known studies have linked river designation as wild and scenic with increased

Case Study: Wild and Scenic Suitability of Rivers in Utah's National Forests

Utah does not currently have any rivers or river segments included in the National Wild and Scenic Rivers System (NWSRS). The U.S. Forest Service is in the process of conducting suitability studies to determine which of Utah's rivers should be recommended to Congress for inclusion in the NWSRS.

Over the past decade, as part of their regular land and resource management plans, the Forest Service has identified 86 eligible river segments in Utah's Ashley, Dixie, Fishlake, Manti-La Sal, and Wasatch-Cache national forests. The Forest Service released a Draft Environmental Impact Statement (DEIS) for Wild and Scenic Rivers Suitability in December 2007, exploring the environmental and social impacts of designating these river segments and presenting alternatives to this form of designation. Encouraging public involvement in the suitability studies and potential recommendations, the Forest Service has held 17 public meetings in Utah, including two meetings in Wyoming and Colorado, and provided a public comment period that extended through February 15, 2008. The final decision recommendation on inclusion in the NWSRS had an expected release date in the fall or winter of 2008 for those segments meeting the suitability requirements. Several environmental and interest groups, including American Whitewater and Utah Rivers Council, are rallying public support for river protection.

The Green River

[1] Kevin Colburn, "Support Wild and Scenic Rivers in Utah," American Whitewater. http://www.americanwhitewater.org/content/Article_view_articleid_29925_display_full. (Accessed August 11, 2008).
[2] United States Department of Agriculture, Forest Service. Draft Environmental Impact Statement: Wild and Scenic River Suitability Study for National Forest System Lands in Utah, Catherine Kahlow. November 2007.
[3] U.S. Forest Service. News Release: Forest Service Releases Draft Environmental Impact Statement for Wild and Scenic River Suitability. December 7, 2007.
[4] United States Department of Agriculture, Forest Service. Draft Environmental Impact Statement: Wild and Scenic River Suitability Study for National Forest System Lands in Utah, Catherine Kahlow. November 2007.
[5] United States Department of Agriculture, Forest Service. Draft Environmental Impact Statement: Wild and Scenic River Suitability Study for National Forest System Lands in Utah, Catherine Kahlow. November 2007.
[6] U.S. Forest Service Intermountain Region, "Wild and Scenic River Suitability Study for National Forest System Lands in Utah; Basic Project Timeline," U.S. Forest Service, http://www.fs.fed.us/r4/rivers/timeline.shtml (Accessed August 11, 2008).

recreational use,[72] recreation on designated rivers is an important focus of their management. Typically, access, natural attributes, and availability of services are the factors that most influence recreation on the nation's waterways.[73] Designation in the NWSRS does not automatically limit recreational uses of waterways, unless limitations or permits on public use are necessary to protect resource values.[74] Beyond regulating use, recreation management on designated rivers must also address the need for and maintenance of facilities such as campsites, restrooms, access ramps, and garbage disposal.[75] Except where other federal or state restrictions apply (such as hunting restrictions in national parks), hunting and fishing on designated rivers remain under state jurisdiction.[76]

The major land use issues addressed by wild and scenic river CMPs are mining, grazing, agriculture, logging, and private land development, with management guided by the classification as wild, scenic, or recreational, and the special attributes of particular segments.[77] In general, current uses of the river and adjacent lands are permitted to continue.[78] Uses clearly threatening to the values of the river area are addressed and regulated through the CMP on a case-by-case, river-by-river basis.[79]

The Wild and Scenic Rivers Act does, however, regulate activities that have the potential to have adverse effects on the river condition and values. One land use issue specifically addressed in the Act is mining and mineral development on public lands.[80] Regulating mining throughout the NWSRS provides safeguards against water pollution and impairment of scenic values.[81] Any mining lease or permit issued or renewed after the date of designation of a particular river segment is subject to conditions set by the Secretary of the Interior or the Secretary of Agriculture. Only segments classified as *wild* have extended protection from mining; the river bed, bank, and land within one-quarter mile of the bank are removed from mineral leasing.[82]

For land uses that may not necessarily have adverse affects on designated rivers, the Wild and Scenic Rivers Act typically allows continued use of existing activities. The Act specifically addresses land uses such as logging, grazing, agriculture, and private land development within the river corridor and lands adjacent to designated segments and may limit activities that would adversely affect the river values. Designation usually has little to no effect on either timber harvesting or logging within a river corridor, beyond the restrictions necessary to protect ORVs. Similarly, existing agricultural and livestock grazing practices are usually unaffected.[83]

In certain cases, private lands may also lie within the corridor of potential wild and scenic segments. Many private landowners fear condemnation of their land by the federal government if the segment is designated under

the NWSRS. The Act, however, neither gives nor implies government control of private land within the designated corridor.[84] Private land owners within the river corridor can use their property as they did before designation, and there is no effect on their property rights.[85] In cases where proposed development on private lands within the river corridor will adversely affect the river values, the government may enter into easements with the landowners to prevent harmful development while leaving the title of the land to the existing owner. In general, despite land owner fears concerning designation of certain river segments, the rights of land owners do not change and future development on private lands is dictated by the classification of each segment.

One of the major protections afforded to designated rivers is protection from federally funded and licensed water resource development projects. The Act prohibits the Federal Energy Regulatory Commission (FERC) from licensing the construction of dams, water conduits, reservoirs, powerhouses, transmission lines, or other projects on any designated component of the NWSRS or in any areas that would directly affect designated segments.[86] The Act also prohibits any federal agency from assisting through loans or licenses any water resource project that would have adverse effects on the values for which the river was designated.[87] This provision protects the free-flowing nature of wild and scenic rivers and is sometimes viewed as the main impetus for designation. However strong, this provision has one serious limitation; it does not prohibit the construction of water resource projects above or below the designated segment so long as the project in question does not "unreasonably" diminish the values present on the date of designation.[88] Here, the Wild and Scenic Rivers Act fails to recognize the importance of ecosystem management by ignoring that stream flows, water quality, and fish habitat are affected by activities above and below the designated segments.[89]

Verde River, Coconino National Forest, Photo from the U.S. Forest Service

Federal Reserved Water Rights Doctrine

Under the federal reserved water rights doctrine (FWRRD) when the federal government reserves public lands for national parks, monuments, or forests, it implicitly reserves a sufficient amount of water to satisfy the purposes for which they were created.[90] The FWRRD is analogous to the water rights doctrine, called the Winters Doctrine, applicable to Indian reservations. Under the Winters Doctrine when an Indian reservation was established by treaty, the tribe reserved water rights sufficient to achieve the purposes of the reservation. The Supreme Court has interpreted the FWRRD narrowly. Presently, federal reserved water rights may only include "quantities of water necessary to meet the primary purposes for which the national park or national forest was established and only in the minimum amounts necessary to meet those purposes."[91] Though restricted by these provisions, the date of priority for federal reserved rights is the date the land reservation was established, giving federal reserved rights senior priority dates when compared with the majority of water rights adjudicated by state law.[92] In the case of wild and scenic rivers, the Wild and Scenic Rivers Act implicitly creates a reserved water right to meet the purposes of the Act: preservation of free-flowing condition and outstanding river values.[93] Although the federal reserved rights for components of the NWSRS have priority dates as of the date of designation into the system, to claim those rights, the administering agency must first identify the amount of water necessary to meet the purposes of the Act, and then must codify that right through the state water rights adjudication system.[94] Often other water rights holders object to the amount claimed for the preservation of designated stretches.[95] Although reserved water rights are attached to each designated stream segment, the right is not always claimed if other flow protections exist, such as state instream flow programs or existing reserved rights on national forest lands.[96]

State River Protection Programs

In addition to the NWSRS, several Rockies states have their own programs to designate state rivers and streams for outstanding qualities. These systems of designation provide varying levels of protection on the state and local levels (see Table 5).

Thirty-three states have state river protection programs modeled after the NWSRS. Idaho is the only state in the Rockies Region with such a program. In the Idaho State Water Plan, the Idaho Board of Water Resources has the authority to designate and protect rivers within the state[97] as "natural" or "recreational" waters. The difference in designation is based on the amount of existing development within the river corridor. "Natural" rivers are free of substantial human-made development in the waterway and the riparian area is largely undeveloped. "Recreational" rivers may have a certain level of development in the waterway and riparian area. Designation prohibits the construction of water resource projects or alterations to the streambed that would compromise the values for which the waterway was designated.[98] The benefit of this program, when compared with the NWSRS, is that Idaho's program protects its rivers while leaving control of those rivers to the state government. As of 1996, 1,700 miles of Idaho's rivers had been protected under this system,[99] more than the total miles of rivers protected as wild and scenic in the entire Rockies Region.

While no other Rockies state has a river protection program similar to Idaho's, several Rockies states have programs that designate and may provide protection to rivers and streams based on their outstanding values. Colorado, Utah, Montana, and Wyoming each have state programs that designate rivers based on fish habitat or population. Colorado's Division of Wildlife has two levels of classification: Wild Trout waters and Gold Medal waters. Wild Trout waters provide habitat for wild trout populations and have primary management objectives to sustain that population. Gold Medal waters are those consistently producing a minimum trout standing stock of 60 pounds per acre and a minimum of 12 quality trout per acre where a quality trout is defined as any trout 14 inches or longer in length.[100]

Utah's Blue Ribbon Fisheries program is similar in that it recognizes waters that support viable fish populations and can withstand pressure from angling.[101] In Montana, Montana Fish, Wildlife and Parks designates Blue and Red Ribbon Streams based on the condition of fisheries, habitat, the presence of native or non-native fish, and the present use of the river segment.[102] This classification system was designed to help communicate the relative importance of Montana's various waterways.[103] Designation under Montana's system does not change the management of rivers but raises awareness and draws attention to the condition of important rivers.[104] Wyoming also has a blue ribbon trout stream program. Designation and classification under this system is based solely on the density (pounds per mile) of sport fish, or those fish most sought out by anglers. Tiers of designation in this program are based on the pounds of sport fish per mile. Once classified, the waters are managed to sustain angling quality, which plays out differently on each river or stream.[105]

As mentioned in the Management section, private land holdings within a proposed river corridor often prevent the designation of the segment as wild and scenic due to private land owner fears of land condemnation. So although designation under the NWSRS may provide

Case Study: The Snake River Headwaters


The Snake River and Mt. Moran

The Snake River Headwaters in northwest Wyoming contains some of the purest waters and largest cutthroat trout populations remaining in the lower 48 states. Several years ago, a number of groups interested in protecting the rivers and streams of this watershed came together to create the Campaign for the Snake Headwaters. Backed by Idaho Senator Craig Thomas, the Snake Headwaters Legacy Act of 2007 was submitted to Congress, petitioning the federal government to designate 23 distinct stream segments on 13 rivers and streams encompassing approximately 388 river miles as Wild and Scenic rivers.[1] The rivers of this watershed, in addition to having high water quality, provide vital habitat for a large array of wildlife species, including bald eagle, osprey, moose, elk, deer, grizzly bears, wolves, Wyoming's largest population of river otters, and over 150 species of birds.[2] What makes this Wild and Scenic nomination unique is that it includes an entire watershed, instead of just one river or stream segment.[3] Since submission to Congress on May 3, 2007, however, there has been no progress on designating the Snake Headwaters as wild and scenic. Recently, the Snake Headwaters Legacy Act has been folded into New Mexico Senator Jeff Bingaman's Omnibus Public Lands Management Act of 2008, with the hope that this will facilitate its passage through the Senate.[4] Though members of the Greater Yellowstone Coalition (GYC) were optimistic that the bill would pass before the closing of the Congressional session in November 2008, it was not reviewed and will now have to wait for Congress to reconvene in January 2009 to be decided.

[1] Bosse, Scott, Email correspondence with author, 7/28/2008.
[2] Campaign for the Snake Headwaters, Informational pamphlet (also available online: www.snakeheadwaters.org).
[3] McNamara, Amy, State of the Rockies Interview, 7/2008.
[4] Bosse, Scott, 7/28/08.

a greater level of protection than state and local programs, because of these controversies, state programs play a vital role in the greater system of river and stream protection.

Table 5: State River Programs

State	Responsible Agency	Program
Arizona	None	None
Colorado	Colorado Division of Wildlife	Gold Medal and Wild Trout fishing streams
Idaho	Idaho Department of Water Resources	Natural and Recreational Rivers
Montana	Montana Fish, Wildlife & Parks	Blue and Red Ribbon Streams
Nevada	None	None
New Mexico	None	None
Utah	Utah Division of Wildlife Resources	Blue Ribbon Fisheries
Wyoming	Wyoming Game and Fish	Blue Ribbon Trout Streams

Source: Compiled by the State of the Rockies Project, 2008

Designation by Nongovernmental Organizations

In addition to individual state programs, a number of national and regional nongovernmental organizations have programs that aim to raise awareness of unique waters and work to protect them. Among the many groups and agencies interested in water issues in the Rockies, some of the major groups are American Rivers, the Greater Yellowstone Coalition, and Trout Unlimited.

American Rivers is a national organization based in Washington D.C. that works to protect rivers and maintain healthy river ecosystems nationwide. American Rivers has four major campaigns that address different aspects of river protection: Healthy Waters, Water for Life, River Renewal, and River Heritage.[106] The campaign most relevant to the topic of this report is the River Heritage campaign, which works towards protecting the nation's remaining segments of free-flowing rivers through the wild and scenic designation.[107] The organization is currently promoting the "40x40 Challenge" to designate 40 rivers as wild and scenic in celebration of the system's 40th anniversary on October 2, 2008. While this initiative is taking place nationwide, American Rivers is backing wild and scenic designation for two important Rockies waterways: the Snake headwaters of Wyoming and Fossil Creek in Arizona.

In addition to promoting river protection through wild and scenic designation, every year since 1986 American Rivers has released a report on America's most endangered rivers to highlight near-term threats, such as proposed water diversions, power plants, or other harmful actions. In the 2008 edition of the report, two rivers in the Rockies were listed in the top ten most endangered rivers in the nation. The Cache la Poudre River in Colorado was listed as the third most endangered due to a proposed water diversion and reservoir project. The Gila River in New Mexico, also threatened by a water development project, was listed as the seventh most endangered river.[108] The endangered rivers report aims to raise awareness of river-related issues with the hope of promoting public action.

Trout Unlimited's goal is to "conserve, protect, and restore North America's cold water fisheries and their watersheds."[109] Operating nationally, Trout Unlimited has focused on the Rockies region through a Western Water Project (WWP) since 1998. Through the WWP, Trout Unlimited is committed to working at the state level on water management issues with the ultimate goal of protecting and restoring western fisheries.[110] The WWP has branches operating in five Rockies states: Colorado, Idaho, Montana, Utah, and Wyoming. The main goals of the WWP are to build political alliances with groups that favor healthy stream flows, restore stream flows in key river basins to maintain sustainable coldwater fisheries, and defend instream flows.[111] Trout Unlimited's WWP has had several successes in these states including aiding in negotiations over instream flow rights for the Gunnison River through the Black Canyon of Gunnison National Park in Colorado, working with irrigators in Idaho to obtain a first donation of water rights for instream flow protection, and negotiating the removal of a dam on Utah's American Fork River.[112]

The Greater Yellowstone Coalition (GYC) is a regional organization concerned with the protection of the Greater Yellowstone ecosystem. The Greater Yellowstone ecosystem covers 18 million acres and spans portions of Idaho, Wyoming, and Montana. The branch of the GYC concerned with rivers is called Wild Rivers and Wild Fish. This program has four areas of focus: saving wild rivers under the Wild and Scenic Rivers Act, protecting native and wild trout fisheries, maintaining vital connections between rivers and their floodplains, and preserving clean water.[113] Under this program, the GYC is currently involved in the Snake Headwaters Campaign, advocating for several hundred miles of the rivers and streams in the Snake River drainage to be designated and protected under the Wild and Scenic Rivers Act.[114]

Conclusion

As the Rocky Mountain Region faces continued population growth and increasing demand for municipal water supplies, a balance will have to be found between water consumption and river protection. This report explores several avenues of river value protection, focusing

on the National Wild and Scenic Rivers System as one of the highest levels of protection that can be afforded to a river or stream.

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[5] Tim Palmer, *Endangered Rivers and the Conservation Movement Second Edition* (New York: Rowman & Littlefield Publishers, Inc., 1986), 1.
[6] Mark T. Anderson and Lloyd H. Woosley Jr., 2005.
[7] *Ibid.*
[8] *Ibid.*
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[10] Justice Gregory J. Hobbs Jr. *Citizen's Guide to Colorado Water Law* (Denver, Colorado: Colorado Foundation for Water Education, 2004).
[11] USGS Circular, Citizen's Guide to Colorado Water Law.
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[14] Eric B. Hecox, *Western States Water Laws: A Summary for the Bureau of Land Management* (Bureau of Land Management National Science and Technology Center. 2001)
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[16] *Ibid.*
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[18] National Wild and Scenic Rivers http://www.rivers.gov/. Accessed 2/4/09.
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[24] Paul Bockhorst, *A River Reborn: The Restoration of Fossil Creek*, DVD (Paul Bockhorst Productions, 2007).
[25] Marc Reisner, *Cadillac Desert: The American West and Its Disappearing Water* (New York: Penguin Books, 1986), 159.
[26] Tim Palmer, (1993) 22.
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[40] *Ibid,* 10.
[41] *Ibid,* 11.
[42] *Ibid,* 12.
[43] *Ibid,* 12.
[44] *Ibid,* 12.
[45] *Ibid,* 12.
[46] *Ibid,* 13.
[47] *Ibid,* 13.
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[49] *Ibid,* 17.
[50] *Ibid,* 19.
[51] *Ibid,* 19.
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[61] Interagency Wild and Scenic Rivers Coordinating Council, 21.
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[63] Wild and Scenic Rivers Act Section 2(b)(1).
[64] Wild and Scenic Rivers Act Section 2(b)(2).
[65] Wild and Scenic Rivers Act Section 2(b)(3).
[66] Palmer: 1993, 61.
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[68] Wild and Scenic Rivers Act Section 3(d)(1).
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[70] Interagency Wild and Scenic Rivers Coordinating Council, 37.
[71] Interagency Wild and Scenic Rivers Coordinating Council, 37.
[72] Interagency Wild and Scenic Rivers Coordinating Council, 48.
[73] Interagency Wild and Scenic Rivers Coordinating Council, 48.
[74] Interagency Wild and Scenic Rivers Coordinating Council, 37.
[75] Interagency Wild and Scenic Rivers Coordinating Council, 48.
[76] Interagency Wild and Scenic Rivers Coordinating Council, 48.
[77] Wild and Scenic Rivers Act Section 10(a)
[78] Interagency Wild and Scenic Rivers Coordinating Council and Tim Palmer, 246.
[79] Interagency Wild and Scenic Rivers Coordinating Council, 38.
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[84] Interagency Wild and Scenic Rivers Coordinating Council, 39.
[85] Interagency Wild and Scenic Rivers Coordinating Council, 40.
[86] Wild and Scenic Rivers Act Section 7(a).
[87] Wild and Scenic Rivers Act Section 7(a).
[88] Wild and Scenic Rivers Act Section 7 Restrictions on hydro and water resource development projects on designated rivers.
[89] Tim Palmer, *The Wild and Scenic Rivers of America* (Washington D.C.: Island Press, 1993), 263.
[90] Eric B. Hecox, *Western States Water Laws: A Summary for the Bureau of Land Management* (Bureau of Land Management National Science and Technology Center, 2001).
[91] *Ibid.*
[92] *Ibid.*.
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[94] Eric B. Hecox: 2001.
[95] CRS Report for Congress.
[96] *Ibid.*
[97] Idaho State Water Plan, Adopted by The Idaho Water Resource Board, December 1996. p. 82-90.
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[99] Idaho State Water Plan, 1996.
[100] "Wild and Gold Medal Trout Management" Colorado Wildlife Commission Policy. Revised June 12, 2008.
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[103] *Ibid.*
[104] *Ibid.*
[105] Dirk Miller, Wyoming Game and Fish, email correspondence with author, July 29, 2008.
[106] American Rivers, "Campaigns." http://www.americanrivers.org/site/PageServer?pagename=AR7_Campaigns. (Accessed July 2008).
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[112] Trout Unlimited, "WWP Accomplishments – 10 Years," http://www.tu.org/site/c.kkLRJ7MSKtH/b.4176411/, (Accessed December 1, 2008).
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Case Study: The Black Canyon

Water sufficient to maintain natural features and processes, both on the land and in watercourses, is fundamental to the health of national park lands. This is a difficult balancing act for the Department of Interior as it seeks to balance its competing statutory obligations of protecting the health of the land and wildlife in situations where competing non-federal and private demands exist on water for hydropower and consumptive use water rights. In a series of cases, including United States v. New Mexico,[1] the Supreme Court developed the "implied-reservation-of-water" doctrine.[2] Under this doctrine, when the President or Congress reserved land from the public domain for a purpose, a quantity of water needed to accomplish that purpose was *impliedly* reserved.[3] This doctrine applies to all national monuments and parks including the Black Canyon of the Gunnison National Park. In each case, the quantity of water reserved for that national park must be adjudicated in state court.

Originally set aside as a National Monument in 1933, the Black Canyon became a National Park in 1999.[4] Two years later, the National Park Service began quantifying the water needs of the Canyon's ecosystem.[5] Once the water needed to maintain flows through the canyon was quantified, the National Park Service could claim through Colorado water court the park's federal reserved water right. With a priority date of 1933, the reserved right of the Black Canyon is senior to many rights held by irrigators, power plants, and other interests in the region.[6]

The 2001 filing in Gunnison District Water Court by the National Park Service sought to employ their reserved water right on grounds that insufficient flow caused by the upstream construction of the Wayne Aspinall series of dams in the 1960s had led to sediment and vegetative build-up. The filing called for at least 300 cubic feet per second (cfs) throughout the year and higher flushing flows in May and June. This request, according to local officials, would supersede longstanding water rights with more junior priority dates for ranching and agriculture in the Gunnison Basin.

In 2003, Department of Interior and Colorado state officials entered into an agreement. Instead of exercising the federal water right to flows of *at least* 300 cfs, the agreement stated that the Gunnison through the Black Canyon would receive 300 cfs or natural flow – *whichever was less*.[7] Episodic, high volume flows were included, but given a priority date of 2003; making this flushing right junior to every right prior, including the Aspinall rights.[8] When this became public, a number of environmental groups began taking actions to have the agreement reevaluated; asserting that low natural flows (below 300 cfs) would jeopardize the Park's ecosystem.[9]

In 2006, U.S. district judge Clarence Brimmer ruled against the NPS-Colorado agreement, calling the earlier decision "arbitrary, capricious, and an abuse of discretion"[10] thereby returning the case to Colorado water court. This action upheld the fundamental necessity to protect the natural resources of the Black Canyon and required a reassessment of the timing and amounts of water flow needed. This ruling effectively prevented the federal government from negotiating away necessary waters to maintain the natural features of the Black Canyon NP and required a transparent process to re-adjudicate the federal reserved water right of the Black Canyon.[11]

The decision of the U.S. District Judge in 2006 led to negotiations aimed at reaching an agreement concerning water rights on the Gunnison River between environmental groups, federal and state agency officials, and other interested parties. The negotiations ended with a decree giving Black Canyon rights to a year-round flow of 300 cfs, and seasonal shoulder and peak flows based on the year's hydrologic conditions.[12] This June, 2008 decree, made official on December 31, 2008, also allows for slight modifications to protect the pre-existing water rights of interested parties.[13] After 30 years of contention over the Gunnison flow in Black Canyon, the new decree provides some compromise with state water rights and protects the ecosystems and aesthetics of the Gunnison River.

The Painted Wall, Gunnison Canyon - © Lisa Lynch, NPS

[1] 438 U.S. 696 (1978).
[2] This is also called the Federal Reserved Water Rights doctrine.
[3] This doctrine is analogous to the Winters doctrine under which water rights necessary for an Indian reservation were reserved when the reservation was established.
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United States Laws and Policies Protecting Wildlife

The 2009 Colorado College State of the Rockies Report Card

By Phillip M. Kannan

I. Introduction

The issue of which level of government has authority to protect wildlife in the United States has a contentious history. This question is one of the many in the states' rights versus federal authority conflict. As the following discussion demonstrates, the trend has been from almost absolute state control, from 1789 through approximately 1920, to a regime today in which states and the federal government share this regulatory responsibility. The decline in state authority and the corresponding assent of federal power resulted from an expanded role of the U.S. at the international level, a broader interpretation of Congress's authority under the interstate commerce clause of the Constitution,[1] a recognition that state laws alone would not protect adequately the national interest in wildlife, and a more aggressive management of federally owned land.

II. The Transition from Exclusive State Regulation to a Shared Regime for Protecting Wildlife

At the founding of the U.S., the regulation of the wildlife within a state was claimed by that state. This authority was based on a legal theory called the "state ownership doctrine" under which each state claimed ownership on behalf of its people of all wildlife within its boundaries. With ownership came the right to regulate.

The United States Supreme Court in 1896 recognized the state ownership doctrine in *Greer v. Connecticut*.[2] At issue in this case was a Connecticut law that prohibited the transportation of killed game from the state. In upholding this law, the Court stated, "The sole consequence of the provision forbidding the transportation of game killed within the state, beyond the state, is to confine the use of such game to those who own it, - the people of that state."[3] The Court held the state law did not restrict interstate commerce, and thus did not violate the interstate commerce clause of the Constitution, because by the very terms of the state law there could be no interstate commerce in Connecticut's game.[4]

In 1900 Congress was faced with plummeting populations of migratory birds; however, because of the Greer decision, Congress had only limited authority to provide protection. Congress's resolution of this dilemma of a great need but limited power was the Lacey Act.[5] This law prohibits the interstate transportation of "any wild animals or birds" killed in violation of state law.[6] This law recognizes and supports state laws rather than attempting to preempt them, and it makes interstate transportation a prerequisite for a violation and thus ensures that the law is a valid exercise of Congress's interstate commerce power.

So strong was the state ownership doctrine in the early 1900's that two federal courts struck down the Migratory Bird Act of 1913, a federal statute which prohibited the hunting of migratory birds except in compliance with federal law.[7] Under these cases, migratory animals merely passing through a state became the property of the state while they were within its borders. In reaction to these cases, in 1916 the U.S. entered into a treaty with England (on behalf of Canada) to protect birds that migrated between the U.S. and Canada, and Congress enacted the Migratory Bird Treaty Act to implement the requirements of the treaty.[8] The Migratory Bird Treaty Act was challenged in court by Missouri which claimed that it was an unconstitutional invasion of Missouri's sovereign right.[9] The Court characterized Missouri's theory as follows: "The State … founds its claim of exclusive authority upon an assertion of title to migratory birds … . To put the claim of the State upon title is to lean upon a slender reed."[10] In contrast to this slender reed, the Court held the national interest was great: "Here a national interest of very nearly the first magnitude is involved. It can be protected only by a national action in concert with that of another [national] power."[11] The Court wisely concluded that the Constitution did not compel it to tie the hands of the only power that could prevent the destruction of a valuable commercial resource, migratory birds.

The decline in the state ownership doctrine was paralleled by the ascent of federal interstate commerce power. For example, the Supreme Court interpreted that power to include the authority of the federal government to regulate wheat production even if the farmer only fed his crop to his own animals on his own farm.[12] Such interpretations of Congress's authority under the interstate commerce clause are the bases of modern laws that provide protection for the environment including wildlife. This includes the National Environmental Policy Act,[13] the Clean Air Act,[14] the Clean Water Act,[15] the Resource Conservation and Recovery Act,[16] the Comprehensive Environmental Response, Compensation, and Liability Act,[17] and most importantly for wildlife the Endangered Species Act of 1973.[18]

The second fount of constitutional authority for federal regulation of wildlife is the property clause which states, "Congress shall have Power to dispose of and make all needful Rules and Regulations respecting the Territory or other Property belonging to the United States."[19] The Supreme Court has held that "[the] power over the public land thus entrusted to Congress is without

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limitations."[20]

The property belonging to the U.S. includes national parks (over 80 million acres), national forests (191 million acres), national wildlife refuges (88 million acres), and the land managed by the Bureau of Land Management (BLM) (350 million acres). Wilderness areas may be designated on any of these four categories of federal land.[21] National parks[22] and wilderness areas[23] are managed under a preservationist approach which provides extensive protection for wildlife.[24] National forests[25] and BLM lands[26] are managed under a multiple use sustained yield approach. Wildlife refuges are managed under a compatible use approach which means that the Fish and Wildlife Service can allow any use of a wildlife refuge that is compatible with the purpose for which the refuge was established.[27]

Just as reports of Mark Twain's demise proved premature, so too was the demise of the state ownership doctrine in the wake of the Hughes decision. State statutes and constitutional provisions continued to assert state ownership of wildlife post-Hughes, and state courts consistently interpreted Hughes to be limited to situations involving federal-state conflicts. Thus, the state ownership doctrine lives on in the twenty-first century in virtually all states, affording states ample authority to regulate the taking of wildlife and to protect their habitat.[30]

Moreover, every state has general police power under which the state can enact laws to protect public health and welfare.[31] This power is broad, but not unlimited.[32]

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In Kleppe v. New Mexico the Court stated that "the complete power that Congress has over public lands necessarily includes the power to regulate and protect wildlife living there."[28] Because of this broad power to protect wildlife the Court upheld the Wild Free-Roaming Horses and Burros Act which protected these animals from capture, branding, harassment, and killing.[29] New Mexico's claim that it had authority to impound all horses, mules, or asses found running at large was rejected.

III. The Current Balance of Power between State and Federal Governments

The state ownership doctrine may be of no effect against the federal government, but it is not completely void. Two commentators have summarized its status as follows:

Thus, in the U.S. there is a sharing of authority to protect wildlife. The federal government can use its authority under the interstate commerce clause and the property clause to enact laws protecting wildlife; any state law in conflict with such federal laws will be void. States can use their claim to ownership of wildlife and their police power to enact laws to protect wildlife to the extent their laws are not inconsistent with federal law. Thus, there is an opportunity to coordinate state and federal laws to better protect wildlife; however, there is a challenge to avoid duplication, tension, and inefficiency that multiple-level government and shared authority can cause.

The following section discusses federal laws that provide some protection for wildlife. Other articles in this report will focus on laws of the Rockies states that seek this same goal.

IV. Federal Laws Protecting Wildlife

One can argue that every federal environmental law protects wildlife to some degree. Consider the Clean Air Act which establishes national ambient air quality standards for pollutants that cause chronic health effects[33] and technology standards for hazardous air pollutants.[34] This law has improved the quality of the air wildlife breathes. It has reduced the pollution from the atmosphere that falls into rivers and lakes and upon the plants, and thus, has improved the water they drink and the food they eat. Such laws indirectly protect wildlife.

There is a spectrum of federal laws that protect wildlife. It starts on the low end with laws such as the Clean Air Act that work indirectly to protect wildlife and moves to the high end with laws such as the Endangered Species Act that specifically prohibit harming, harassing, wounding, and killing of listed species and the modification of their critical habitat if the modification harms a critical function such as feeding or breeding. The following is a brief description of the laws that fall along this spectrum.

A. Protecting Wildlife under Wildlife-Focused Laws

There are a few narrowly focused laws that provide almost complete protection for the small set of targeted wildlife. Two of the most important of these are the Eagle Protection Act[35] and the Wild Free-Roaming Horses and Burros Act.[36]

The Eagle Protection Act prohibits all persons from knowingly taking, possessing, or selling an eagle or eagle part. There are limited exceptions for Native Americans' religious purposes, for scientific purposes, and for exhibitions provided a permit has been issued by the Department of Interior.

The Wild Free-Roaming Horses and Burros Act protects these animals on federal and private lands. If federal agents determine there is an overpopulation on a particular federal property, the federal agency is to remove the excess or have them adopted; only as a last resort can the excess population be killed (humanely). If the animals stray onto private land, they cannot be killed; the only exception is that a federal agent can do so.

The Endangered Species Act affords protection to two *classes* of species, namely endangered and threatened species. No person is allowed to take a listed species without an incidental take permit. Taking is defined broadly to include harassing and habitat modification as well as killing. Federal agencies are prohibited from taking actions that are likely to jeopardize the continued existence of listed species or modify their critical habitat. They must also utilize their authority to conserve listed species, that is, to restore their numbers so as to remove them from the lists.[37] Thus, one can conclude that although this law applies only to a small number of animal species, it provides extensive protection to them.

The Migratory Bird Treaty Act makes it unlawful for any person "to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase, deliver for shipment, ship, export, import, cause to be shipped, exported, or imported … any migratory bird" without a federal license.[38] The set of wildlife protected is broader than that of the Endangered Species Act; however, licenses to take migratory birds are much more available than incidental take permits under the Endangered Species Act.

B. Protecting Wildlife by Protecting Wetlands

Wetlands are among the most productive of all ecosystems; the Environmental Protection Agency (EPA) has stated that more than one-third of threatened species and endangered species live only in wetlands, and half use wetlands at some point of their lives.[39] Protecting wetlands will protect those species and the other wildlife that depend on wetlands.

The Clean Water Act prohibits the discharge of dredged or fill material into navigable waters, including wetlands, without a permit.[40] The Corps of Engineers and EPA are prohibited from issuing a permit to fill wetlands if there is a practicable alternative.[41] Thus, the Corps and EPA must select the alternative that will cause the least harm to wetlands if it is practicable.

C. Protecting Wildlife under Limited-Use Land Laws

Laws establishing the National Park System, National Wildlife Refuge System, and federal land managed under the Wilderness Protection Act are the most important laws that protect wildlife by protecting their habitat. Hunting is banned in national parks unless the law creating a particular national park specifically allowed it.[42] Hunting is permitted in a wildlife refuge if the Fish and Wildlife Service has determined that it is compatible with the purposes of the refuge.

D. Protecting Wildlife under Multiple-Use Land Laws

The two most important multiple use laws are the National Forest Management Act (NFMA) and the Federal Land Policy and Management Act (FLPMA). Federal lands managed under these acts are to be administered for five different purposes: outdoor recreation, range, timber, watershed, and wildlife and fish purposes. Thus, these statutes allow the federal agencies to manage the lands under their control to protect wildlife. Until recently the Forest Service interpreted one provision of the NFMA[43] as requiring it "to maintain viable populations of existing native and desirable non-native vertebrate species."[44]

NFMA and FLPMA do not require that every

acre be managed for every purpose.[45] Moreover, the managers have great flexibility in deciding how much protection to provide for wildlife. Because these laws "breathe discretion at every pore,"[46] courts will not determine the balance that should be struck between the competing purposes for a particular federal property.[47] In one remarkable example of the deference courts give to agency decisions regarding how the agency uses the land it manages, the court upheld the Forest Service's decision to allocate 100% of forage to livestock and none to wildlife.[48]

E. Protecting Wildlife under Environmental Impact Assessment Laws

The National Environmental Policy Act (NEPA)[49] requires that an environmental impact statement (EIS) be prepared on all major federal actions significantly affecting the quality of the environment. Each EIS must include a reasonable set of alternatives to the proposed action;[50] however, there is no requirement that the agency select the alternative that causes minimal harm to the environment.[51] The Supreme Court specifically has held that NEPA does not require the agency to select the alternative that minimizes the harm to wildlife:

> *"[I]t would not have violated NEPA if the Forest Service, after complying with the Act's procedural prerequisites, had decided that the benefits to be derived from downhill skiing at Sandy Butte justified the issuance of a special use permit, notwithstanding the loss of 15 percent, 50 percent, or even 100 percent of the mule deer herd."*[52]

NEPA can help protect wildlife by making the decision-maker aware of the impact of the proposed federal action on wildlife, and thus enable him/her to weigh wildlife protection against other interests. Also, because the EIS is made available to the public, individuals and environmental groups can bring political pressure on the decision-maker to choose an alternative that reduces the harm to wildlife. If the EIS is inadequate or the decision-maker failed to give sufficient consideration to an alternative that reduced harm to wildlife, a party with standing can seek judicial review of the agency's final decision.[53]

F. Protecting Wildlife under Broad Environmental Laws

A law that reduces pollution or requires the cleanup of hazardous sites will improve the environment. That, in turn, will benefit wildlife directly or indirectly. Thus, such laws can be considered as wildlife protection measures at the far end of the spectrum.[54]

V. Conclusions

Wildlife can be protected by laws that focus on wildlife itself and by laws that preserve habitat. This article provides an overview of the major federal command-and-control laws of each type. It is unfortunate that there is no one law, The Wildlife Protection Act, which integrates and coordinates the scattered, incomplete, and at times overlapping approaches that exist now.

In addition to the command-and-control laws there are other federal programs that benefit wildlife. These are often based on incentives; examples include purchasing wildlife conservation easements and payments to farmers to take land out of production. A truly integrated approach to wildlife protection would include those laws as well as the command-and-control laws.

[1] U.S. Const., art. I, § 8 ("The Congress shall have Power … [t]o regulate Commerce with foreign Nations, and among the several States, and with Indian Tribes …").
[2] 161 U.S. 519 (1896).
[3] Id. at 529.
[4] This might be a circular argument, but it was a central part of wildlife law until 1979 when Greer was overruled in Hughes v. Oklahoma, 441 U.S. 322 (1979).
[5] 16 U.S.C. § 3372.
[6] 16 U.S.C. § 3372(a) ("It is unlawful for any person ... to import, export, transport, sell, receive, acquire, or purchase in interstate or foreign commerce … wildlife taken, possessed, transported, or sold in violation of any law or regulation of any State or in violation of any foreign law …").
[7] United States v. Shauver, 214 F.154 (E.D. Ark. 1914) and United States v. McCullagh, 221 F. Supp. 288 (D. Kan. 1915).
[8] 16 U.S.C. §§ 703-711.
[9] Missouri v. Holland, 252 U.S. 416 (1920).
[10] Id at 434.
[11] Id at 435.
[12] Wickard v. Filburn, 317 U.S. 111 (1942).
[13] 42 U.S.C. §§ 4321-4370f.
[14] 42 U.S.C. §§ 7401-7642.
[15] 33 U.S.C. §§ 1251-1270.
[16] 42 U.S.C. §§ 6901-6992k.
[17] 42 U.S.C. §§ 9601-9675.
[18] 16 U.S.C. §§ 1531-1543.
[19] U.S. Const., art. IV, § 3, cl. 2.
[20] Kleppe v. New Mexico, 426 U.S. 529, 540-541 (1976) quoting United States v. San Francisco, 310 U.S. 16, 29 (1940).
[21] 16 U.S.C. § 1131.
[22] 16 U.S.C. §§ 1-18.
[23] 16 U.S.C. §§ 1131-1136.
[24] 16 U.S.C. § 1131(c) (stating the purpose of wilderness areas is to preserve their "primeval character and influence" and natural condition with motorized equipment, permanent roads, and commercial activity generally prohibited).
[25] See National Forest Management Act of 1976 (NFMA), 16 U.S.C. §§ 1600-1614 and Multiple Use, Sustained Yield Act, 16 U.S.C. § 531(a).
[26] See Federal Land Policy and Management Act of 1976 (FLPMA), 43 U.S.C. §§ 1701-1784.
[27] 16 U.S.C. §§ 668dd-668ee.
[28] Kleppe v. New Mexico, 426 U.S. 529, 547 (1976).
[29] 16 U.S.C. §§ 1331-1340.
[30] Michael C. Blumm and Lucus Ritchie, The Pioneer Spirit and the Public Trust: The American Rule of Capture and State Ownership of Wildlife, 35 Envtl. L. 673, 706 (2005).
[31] Id. at 713.
[32] See generally Andrew Cook, Commerce Clause and Privileges and Immunities Clause: Eighth Circuit Court of Appeals Upholds North Dakota's Nonresident Hunting Regulations, Reaffirming States' Rights to Regulate Wildlife Resources within Their Borders, 83 N. Dak. L. Rev. 1029, 1034 (2007).
[33] 42 U.S.C. §§ 7408-7409.
[34] 42 U.S.C. § 7412.
[35] 16 U.S.C. §§ 668-668d.
[36] 16 U.S.C. §§ 1331-1340.
[37] See Phillip M. Kannan, The Endangered Species Act of 1973: An Overview *in* The 2006 State of the Rockies Report Card at 59.
[38] 16 U.S.C. § 703.
[39] America's Wetlands: Our Vital Link between Land and Water, published by the Environmental Protection Agency.
[40] 33 U.S.C. § 1344.
[41] See Section 404(b)(1) Guidelines. Available at http://www.usace.army.mil/cw/cecwo/reg/40cfr230.pdf. See also Memorandum of Agreement between the Department of the Army and the Environmental Protection Agency, The Determination of Mitigation under the Clean Water Act § 404(b)(1) Guidelines.
[42] National Rifle Association v. Potter, 628 F. Supp. 903 (D.D.C. 1986) and Fund for Animals v. Mainella, 294 F. Supp.2d 46 (D.D.C. 2003).
[43] 16 U.S.C. § 1604(g)(3)(B).
[44] 36 C.F.R. § 219.19. For a discussion of this obligation, see Inland Empire Public Lands Council v. United States Forest Service, 88 F.3d 754 (9th Cir. 1996).
[45] Wind River Multiple-Use Advocates v. Espy, 835 F. Supp. 1362 (D. Wyo. 1993).
[46] Perkins v. Bergland, 608 F.2d 803, 806-807 (9th Cir. 1979).
[47] Id. at 807.
[48] Forest Guardians v. United States Forest Service, 329 F.3d 1089 (9th Cir. 2003).
[49] 42 U.S.C. §§ 4321-4370d.
[50] See Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519 (1978).
[51] Strycker's Bay Neighborhood Council, Inc. v. Karlen, 444 U.S. 223 (1980).
[52] Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 351 (1989).
[53] Id.

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Wildlife: Range and Condition

The Historic and Current State of Wildlife in the Rockies

By Julia Head

THE 2009 COLORADO COLLEGE STATE OF THE ROCKIES REPORT CARD

Key Findings

- In the last 150 years, elk have lost 74 percent of their range and cougar have lost 36 percent of their range.
- Coyote range has increased 40 percent over the last 150 years.
- Animal-vehicle collisions increased 50 percent between 1990 and 2004.
- A 5.4 °F increase in average July air temperatures could eliminate 50 percent of currently viable trout stream habitat in the Rockies.
- Habitat loss and fragmentation have led to population decreases in approximately 83% of U.S. species.

About the author: Julia Head (Colorado College '09) is a student researcher for the 2008/09 State of the Rockies Project.

Introduction

The Rockies region has a rich and complex natural heritage. From the alpine tundra of Colorado's high peaks to the Sonoran Desert of southern Arizona, the eight-state region supports a diverse range of ecosystems and species. However, for many of these species and their habitats the past has been turbulent and the future remains uncertain. As more people move to the Rockies, how can the region manage both rapid growth and fragile natural systems to maintain healthy wildlife, one of its defining characteristics?

Wildlife plays a crucial role in natural ecosystems, which in turn provide free environmental services such as waste detoxification, pest control, climate stabilization, pollination, and flood protection that would be extremely expensive or impossible to replace if the ecosystems were irreversibly damaged.[1] Wildlife associated with recreation also brings significant economic benefits to communities throughout the Rockies region. Small rural communities in particular benefit from the revenue generated from tourism, hunting and fishing, and other forms of outdoor recreation. In the Rocky Mountain West, 13 percent of the population fish, 6 percent hunt, and 31 percent participate in some form of wildlife watching.[2] Hunting generates 3.2 percent of the income in the Rocky Mountain region as opposed to the national average of 1.8 percent.[3] The numerous individuals and groups that participate in wildlife-related activities in the Rockies region have a large stake in maintaining the open space and functioning ecosystems that directly or indirectly make these activities possible and enjoyable.

The richness of wildlife, beauty of the landscape, and abundance of natural reserves attract visitors, new residents, developers, and industry to the Rockies region at an ever increasing rate. Rapid growth in the Rockies has had and will continue to have significant impacts on its intricate and dynamic ecosystems. Grazing allotments, migration routes, and winter grazing areas once included in the historical ranges of wildlife have been narrowed and broken into disconnected islands of open land. Studies have indicated that in areas of higher human influence, species ranges are more likely to contract and less likely to persist.[4] Within the last 150 years, species iconic to the west, such as elk, bison, pronghorn, grizzly bear, grey wolf, and lynx have lost significant portions of their historical ranges (See Figure 1).[5]

As discussed later in this report, the elk population of northwestern Wyoming provides an informative case study on the habitat fragmentation and the human intervention that has, in places, become necessary for elk survival. Arguments about what an endangered species is and what it should be are major topics in courtrooms today. Predator reintroduction polarizes the public and spurs intensive lobbying and debate over legislation. At the heart of these issues remains the question of how humans and wildlife can most optimally live together on a limited amount of land.

Human activities have reduced wildlife habitat, increased human–wildlife contact and conflict, and decreased populations of both predators and prey. An ongoing example of human–wildlife conflict involves bison carrying brucellosis, a disease introduced to native ungulate populations by cattle in the early 1900's.[6] In the 2007–2008 season alone, fear that the brucellosis would be transferred from bison to cattle led to the slaughter of 1,544 bison moving from Yellowstone National Park into Montana seeking winter grazing.[7] Other conflicts include the introduction of non-native species and the habituation of wild animals to humans.

This Rockies topic report examines the past and present ranges and condition of wildlife in the Rockies region. A comprehensive view of this subject is important for understanding how to protect species, as well as their habitats and migration routes. (See Tables 1A and 1B). By pooling and assessing data over the entire Rockies region and understanding the important issues surrounding wildlife on a scientific basis, we can form a solid platform upon which to make informed decisions about wildlife preservation, wildlife management, and human interests relating to wildlife.

Table 1a: Rockies Focus Species

	Primary Focus Species	Threatened or Endangered	Desireable for Hunting/Fishing
Mammals	Gray wolf (Canis lupus)	Endangered	Yes
	Grizzly bear (Ursus arctos)	Threatened	
	Canadian lynx (Lynx Canadensis)	Threatened	
	North American cougar (Puma concolor cou-guar)		Yes
	Black footed Ferret (Mustela nigripes)	Endangered	
	Elk (Cervus canadensis)		Yes
	Mule deer (Odocoileus hemionus)		Yes
	Bison (Bison bison)		Yes
	Pronghorn (Antilocapra americana)		Yes
Reptiles/ Amphibians	Sagebrush Lizard (Sceloporus graciosus)		
	Tree Lizard (Uta ornata)		
	Red Spotted Toad (Bufo punctatus)		
Birds	Peregrine falcon (Falco peregrinus)		
	Sage grouse (Centrocercus urophasianus)		
Fish	Cutthroat trout (Oncorhynchus clarki)	Threatened	
	*Table 1b lists secondary focus species		

Table 1B: Rockies Focus Species

	Secondary Focus Species	Threatened or Endangered	Desireable for Hunting/Fishing
Mammals	Wolverine (Gulo gulo)		
	Beaver (Castor canadensis)		Yes
	River otter (Lontra canadensis)		
	Snowshoe hare (Lepus americanus)		Yes
	Marmot (Marmota flaviventris)		
	Big brown bat (Eptesicus fuscus)		
	American Pika (Ochotona princes)		
	Black tailed prarie dog (Cynomys ludovicianus)		
	Bighorn sheep (Ovis canadensis)		Yes
Amphibians	Woodhouse's toad (Bufo woodhousii)		
	Boreal toad (Bufo boreas)		
	Wood frog (Rana sylvatica)		
	Northern leopard frog (Rana pipiens)		
	Long-toed salamander (Ambystoma macrodactylum)		
	Tiger salamander (Ambystoma tigrinum)		
	Canyon Tree frog (Hyla arenicola)		
Reptiles	Bull snake (Pituophis cantenifer)		
	Western Rattlesnake (Crotalus viridis)		
	Desert Spiny Lizard (Sceloporus magister)		
	Eastern Fence Lizard (Sceloporus undulatus)		
	Plateau Whiptail (Cnemidophorous neotesselatus)		
	Desert Tortise (Gopherus agassizii)	Threatened	
Birds	Golden eagle (Aquila chrysaetos)		
	Bald eagle (Haliaeetus leucocephalus)		
	Sandhill crane (Grus canadensis)		
	Spotted owl (Strix occidentalis)	Threatened	
	Mountain plover (Charadrius montanus)		
Fish	Colorado pikeminnow (Ptychocheilus lucius)	Endangered	
	Razorback sucker (Xyrauchen texanus)	Endangered	
	Bonytail (Gila elegans)	Endangered	
	Flannelmouth Sucker (Catosomus latipinnis)		
	Desert Sucker (Catostomus clarkii)		
	Speckled Dace (Rhinichthys osculus)		
	Virgin Spinedale (Lepidomeda mollispinus)		

Source: Tables 1A and 1B created by the State of the Rockies Project, 2008

Historical and Current Ranges

In the mid-1800's as many as 30 million bison roamed the plains of North America.[8] The vast grasslands and mountainous areas also supported a suite of other herbivores, including pronghorn, elk, deer, mountain goat, and bighorn sheep. Predator populations of wolves, grizzly bears, cougars, lynx, and coyotes regulated these herbivore populations. Experts estimate that nearly 1.5 million wolves may have lived in North America in the early 1800's.[9] Historical ranges, shown in blue and tan in Figure 1, indicate the extent of several wildlife species in North America.

As early settlers made their way west, North America's wildlife populations plummeted due to market hunting and habitat loss. The ungulates of the region were initially used mainly for food and materials. Later, however, the focus turned to harvesting only the most profitable parts of the animals, such as the hides, and clearing out the competition for grazing cattle. These extreme harvests also contributed to the government's effort to change the Native American's nomadic way of life and force them onto reservation lands.[10] By 1889, there were less than 1,000 bison left in the U.S. Other species fared just as poorly. Between 1850 and 1950, grizzly bears were eliminated from 98 percent of their original range, with extirpation occurring earliest in the Great Plains and later in remote mountainous areas.[11] Wolves were historically distributed throughout the U.S., from the east to the west coast, south of Canada, and north of central Mexico. However, ranchers and farmers perceived wolves as a threat to livestock, and through a concerted eradication effort sponsored by the U.S. government, wolves were confined to northeastern Minnesota and Isle Royale National Park in Lake Superior by 1960.[12]

Beginning in the late 1800's, conservation-minded individuals such as Theodore Roosevelt, George Bird Grinnell, and John Muir led efforts to conserve land and manage wildlife.[13] The model that developed out of their efforts has two main principles: our fish and wildlife belong to all North American citizens and should be managed in a way that will sustain their populations indefinitely.[14] Based on this model, wildlife management, especially for game species, was primarily concerned with species restoration and population growth.

Despite these efforts, current ranges of many native species are small fractions of what they once were. Within the last 150 years, elk have lost 74 percent of their range, pronghorn 64 percent, grizzly bear 53 percent, swift fox 60 percent, grey wolf 42 percent, lynx 39 percent, wolverine 37 percent, and cougar 36 percent (See Figure 1: Historic and Current Ranges of Selected Species).[15] Some species that seem quite common no longer occupy the full extent of their historical range. Moose and mule deer have experienced range contractions of 11 percent and 8 percent, respectively.[16] However, the picture is not so bleak for all species, especially generalists that have taken advantage of human changes to the environment. Range increases for some generalists include 10 percent for hooded skunk, 13 percent for red fox, 13 percent for

raccoon, and 40 percent for coyote.[17]

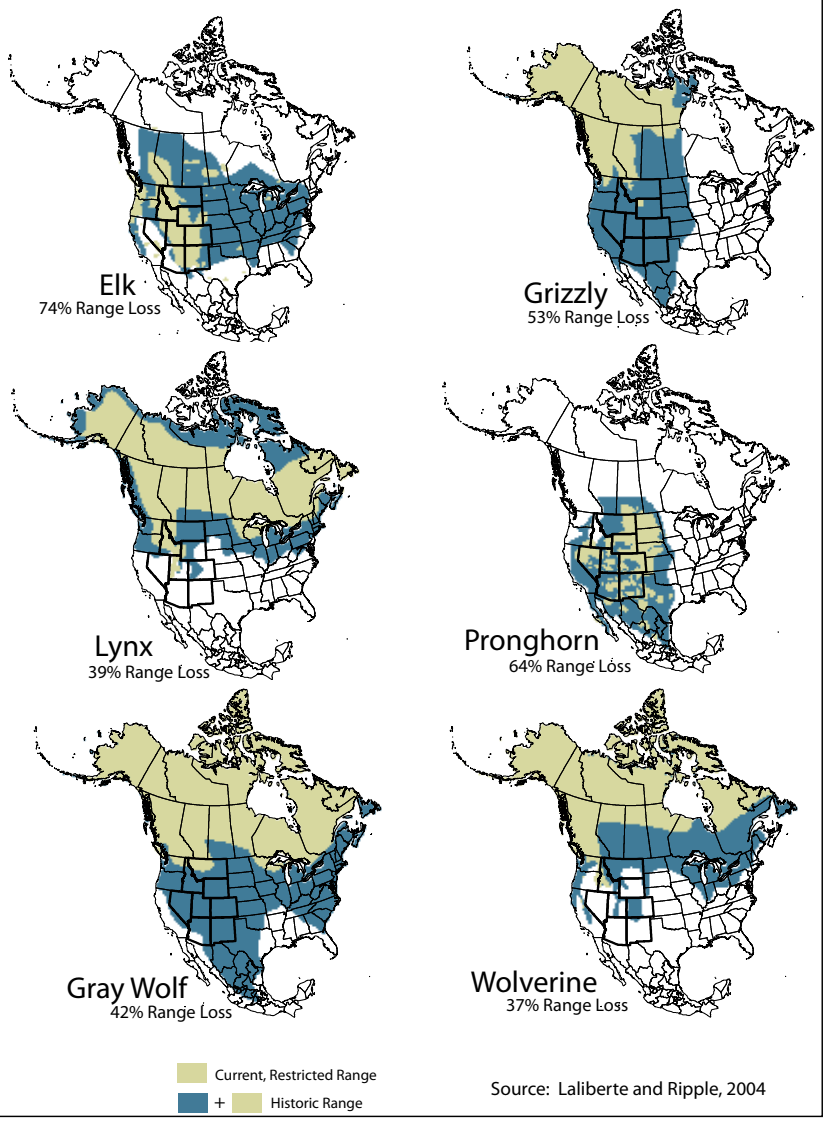
In certain areas, restoration and reintroduction of extirpated species has been highly successful. Figure 1 show the current ranges of several species that have been brought back from the brink of extinction. However, in some areas, successful reintroduction and restoration programs have become a double-edged sword. For example, Yellowstone National Park has been very successful at expanding its bison population and fostering the population of reintroduced wolves. In 1995 and 1996 a total of 31 wolves were introduced into Yellowstone National Park. The population has grown to over 400 wolves in the region.[18] Wolves have had positive effects on the ecosystem, such as fostering the regeneration of degraded riparian areas by forcing the elk to regain more natural movement patterns. However, as anticipated at the time of reintroduction, they have also expanded beyond

the boundaries of the park, angering humans when they injure or kill livestock and pets.

Bison populations, like wolf populations, have significantly increased within the past 100 years as a direct result of restoration efforts. However, when bison move beyond the boundaries of Yellowstone National Park, where restoration efforts have been particularly successful, bison face stressful herding and possible slaughter because of the risk of their transmitting brucellosis to cattle grazing near the park. For a more complete discussion of the issue of bison and brucellosis, please see the case study. Elk populations in the Rockies, especially in national parks and refuges, has been so successful that some areas now have overpopulation problems. In Rocky Mountain National Park, the current management plan calls for gradual culling (lethal reduction) of the herd using sharpshooters.[19] However, it is important to keep in mind that the overpopulation problems in national parks and refuges do not reflect overall trends in the U.S.

While some areas, such as Yellowstone National Park, have shown success with supporting the natural migration of native wildlife populations, other areas face mounting pressures as human populations grow and encroach on habitat. Fragmentation or the breaking up of habitat is one of the biggest challenges facing wildlife today. In the U.S., fragmentation in the form of development occurs at a rate of about 2 million acres of land per year, or 6,000 acres per day.[20] Higher human densities lead to greater impacts on nature.[21] Habitat loss and fragmentation have led to population decreases in approximately 83 percent of U.S. species that are becoming endangered and over 25 percent of designated at risk-species (553 species) live only in fast-growing U.S.

Figure 1: Historic and Current Ranges of Selected Species
Loss over 150 Years



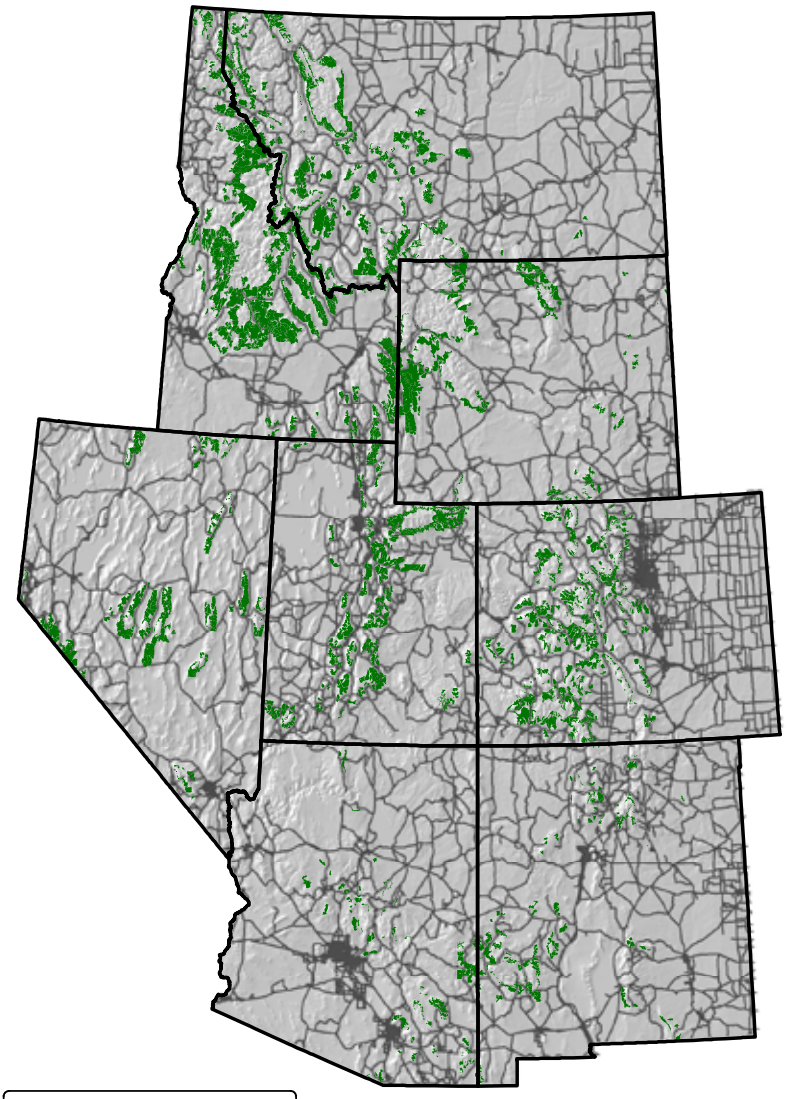
Source: Laliberte and Ripple, 2004

metropolitan areas.[22] While habitat loss is the most evident detrimental effect of fragmentation, other negative effects on ecosystems and species can compound over time,[23] such as impacts associated with roads.

Roads create a significant amount of fragmentation in the U.S. and around the world. When major roads cut through a wildlife range, vehicle collisions with wildlife can be dangerous for animals and humans, as well as damaging to automobiles. An estimate from 1987 indicated that one million vertebrates are killed on U.S. roads every day.[24] More recent research suggests that while the total number of crashes per year in the U.S. has remained relatively stable, animal–vehicle collisions steadily increased by about 50 percent between 1990 and 2004.[25] Furthermore, scientists have estimated that the effects of a road extend over a band approximately 600 meters wide.[26] Studies on National Parks have found that wildlife mortality associated with the boundaries of these protected areas is extremely common among all large carnivore species for which data are available and that mortality is particularly high when conservation areas are surrounded by high densities of people.[27] Even large tracts of protected land do not cover sufficient land to allow for the natural movements of many species, especially large herbivores which require vast areas of forage and large carnivores that need large areas to roam and capture prey (See Figure 2).

Such threats to wildlife habitats and populations have raised concerns about conserving biodiversity, particularly in sensitive areas. Scientific studies have shown that contiguous range is crucial in maintaining healthy levels of diversity, which provides plant and animal populations with more resilience to stresses such as drought, floods, pest infestations, disease outbreaks, and changes in climatic conditions.[28] Thus, in directing conservation efforts, the focus is beginning to shift towards an approach that considers the contiguity or fragmentation of the landscape and the levels of biodiversity present in the area.

Figure 2: Roadless Areas and the Major Road Network of the Rockies



Source: National Atlas of the United States, USGS, 2004 (roads) and USDA Forest Service, 2008 (roadless areas)

Note: the roads depicted here do not include Forest Service or private roads.

When considering the current and future ranges for wildlife in the Rockies region, it is important to note that wildlife does not observe political borders or land ownership boundaries. The West is made up of a patchwork of federal, state, tribal, and local government lands as well as private lands. These lands are currently home to rapid development and ecologically intact landscapes, both of which are essential to economic strength and quality of life in the West. Change is occurring at a pace that is difficult for decision makers to monitor and control.[29]

Migration patterns

As knowledge about wildlife biology increases, an understanding of wildlife migration plays an ever increasing role in implementing conservation and management techniques. Animals migrate when seasonal conditions reduce food availability, limit movement or prove unsuitable for bearing or raising young.[30] The scientific definition of a migration is a seasonal roundtrip movement between discrete areas not used at other times of the year.[31] Migration corridors are essential to these seasonal movements and serve as an important intermediate range that

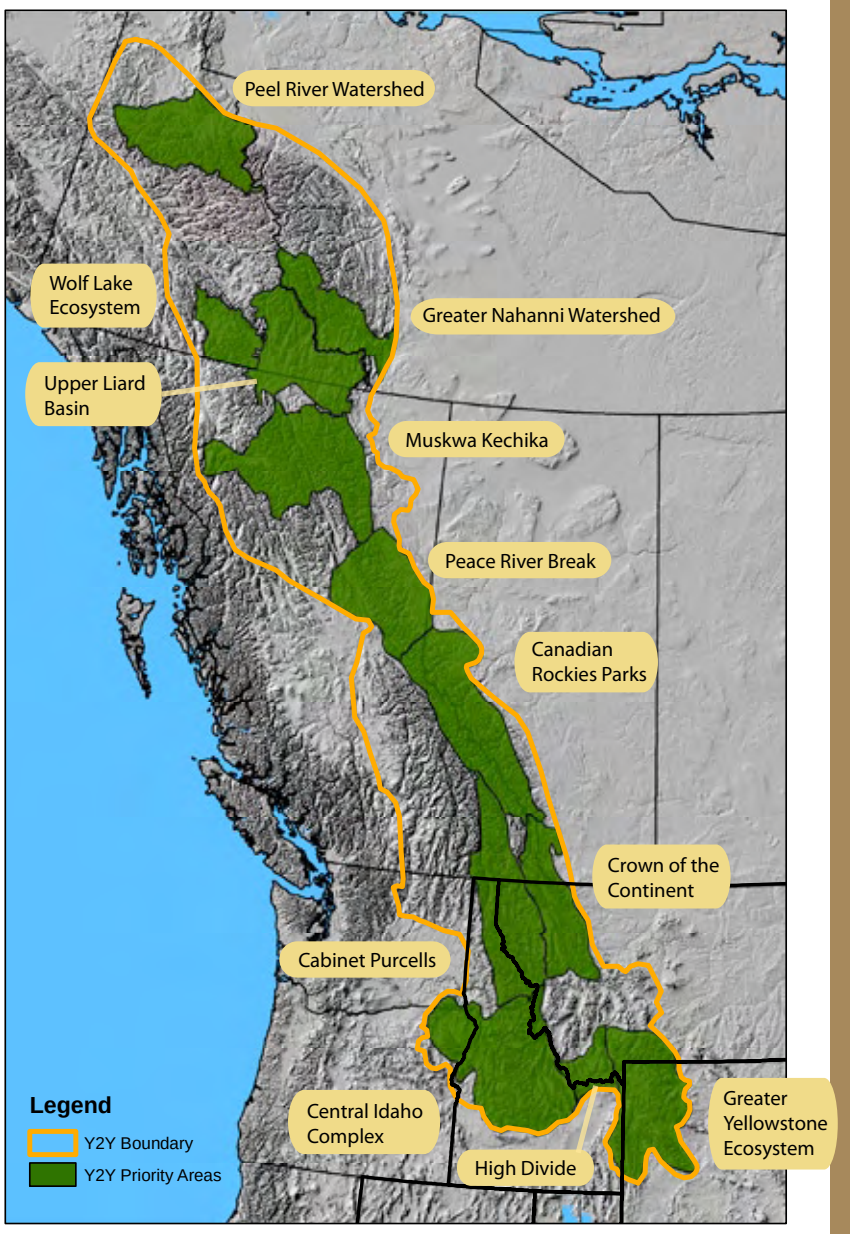
Case Study:
Yellowstone to Yukon Conservation Initiative

Yellowstone to Yukon, or Y2Y, is a conservation initiative working to protect the natural heritage of the mountain region from Yellowstone National Park to the Mackenzie Mountains in Canada. Y2Y envisions a connected, functioning ecosystem in which wildlife and humans can coexist and thrive. To reach these goals, Y2Y staff members and researchers collaborate with diverse groups involved in the Rocky Mountain region, including environmental nongovernment organizations (ENGOs), government agencies, First Nations/Native American communities, hunters, anglers, ranchers, researchers, foundations, and businesses.

In the lower 48 states, the Y2Y region is one of the few remaining places where a full suite of carnivores and ungulates can be found. Much of the research associated with Y2Y initiative focuses on the needs of grizzly bears, birds, and fish. In conserving key habitat areas and habitat connectivity for grizzlies, the Y2Y strategy also protects many other animals including wolverine, lynx, and moose. The Y2Y bird conservation strategy focuses on 20 sensitive species chosen from the region's 275 bird species, including golden eagle, long-billed curlew, and ruffed grouse. The aquatic conservation strategy prioritizes watershed health and uses the native cutthroat and bull trout as indicator species. While the overall approach of Y2Y may seem ambitious or even idealistic, ecosystem and connectivity approaches are gaining momentum in the field of wildland and wildlife conservation.[1]

[1] Yellowstone to Yukon Conservation Initiative. "People Working Together to Maintain and Restore the Unique Natural Heritage of the Yellowstone to Yukon region." http://www.y2y.net/home.aspx (Accessed July 24, 2008).

Figure 3: Yellowstone to Yukon Boundary and Priority Areas



Source: Yellowstone to Yukon Conservation Initiative, accessed 2008

provides food for migrating animals.[32]

Historically, migration corridors were dictated by the confines of topography, forage, weather, and other natural influences. Now, migration corridors are narrowed and often completely cut off by housing developments, industry, resource extraction, roads, fences, and other human-made structures or activities. A study contrasting 29 terrestrial mammals from five continents representing 103 populations reported that the remaining long-distance migrants have poor long-term prospects.[33] The same study found that areas of low human density in the Rockies region continue to experience the longest and largest of the remaining New World long-distance migrations south of central Canada.[34] Many of these long-distance movements occur in or adjacent to the 18 million acre Greater Yellowstone region, where about 75 percent of the migration routes for elk, bison, and pronghorn have already been lost.[35] The main pressures that have contributed to loss of bison, elk, and pronghorn migration routes in the Greater Yellowstone ecosystem are: little tolerance for bison outside of protected areas, the concentration of elk on 23 winter feeding grounds in Wyoming, a 20 percent increase in the human population in the last decade, and the associated loss of habitat, especially in areas crucial to the approximately 100,000 wintering ungulates in the southern part of the ecosystem.[36] Thus, the unprotected lands within and adjacent to the Greater Yellowstone region are highly valuable to conservation efforts. Unfortunately, accelerated leasing of public lands for energy development in the area will likely reduce and perhaps truncate such migrations.[37]

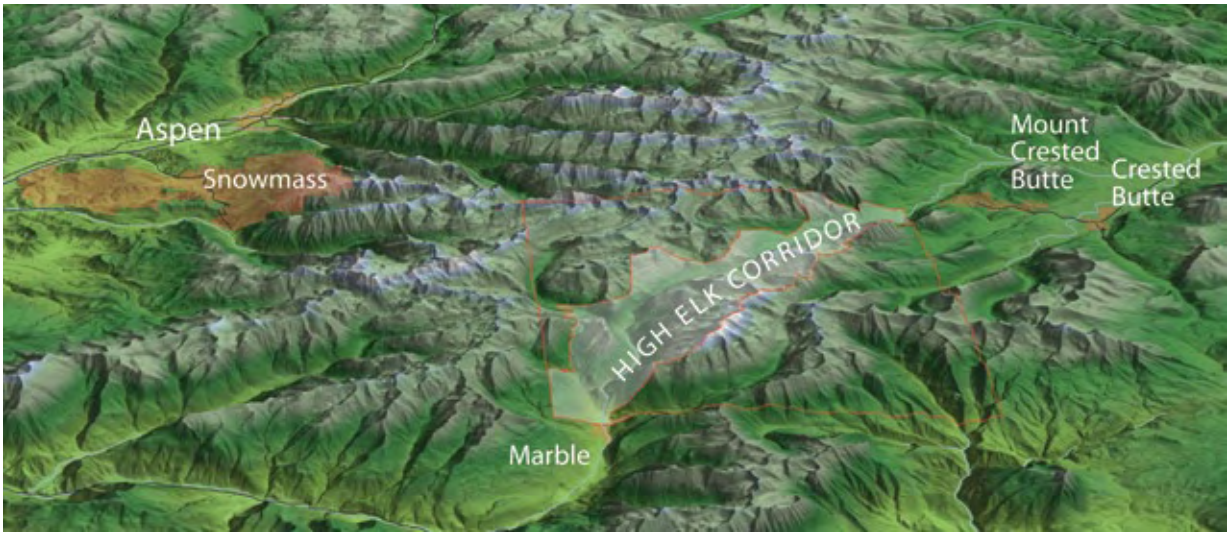
Case Study: Crested Butte High Elk Corridor

The High Elk corridor is a valley system that connects the mountainous Maroon Bells and Ragged wilderness areas. North of Crested Butte, a rugged, seasonal road traverses the valley, connecting the former mining towns of Gothic, Crystal, and Marble. The area includes the Rocky Mountain Biological Lab, as well as two watersheds providing drinking water for downstream communities, numerous recreational opportunities in the beautiful and wild landscape, and important cultural heritage in its historical mining areas. As its name implies, the area is also an important wildlife migration corridor and a hotspot for ecological diversity. Although the High Elk corridor is sandwiched between two wilderness areas, much of the 6,000 acre land area is privately owned. Many of these private lands are old mining claims which still fall under the jurisdiction of the outdated 1872 mining laws. Due to the nature of these laws as well as the other private in-holdings in the area, the High Elk Corridor has very incomplete protection.

Until now, the remote location, limited accessibility, severe winters, and avalanches have hindered development. But current interests in off-the-grid homes and trophy vacation homes, as well as the capabilities offered by the Internet, are putting this pristine area at risk. Friends of High Elk, a coalition that has created a fund to purchase land and conservation easements in the corridor, has protected 1,100 acres of the 2,500 acres of vulnerable areas within the corridor. However, the estimated total value of these vulnerable lands is $6.5 million, and the coalition faces increasing pressure from developers and land speculators. By finding solutions with property owners, the Friends of High Elk coalition hopes to secure this important area and create a contiguous wilderness area for the benefit of the ecosystem and future generations.[1]

[1] Friends of the High Elk. "Preserving the High Elk Corridor." A publication from The Trust for Public Land. 2006.

Figure 4: High Elk Conservation Corridor



Source: Trust for Public Land, 2001

Traditionally, conservation efforts have focused on individual species and crucial habitat for particular species. As conservation efforts shift towards a more holistic approach, migration corridors have received heightened attention from conservation groups. However, some researchers argue that animals need habitat rather than specific corridors and that corridors are too expensive relative to the amount of wildlife use. Furthermore, they contend that connecting isolated habitats with protected corridors would slow evolution by genetic drift and facilitate the spread of catastrophes such as fires, diseases, or introduced species.[38] However, the recommendations of studies critical of corridor preservation have not completely ruled out the potential benefits of protecting migration corridors, but have rather encouraged policymakers to consider the costs and benefits of the corridors and investigate other conservation options.

Although there are arguments against the focus on migration corridors as conservation tools, legitimate corridors that multiple species use for migration and habitat can produce economic gain in the long run. The economic benefits derived from the survival and health of big game herds and migratory birds rely heavily on the effective management of seasonal ranges and the migration corridors.[39] Wildlife corridors help support the hunting and wildlife watching industries, while also protecting biodiversity and wildlife migration paths. They thus contribute to healthy, functioning, and resilient ecosystems which provide humans with important nutrient cycling services, pollination, and pest and disease control.

Trophic Cascades

Recent scientific studies have researched the role of predators in trophic cascades to investigate how interactions within ecosystems impact species. A trophic cascade occurs when a top predator in a food chain suppresses the abundance of prey species, which in turn reduces pressure on the next trophic level, or species in the food chain. If the prey is an herbivore, then the top predator would decrease pressure on producers (plants). While any change in the trophic structure will cause a change in the ecosystem, there is debate as to the relative strength of top-down forces (removing the top predator) vs. the strength of bottom-up controls (changing plant productivity) (See Figure 5 and Table 2 in the Zion National Park Case Study).[40]

Large carnivores, many pushed to the brink of extinction during the 19th century, are rebounding in some areas, often as a result of reintroduction. This has created a unique scientific opportunity to understand the role of large predators in an ecosystem. Berger et al. studied the effect of grizzly bears and gray wolves in the southern greater Yellowstone ecosystem. In areas where grizzlies and wolves were locally extinct, there was an increase of moose, a riparian-dependent herbivore. The subsequent alteration of riparian vegetation structure and density caused the consequent reduction of avian neotropical migrants that rely on riparian willow communities.[41] This study supports the hypothesis that large carnivores play a crucial role in regulating terrestrial ecosystems, or the "top-down effect." The findings of this study have wide-reaching implications for our understanding of ecosystems impacted by predator removal or reintroduction.[42]

Climate Change

(See Figures 6 and 7)

Climate change is now a ubiquitous term that generates frequent conversation and debate and extensive media coverage (including more than 60 million "hits" on a Google Internet search). The Intergovernmental Panel on Climate Change stated in the 2007 report that "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice rising global average sea level."[43] Trends in increasing temperatures are occurring at levels well above background variation, and many studies have shown a strong link between human activities and temperature

Case Study: Trophic Cascade in Zion National Park, Utah

In a 2006 study, Ripple and Beschta examined the dynamic interactions between human use, cougar presence, deer presence, cottonwood growth, stream channel morphology, and populations of wildflowers, amphibians, lizards, and butterflies.[1] They found that areas with high numbers of human visitors to Zion Canyon within Zion National Park reduced cougar densities, which in turn allowed for higher mule deer densities, subsequent increased browsing intensities, decreased growth of cottonwood seedlings into mature trees, increased bank erosion, and reduction in both terrestrial and aquatic species abundance. Thus, the presence or absence of a large predator, in this case the cougar, appears to have significant effects on lower trophic levels as well as abiotic factors and native species abundance.

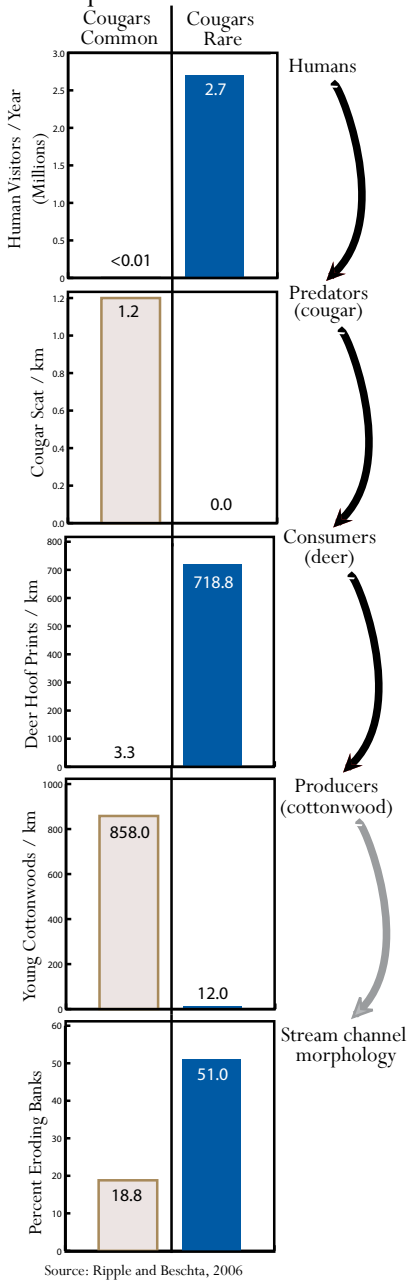
[1] Ripple, William J. and Robert L. Beschta. "Linking a Cougar Decline, Trophic Cascade, and Catastrophic Regime Shift in Zion National Park." *Biological Conservation* 133 (2006): 397-408.

Table 2: Species Abundance

	Hydroponic plants % of observations (rushes, cattails, scouring rush)	Wildflowers No. / km (Asters, Cardinal flowers)	Amphibians No. / km (frogs, toads)	Lizards No. / km	Butterflies No. / km
Cougar Common	63.8	808.3	358.4	16.7	58.3
Cougar Rare	14.3	0	1.4	6.3	13.3

Source: Ripple and Beschta, 2006

Figure 5:
Trophic Cascade



Source: Ripple and Beschta, 2006

changes.[44] Warming has had significant impacts on wildlife in the last 100 years, and various studies and models predict that warming will continue to put escalating pressure on species and their habitat (See Table 3).

Research by the U.S. Geological Survey indicates that given the current trends in carbon dioxide emissions, expansive sagebrush habitats throughout the western U.S. could decline by 59 percent before the end of this century.[45] Sage grouse, mule deer, pronghorn, and many other species that rely on these areas are likely to decline in the face of shrinking habitat.

Sage brush habitat is not the only land type that is predicted to face significant impacts due to climate change. The Great Basin of western North America is a region of interior drainages between the Rocky Mountains and the Sierra Nevada. A modeling study of the effects of climate change on biodiversity predicted that a 3°C increase in average temperature will cause boreal habitat to recede 500 meters upslope and cause the extinction of 44 percent of the mammals that live in the area.[46]

High-elevation species are especially vulnerable to global warming as there is only a limited amount of space for retreat to higher elevation habitat. The American pika, which lives in high-elevation talus fields, is acutely sensitive to high temperatures and may die in one hour if exposed to temperatures above 75ºF. Beever *et al*. reported that 28 percent of populations in study areas in the mountain ranges of Nevada had experienced recent extirpations, likely due to habitat loss and warming.[47]

Changes in water temperature and streamflow will have drastic impacts on salmonids (a family of fish that includes salmon and trout). Scientists at the University of Wyoming estimate that a 5.4ºF increase in average July air temperatures could eliminate 50 percent of currently viable trout stream habitat in the Rocky Mountain region.[48]

These examples are by no means exhaustive of the implications climate change has for wildlife; however, they do illustrate some of the challenges that wildlife will face in combination with other human influences. Overall, research on climate change indicates that temperature rise and its associated effects will have profound effects on wildlife.

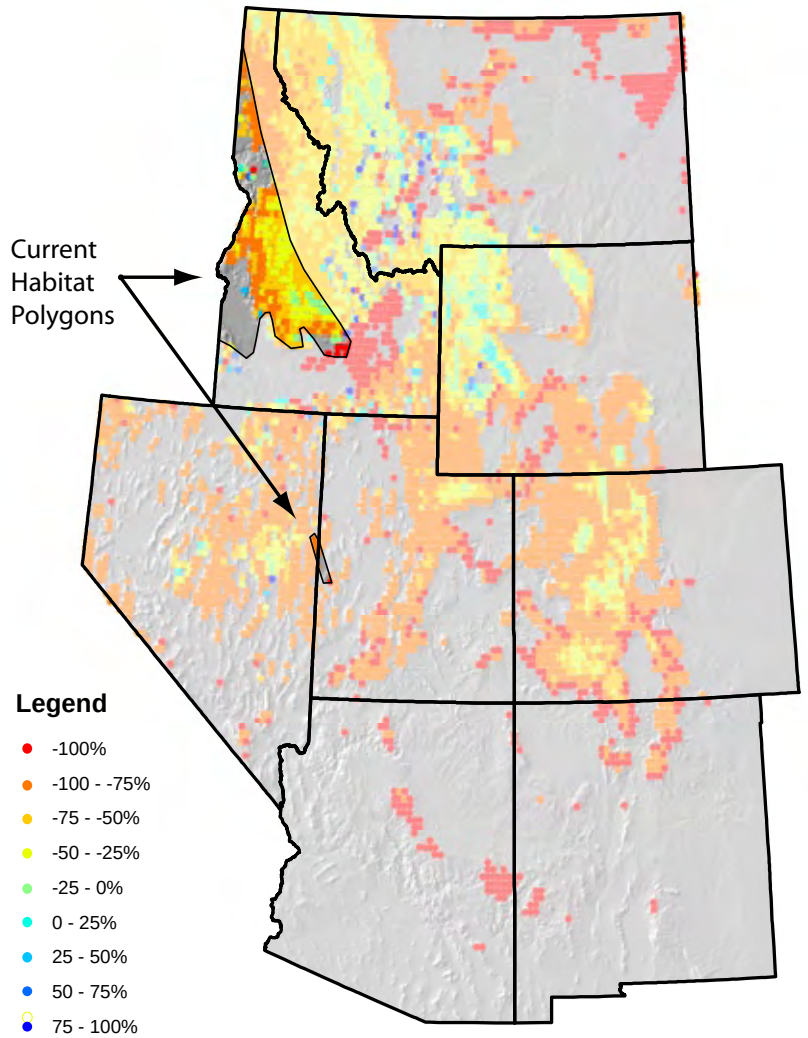
Diseases in Wildlife

Wildlife has evolved alongside many endemic diseases that play an important part of natural population dynamics and evolution. However, introduced diseases can be catastrophic for wildlife conditions and populations, especially when species are already at risk due to other pressures. Often, human-caused conditions create dangerous disease situations for wildlife.

Disease emergence almost invariably results from a change in the ecology of the host, the pathogen, or both. Expanding human populations can put pressure on wildlife habitats, increasing wildlife population densities. Higher population densities can lead to the emergence or higher prevalence of infectious diseases in wildlife.[49] For example, the Jackson National Elk Refuge was created in 1910 to feed wintering elk and keep them off private lands (see case study on page 96). Elk gather in the thousands to feed on the refuge. In this situation of unnatural crowding, diseases which are normally of low prevalence in the population can run out of control. An estimated 35 percent of the elk that winter at the feedgrounds have been exposed to brucellosis; in contrast, only 2 to 3 percent of those wintering on native range without supplemental feed have been exposed.[50]

Brucellosis in bison and elk is a controversial

Figure 6: Current Wolverine Habitat and Projected Snowpack Change, 1976 to 2085



Note: values here reflect the percent change in snowpack from the 1961-1990 baseline for the time period 2070-2099, using the IPCC A1 carbon emission scenario (business-as-usual) and the HADCM3 climate model. The year1976 is the 1961-1990 midpoint; 2085 is the 2070-2099 midpoint.

Sources: Laliberte and Ripple, 2004; ATMOS Consulting, 2004

topic in the Rockies. Scientists have argued that brucellosis in bison in Grand Teton National Park is related to the presence of the disease in managed elk herds that share grazing areas.[51] Brucellosis is an infectious contagious disease caused by the bacteria *brucella abortus*.[52] In cattle and ungulates, including bison and elk, infection with the bacteria results in third trimester abortion in 80 percent of animals. Retained placenta and other complications such as inflammation of the uterus are also common.[53] After an initial abortive event, cattle are usually unaffected by the disease, but continue to have circulating antibodies and may be carriers of the bacteria.[54]

Once the animals have the disease, it is untreatable. However, vaccines are available that range from 65 percent effective for both cattle and bison (Strain 19),[55] to 80 percent effective in cattle (Strain RB51).[56] Brucellosis is a zoonotic disease, which means that it can be transmitted from animals to humans. Humans can contract the disease by ingesting unpasteurized dairy products, handling the tissues of infected animals, or inhaling infectious particles. Rarely, transmission is caused by eating undercooked meat.[57] Human-to-human transmission is infrequent. The disease manifests itself in humans with an irregular or "undulating" fever, headache, sweats, back and joint pain, fatigue and weakness. Severe infections may affect the central nervous system or the lining of the heart and can result in death.[58] At-risk populations include butchers, veterinarians, lab workers, hunters, and travelers. Diagnosis involves culturing the bacteria from body fluids or testing for *brucella* antibodies. Treatment for humans involves taking a combination of antibiotics for an extended period.[59]

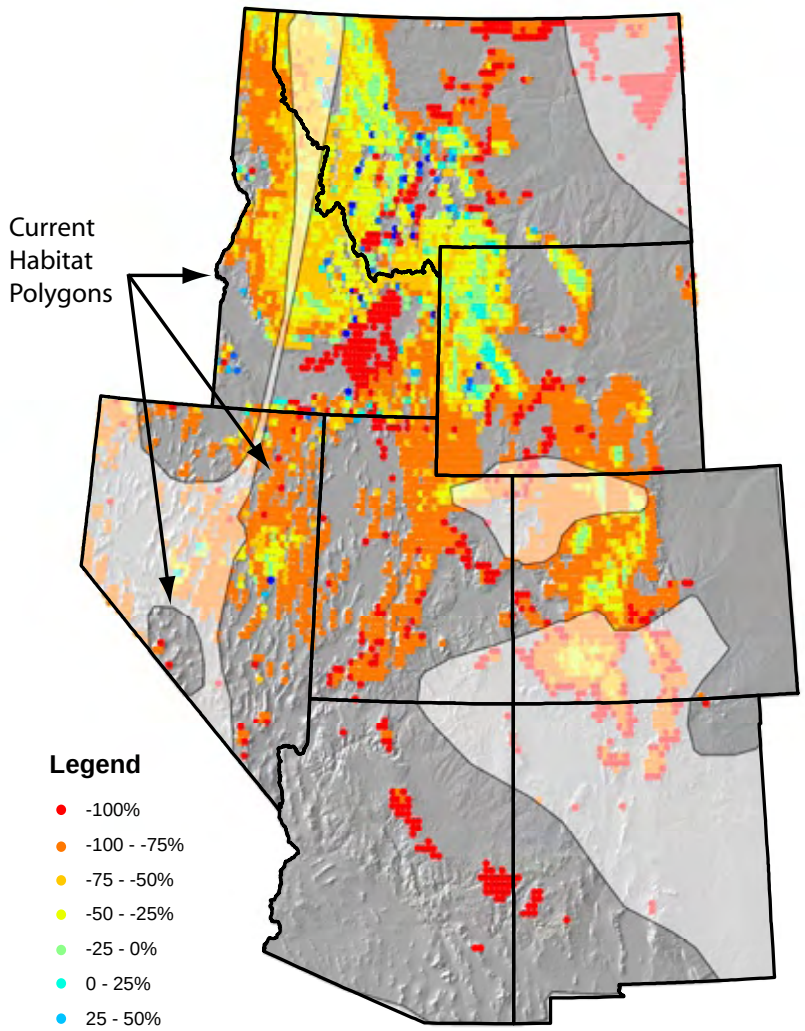
Before antibiotics became easily available, the disease was highly problematic in the U.S. In 1934, The Animal and Plant Health Inspection Service (APHIS) set out to eradicate brucellosis from the U.S.[60] The approach with cattle has been to test, slaughter infected animals, trace back the source of the infection, investigate the case, and vaccinate. However, pasteurization has made the disease uncommon, with only approximately 100 to 200 cases per year in the U.S.[61] Now, most infections in the U.S. are the result of returning travelers who have eaten soft, unpasteurized cheeses in foreign countries.

Although the disease status in the U.S. has changed significantly since 1934, APHIS is still legally bound by the 1934 guidelines. While the test and slaughter program has been highly effective in domesticated animals, the disease persists in wildlife. The brucellosis-free status that many states enjoy has recently been revoked in Montana due to the presence of infected herds. The blame has been primarily focused on wild ungulates that carry the bacteria. For a detailed discussion of the brucellosis issue in the Greater Yellowstone ecosystem please see the Bison in Yellowstone Case Study.

The large number of bison held on private ranches around the U.S. will buffer the species from extinction by brucellosis. The Yellowstone bison herd, however, is among the last with pure bison genetics, most others have been mixed with cattle. However, diseases in endangered species, especially introduced diseases, can have compounding and dangerous consequences.

Human influence on ecosystems, such as the widespread introduction of nonnative flora and fauna into new areas is increasing biogeographical homogeneity. Disease introduction, termed "pathogen pollution," can have similar and compounding effects. Pathogen pollution can cause catastrophic depopulation of native,

Figure 7: Current Bighorn Sheep Habitat and Projected Snowpack Change, 1976 to 2085



Note: values here reflect the percent change in snowpack from the 1961-1990 baseline for the time period 2070-2099, using the IPCC A1 carbon emission scenario (business-as-usual) and the HADCM3 climate model. The year1976 is the 1961-1990 midpoint; 2085 is the 2070-2099 midpoint.

Sources: Laliberte and Ripple, 2004; ATMOS Consulting, 2004

Table 3:
Observed And Projected Changes In Western U.S. Climate Change And Impacts To Wildlife

	20th Century Changes (+1°C)	Future Projections (2020-2029, 1-1.5°C)	Implications for Wildlife
Warmer stream temperature		+0.6-1.2°C	-Reduced survival and reproduction of salmonids. -Impacts on cold water fisheries.
Warmer winters and spring	0.1°C per decade through 20th century – greatest warming in spring and winter.	+1-1.5 °C; greater magnitude of warming in spring and winter	-Shifting geographic range. Increased pest and pathogen outbreaks. -Impacts for animals with temperature dependent sex determination. -Accelerated parasite life cycles and improved pathogen survival.
Earlier spring arrival	Advancement of spring by 5 days per decade. Longer growing season by 2 days per decade.	Continued earlier spring arrival.	-Earlier migrations, nesting, breeding, budburst, flowering. -Changes in synchrony and inter-species interactions.
Streamflow	Peak streamflow 3 weeks earlier than average in existing historical record.	Earlier peak streamflow. Higher winter and early spring flows. Lower summer flows.	-Higher flood frequency. -Earlier peak flow. -Reduced natural summer and autumn flows. -Reduced frequency of reservoir refill. -Increase in the duration of summer dry period. -Floodplain habitat increasingly isolated from the active river environment. -Reduced habitat and survival for terrestrial and aquatic species. -Increased scouring of fish nests, aborting development.
Snowpack	April 1 snow water equivalent declining 15-30%. Earlier snowmelt timing.	Generally decreasing snowpack. Decreased length of snow season.	-Reduced habitat for bighorn sheep, wolverine and other snow-dependent species. -Reduced water availability. -Shrinking alpine habitat.
Glaciers	Declines in glacier volume and area across the west.	Glaciers in Glacier National Park disappearing by approximately 2030.	-Impacts on wildlife that relies on glacier fed streams and lakes.
Fire	Longer fire season. Increased fire frequency and intensity largely due to spring and summer warming and earlier spring snowmelt.	Even longer fire seasons. Increased fire frequency and intensity.	-Six times more acres burned over the last 15 years vs. previous 15 years. -Changes in forest species composition. -Changes in physical forest structure. -Increases in invasive species.
Invasive Species	Spreading worldwide. Outcompeting native Wildlife.	Spreading throughout the west.	-Habitat under climate change more hospitable for invasive species than native species.

Source: Western Governor's Association, 2008

naïve populations and if the pathogen persists it can result in chronic population depression. Ultimately, if the disease evolves in such a way that fewer infected animals can propagate the disease, local extinction can occur.[62] Reintroductions intended to bolster small populations create another disease threat for endangered species. The goal of captive breeding programs is to maintain genetically viable, healthy populations for subsequent release into the wild. The potential to introduce infectious agents into unexposed wild populations in sensitive, protected areas constitutes a serious hurdle for restorative conservation efforts.[63]

Conclusions

The Rocky Mountain West is home to thriving dynamic ecosystems, diverse wildlife, and expansive landscapes. Currently, the eight-state region also supports rapid population growth and booming development. From 2000 to 2006, the population in the Rockies grew 15 percent, while the rest of the U.S. grew 6 percent.[64] Prime wildlife habitat is often sought after as areas for housing developments, fossil fuel and mineral extraction, and agriculture.

Undoubtedly, human land uses directly and indirectly impact wildlife. The question is not whether urban areas will grow or not, but rather how and where they will grow. Pre-meditated, careful planning and effective strategies in community building can significantly reduce the impacts of habitat fragmentation. By balancing development with protecting crucial habitat and maintaining ecological permeability of the landscape, wildlife can effectively move between habitat areas.[65] Careful planning decisions will also affect the quality

of life of people living in these communities and will determine whether the wildlife so emblematic to the West will persist in the future. Ultimately, by planning ahead and making informed decisions, development will be less expensive and more compatible with wildlife.[66]

The long-term impact of human influence on wildlife and wildlife habitat, whether positive or negative, benign or catastrophic, depends on our willingness to be responsible stewards.[67] Wildlife is being constricted into smaller habitat areas and populations face non-endemic diseases, climate change, introduced species, and other human impacts. Careful and effective management will become increasingly important in maintaining the wildlife populations that are so crucial to the functioning ecosystems of the West. As wildlife protection and management moves into the future, government legislation, conservation initiatives, and public voices will be essential in lobbying for wildlife that cannot speak for itself.

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Case Study: Craighead Beringia South Research and Educational Center

Pulling up to the research center in Kelly, Wyoming, on a hot July day the Rockies research team was immediately greeted by the squawking of adolescent ravens. These orphaned birds are a part of the institute's ongoing raven ecology project. Craighead Beringia South Research Center was established in 1998 by Derek J. Craighead as a nonprofit educational and scientific institute. Currently, Derek and his team of researchers are conducting research in the ecologically rich area of Grand Teton National Park, the Gros Ventre River, and the Jackson Hole valley. Overall, the mission of Craighead Beringia South is "to better understand the dynamics of environmental change so that man may be better prepared for his future."[1]

Current projects at the research center include studies of the ecology of the common raven, red-tailed hawk migration, dynamics of the cougar population in Grand Teton National Park, northern Yellowstone large carnivores, and the demographics of sage grouse in the Jackson Hole area. Many of these projects focus on indicator species, which can reveal much about the general health of the ecosystem. Because ravens occupy a top tier in the food chain, the birds serve as an indicator species in the Jackson Hole ecosystem.[2]

In Jackson Hole, the raven population has increased by at least 600 percent over the past 55 years. During the same period, red-tailed hawks, which compete with ravens for prey and nest sites, have declined in number at the same rate. Derek Craighead and Bryan Bedrosian are the lead researchers for the raven ecology project at the institute. By studying nest site competition, reproductive success, roosting ecology, feeding habits, and the impact of West Nile Virus, Craighead and Bedrosian hope to better understand these population changes. Similarly, as large predators have been reintroduced into the Rockies and their numbers expand, the Craighead family has been conducting long-term research on grizzly bears, wolves, cougars, and black bears. Habitat use and interactions among these predators have been important aspects of the studies. The research center is also actively pooling data from researchers working on these specific animals to formulate trends on the effect of carnivore groups on their environment.


Meeting a friend of Beringia South

Researchers from the institute have also been investigating sage grouse, which have been declining in many parts of the West, particularly Wyoming. As energy development rapidly expands in the Pinedale area and sage grouse populations decline, Craighead Beringia South researchers have worked to establish baseline data for Jackson, where energy development has not threatened grouse habitat. Sage grouse are a particularly important part of the ecosystem as they are the main protein fixers in the food chain and therefore are an important food source for predators. Sage grouse numbers thus have a large impact on other wildlife. After the results of the research are reported, Derek sees the real question as what will society be willing to sacrifice for wildlife?[3] In the case of sage grouse, the sacrifice might be slowed or halted gas drilling. For a more complete discussion of the impact of energy development on wildlife, please see its section in the *2009 Report Card*. The detailed research by the Craighead Research Center and other researchers in the region is crucial for understanding the dynamics of wildlife range and population and recognizing the human impacts on these systems.


Rockies Researchers at Beringia South

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Case Study: Yellowstone Bison-Cattle Brucellosis Controversy: Pointing fingers over the spread of brucellosis

A Brief History of Bison in Yellowstone:

Yellowstone National Park is the only area in the lower 48 states where bison have existed in a wild state since the Pliocene Epoch.[1] However, Yellowstone was not immune to the effects of drastic market hunting and habitat destruction in the 19th century. Although the National Park was established in 1872, the bison population continued to dwindle due to poaching and was composed of only 23 animals in 1902.[2] In the same year, the park purchased 21 bison from private herds in Texas to bolster the population.[3] Brucellosis was first detected in Yellowstone bison in 1917. It is likely that the disease was transferred to bison from domestic cattle raised in the park in the early 1900's to provide dairy products and meat for the visitors.[4] From 1907 to 1930, the Yellowstone herd was fostered at the Buffalo Ranch in the Lamar Valley of the Park.[5] As the herd grew, it became increasingly evident that the bison, which as adults weigh between 900 and 2,100 pounds, are not particularly respectful to fences. After many years of rounding up the bison each time they broke free to of the fences, the Park Service decided to let the bison roam freely in the park.[6]

Eventually, the bison regained their natural migration pattern from the high elevations in the central areas of the park in the summer to the lower elevation areas to the north and to the west of the park in the winter. While the bison were allowed some room to roam, they were still heavily managed by park officials. Between 1934 and 1967, Yellowstone National Park operated under a plan of culling ungulate populations for achieving predetermined stocking levels.[7] In 1968, this management strategy changed to a regime of ecological management in which populations of bison and all other wildlife in the park were allowed to fluctuate without human intervention.[8] Growing bison herds caused contention about the transmission of brucellosis from bison moving beyond park boundaries, concern about the effects of snowmobile use on bison movements and controversy over expanding bison ranges.[9] Now, bison are protected and managed by the National Park Service within the park, but once they step foot outside the boundaries, they fall under the jurisdiction of the state. Management techniques have evolved over time, but with an estimated population of 3,000 animals, the same issues of brucellosis and bison moving beyond park boundaries continue to make the future and extent of the Yellowstone bison herds uncertain.

Bison in corral, Yellowstone National Park, 18991-1936. © American Environmental Photographs Collection, [AEP Image Number, e.g., AEP-MIN73], Department of Special Collections, University of Chicago Library.

Bison in Yellowstone Today:

During a cool July morning the Rockies research team met with Rick Wallen, Yellowstone's head bison biologist. From the picnic table at the Buffalo Ranch, where the Yellowstone herd was contained in the early 1900's, we could see a few dozen bison grazing near the banks of the Lamar River. Wallen started off by giving a short background of bison in the West and the genetic background of the Yellowstone herd, which is one of the few remaining pure herds. He stressed that 100 years ago many wildlife populations were at all time lows due to hunting and habitat pressures and that Yellowstone bison are a success story in that the herd has grown from just 44 animals in 1902 to 4,694 animals in the summer of 2007.[10] Despite this bright statistic, Wallen is well aware of the challenges that face Yellowstone bison and other wild herds in the west.

Currently, the Park Service is one of five agencies in a management plan which dictates when and where bison can be outside the park.[11] As temperatures drop and snow falls on the high elevation plateaus of Yellowstone, the animals seek better grazing in the lower elevation areas north and west of the Park boundaries. It is during this time that bison are hazed back into the park, captured, quarantined or slaughtered. Hazing involves attempting to move the bison back into the park using horses, ATVs, snowmobiles and helicopters. The stated rationale for this intensive management and attempted containment is to prevent bison from transmitting brucellosis to cattle.

Wallen is straightforward about the prevalence of brucellosis in the Yellowstone herd – he is constantly working in the field to gather accurate and up to date data on population, genetics and disease occurrence. While finding exact prevalence rates for brucellosis is logistically unfeasible, extensive testing reveals that about 50 percent of Yellowstone bison have antibodies to brucellosis and

about 25 percent are actively infected during late winter.[12] The presence of antibodies indicates that the animal has been exposed to the bacteria, however, antibodies alone do not indicate if the animal has an active infection nor do they indicate whether the individual is contagious or not. A much more expensive and time consuming test, live culture of the bacterium, is necessary to indicate an active infection that could be transmitted. A Texas A&M University study carried out in 1990 demonstrated that bison infected with *Brucella abortus* could transfer the disease to cattle in a confined, controlled setting.[13] Environmental groups, such as the Buffalo Field Campaign, are quick to point out that there has never been a documented case of transmission in the wild.[14] In any case, it is the high brucellosis infection rates of the Yellowstone bison which have incited large scale management techniques by a variety of agencies, mainly the National Park Service and the Montana Department of Livestock.

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The proportion of Yellowstone bison that move out of the park into unprotected winter range varies from 3 to 30 percent annually. The mortalities that result from management techniques, which include hazing, capture and removal, can be high. For example, in the 2007 to 2008 season, 1,728 bison were removed through a variety of management techniques including slaughter, quarantine, and hunting.[15] However, the Yellowstone bison have a high reproductive capability and following high herd reductions, approximately 75 percent of reproductive age females conceive during the next breeding season.[16] The population recovered quickly from high mortality rates from the severe winter that occurred during the 1996 to 1997 season. From 1997 to 2005, the annual population growth rate was 11.5 percent.[17] Presently, the culling practices aim to prevent bison-cattle interaction and maintain a minimum population of 2,500 at the end of the winter. Although Wallen's research team is currently doing genetics testing on the bison, preservation of the Yellowstone herd's genetic diversity has not yet been a consideration in the containment and slaughtering practices. However, Wallen hopes that the management plan will change in order to incorporate this and other important biological considerations into the management activities.

Wallen sees the current management practices of hazing, quarantine and slaughter as far from the ideal situation. Yet the legalities of APHIS and the Montana Department of Livestock hold precedence over the biological aspects of the situation and the protesters who detest such treatment of wildlife. In 2000, the critical habitat for bison was extended slightly beyond the boundaries of Yellowstone, however, these protected areas still do not encompass the whole of bison habitat and there are strict limitations as to how and when the habitat is available to bison.

Wallen is optimistic and hopes that the future will bring a new management plan that will allow the Yellowstone ecosystem to function as naturally as possible and that will foster good relationships between the Park and its neighbors.

Moving Towards Solutions:

Yellowstone National Park is not a self contained ecosystem. It comprises only 11%, or 2.2 million acres, of the Greater Yellowstone Ecosystem which is nearly 20 million acres.[18] In Yellowstone Park, the deep snow of the harsh winter covers the forage. Bison migrate out of the park to lower elevations where snowpack is not as dense and forage can be reached underneath. Because bison leave the park, they face harassment and possible death because of current management practices that are closely tied with brucellosis management.

The Greater Yellowstone Coalition (GYC) asserts that practical solutions exist to manage bison as wildlife while at the same time managing the risk of disease transmission from bison to cattle. GYC operates under the fundamental conclusion that bison are wildlife and need more habitat and tolerance outside the park's boundaries, and the assumption that disease transmission between bison and cattle can occur. The GYC challenges agencies to think about policies based on this assumption to ensure reasonable

Yellowstone Bison Case Study Continued

separation between bison and cattle. To ensure this separation, GYC recommends grazing buyouts on some private and public lands, effective fencing between bison and cattle supplemented by some subsidies, and fundamental changes to the Interagency Bison Management Plan (IMBP).[19] Amy McNamara of the GYC also points out that the regulations regarding brucellosis management were established in the 1930's - when milk was not routinely pasteurized – and that the policies need to change with the times, removing the requirement that cattle herds testing positive for brucellosis be slaughtered.[20] While APHIS has been highly successful with the test and slaughter technique for eradicating brucellosis from cattle, that method is logistically and financially unfeasible in wildlife. GYC would like to see funds directed at developing a better vaccine for cattle that is more effective against brucellosis as well as focusing on a population management program similar to that used in managing elk, deer and other ungulate populations. GYC is in support of regulated and responsible hunting outside the boundaries of Yellowstone National Park.

Hunters and other advocacy groups argue that a legitimate hunt to regulate the bison population, coupled with protected winter range outside the park is part of a sustainable solution to the question of bison management. A limited bison hunt has been allowed in the area surrounding Yellowstone, however, the bison numbers taken during the hunt are very low compared with those taken to slaughter.[21] The best time to hunt bison is in the fall, yet during this time they are still within the park boundaries where hunting is not allowed. The hunting season in Montana stretches from November 15 to February 15, after which female bison are in the late stages of pregnancy and hunting presents an ethical issue.[22] Also, some hunters who believe in the fair chase principle, do not like to hunt bison because when threatened, bison circle up to protect their young and become easier targets, unlike elk that will almost always run to escape.[23] We have yet to see whether a full scale bison hunt will be implemented and if it will be effective in the scheme of bison management. For a more detailed discussion of hunting as a wildlife management tool, please see the Wildlife Management section in the *2009 Report Card*.

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[23] *Ibid.*

Case Study: The National Elk Refuge

Driving south on highway 151 towards Jackson, WY, the expanse of the National Elk Refuge extends to the east transected by the Gros Ventre River. In mid-July, one might wonder why it is called an "Elk Refuge". Almost no elk graze the lush pasture in the summer. However, in the winter 5,000 to 10,000 elk migrate from the high country in and around Grand Teton National Park to winter at the lower elevation of the refuge. To understand why the refuge has become the focal point of several high profile lawsuits and has faced intense criticism from environmental groups, it is helpful to understand the history of the land.

The history of the National Elk Refuge began in the winter of 1910-1911 when citizens of Jackson Hole began feeding elk due to severe winter conditions. Even at that time, accessibility to traditional winter ranges in the Southern part of Jackson Hole as well as the Green River, Snake River and Wind River basins was restricted. The problem was apparently solved with the supplemental feeding – elk were no longer dying on the doorsteps of Jackson Hole residents. In 1912, 1,760 acres of private lands were set aside by Congress as winter range for elk. A later series of executive orders expanded the refuge and broadened the purpose of the area to conserve habitat for birds and other big game besides elk. Currently, the vertebrate fauna that the refuge supports includes 48 mammal species, 175 bird species, 3 reptile species, 4 amphibian species and 11 fish species.[1] Today, the refuge covers 23,754 acres in Teton County.

Although much has changed since 1912, supplemental feeding of elk has continued and the elk population has ballooned. Prior to the feedgrounds, periodic severe winter mortality undoubtedly served as a natural population control on the elk herds, which enjoyed vast summer range and high reproductive capacity.[2] Now, thousands of elk that have become habituated to the refuge congregate at the feed lines every winter. Due to both wildlife management concerns and financial concerns, the refuge is actively trying to reduce reliance on supplemental feeding. In 2008, alfalfa pellets alone cost the refuge $989,000. Half of this cost is covered by the Wyoming Department of Game and Fish. The refuge is trying to decrease the dependence on winter feeding by increasing the production and utilization of natural standing forage.[3] When the State of the Rockies team toured the refuge in July, significant irrigation efforts were quite apparent. Approximately 1,300 acres of the refuge are seeded with non-native species and maintained to enhance grass production.[4]

Besides the enormous costs of supplemental feeding and irrigation, the refuge faces numerous management challenges. Due to extensive development in Jackson and the surrounding areas, the refuge is the best undeveloped winter range that remains. In addition to the elk, a growing population of bison has become habituated to the feeding and herd knowledge of natural migration routes has been lost. Diseases also present significant challenges to the refuge. The unnatural crowding of elk that occurs because of the supplemental feeding provides the perfect breeding ground for a variety of diseases that are normally maintained at low levels in the wild. Diseases of concern include: brucellosis, hemorrhagic septicemia, necrotic stomatitis, gastrointestinal viruses, respiratory viruses (P13, RSV), scabies and gastrointestinal parasites.

Managers of the refuge are particularly concerned about the future threat of chronic wasting disease and tuberculosis. Chronic wasting disease is a prion disease that infects deer, moose, and elk and has symptoms similar to mad cow disease. A prion is not a virus nor a bacterium, but rather an infectious protein. Chronic wasting disease is ultimately always fatal; however, infected animals will not show signs of infection for 18 months, during which they continuously shed infectious prions. The refuge managers are particularly worried that the National Elk Refuge could become a long-term source of infection because the prions can remain viable in the soil for an undetermined number of years. As such, the area could become unsuitable habitat for healthy elk populations into the future. At present, based on testing from samples hunters voluntarily provide, chronic wasting disease is mostly concentrated on the east side of Wyoming; nonetheless, concern for the spread of the disease is great – and has heightened since an infected moose was found approximately 45 miles away from the refuge.[5] Limited scientific investigations have not demonstrated that the disease is transmittable to humans from the soil. However, the evidence is not conclusive as to ungulate to human transmission.[6]

National Elk Refuge © Walt Hecox

On June 3, 2008, Earthjustice filed a lawsuit against the National Elk Refuge on behalf of Defenders

Jackson National Elk Refuge Case Study Continued

National Elk Refuge © Mark Gocke

of Wildlife, the Jackson Hole Conservation Alliance, the National Wildlife Refuge Association, the Greater Yellowstone Coalition and the Wyoming Outdoor Council.[7] These environmental groups argue that the Final Bison and Elk Management Plan and Environmental Impact Statement for the National Elk Refuge, released January 2007, violates the National Environmental Policy Act and the National Wildlife Refuge System Improvement Act, especially with regard to disease control.[8] Under the January 2007 management plan, the refuge plans to reduce the wintering elk population from 7,500 to 5,000 and the bison population from 1,200 to 500 through hunting over a 15-year period with a goal to maintain minimum genetic diversity levels. The plan will also attempt to reduce the need for supplemental feeding by improving habitat, but does not predict an end to supplemental feeding.[9] Therefore the environmental groups argue that the unnatural crowding at the feed lines will continue, producing hot beds for disease and reducing biological and environmental health.

To reduce the unnaturally high elk populations on the National Elk Refuge, supplemental feeding will need to be reduced over time and hunting pressure increased until a herd objective is reached that can be sustained on natural forage in the valley. Legislation, executive orders and administrative action determine the mission and goals of the refuge, which require laborious processes to amend and improve.

Hunting is an important tool for managing the size of the elk and bison herds in Jackson Hole. Hunting of elk occurs on the National Elk Refuge, in Grand Teton National Park and on other public and private lands throughout the valley. Some herds, which have been very successful at increasing in population size, have become adept at avoiding hunters and congregating in no hunting areas where they damage landscaping and natural forage. The hunting industry has a large sway in the future of the refuge and is in favor of options that aim to maintain high numbers of elk – and thus in favor of continued feeding. Tourism is also a factor for the elk refuge, and decreasing the size of the elk herd would likely be unpopular with the visitors. Phasing out supplemental feeding would likely result in significant population decreases. Other impacts involved with reducing supplemental feeding include increased elk grazing on rancher's pastures and increased elk depredation on haystacks. Jackson residents could experience property damage by foraging elk and bison.

Ultimately, the problem is that natural elk and bison migration routes have been lost due to development and reliance on supplemental feeding. Land in the Gros Ventre Valley may offer part of the solution in terms of encouraging the elk to regain a more natural migration pattern, but cannot be the only solution. The refuge has also considered the future option of providing incentives to ranchers to allow bison to winter on their lands. Most likely, a combination of management changes will be necessary to effectively address the issue of supplemental feeding on the refuge.

Though the most prominent, the National Elk Refuge is not the only feedground in Wyoming where unnaturally high populations of elk are being sustained. There are 22 additional feedgrounds managed by the State of Wyoming that face similar challenges involving elk populations, the cost of feeding and the threat of uncontrolled diseases.

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Impacts of Energy Development on Wildlife

Highlighting the Unique Resources of the Rockies

By Alex Weiss

The 2009 Colorado College State of the Rockies Report Card

Key Findings

35 1 30 46 30

- The Powder River Basin of Montana and Wyoming produces more than 35 percent of the nation's coal.
- The San Juan Basin of Colorado and New Mexico is the highest producing natural gas field in the country.
- Since drilling began in the area in 2000, the town of Pinedale has grown by 30 percent.
- Between 2000 and 2004, mule deer populations on the Pinedale Anticline declined 46 percent.
- Sublette County contributes 30 percent to Wyoming's total natural gas production.

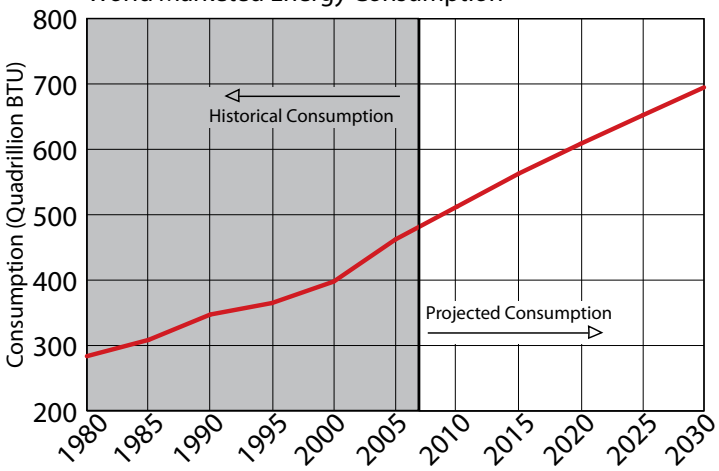
About the author: Alex Weiss (Colorado College '09) is a Student Researcher for the 2008/09 State of the Rockies Project

Introduction

Fossil fuel energy is one of the world's most valuable resources. Every good and service has an energy cost, and even producing energy requires an initial input of some type of energy. Mining coal, for instance, requires large diesel-burning engines in bulldozers, excavators, and transport trains. Solar panels contain silicon, an abundant resource that must nonetheless be mined and processed before it can be used in photovoltaic cells. The energy for these tasks has typically come from fossil fuels.[1] However, while fossil fuels are the most widely used, they are considered non-renewable resources because they take millions of years to form. Coal, petroleum, natural gas, and other fossil fuels are formed from the fossilized remains of organisms that lived hundreds of millions of years ago. Other sources of energy include hydroelectric, nuclear, and geothermal energy; combined, however, these sources constitute only 13 percent of world primary energy production.[2]

Worldwide, energy consumption has increased nearly two-fold since the early 1970's,[3] with most of the increase in India and China. From 1980 through 2005 China's energy consumption increased by almost 400 percent, while India's energy consumption increased by more than 400 percent, and the United States' energy consumption rose by slightly less than 30 percent.[4] Together, China and India are projected to account for more than 45 percent of the worldwide increase in primary energy demand in the next twenty years.[5] During that same time, the International Energy Agency reports that global demand for energy will increase by more than 50 percent (See Figure 1).[6]

Figure 1:
World Marketed Energy Consumption

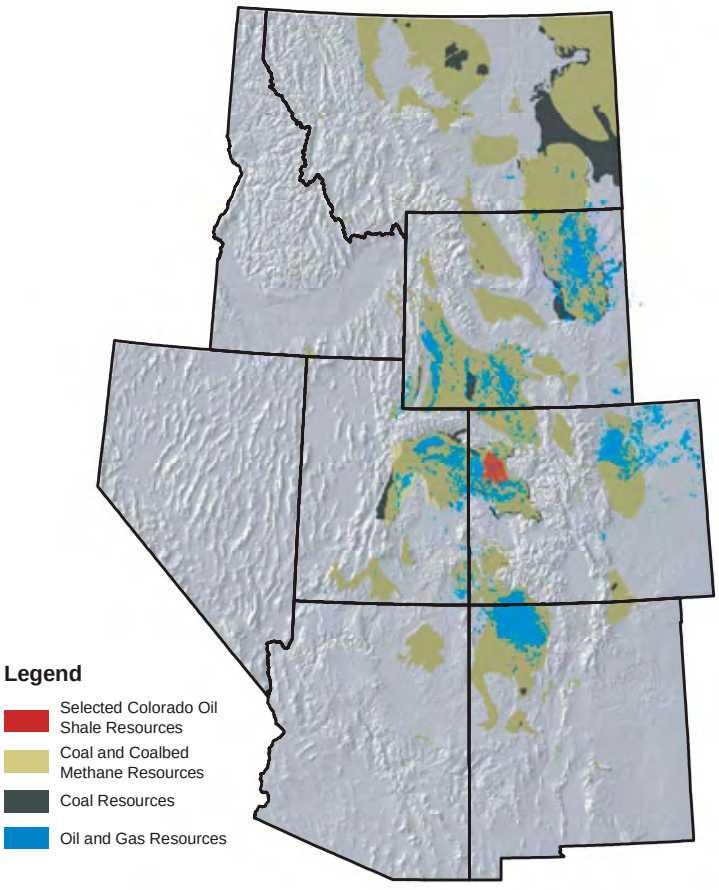


Source: Energy Information Administration, International Energy Outlook, 2008

The U.S. is an energy-thirsty nation. Although having only 4.5 percent of the world's population,[7] the U.S. consumes 21.3 percent of the world's primary energy.[8] Historically, the U.S. produced most of the energy it used nationally. It was not until the late 1950s that consumption outpaced domestic production. Wood supplied most of early settlers' energy needs until 1885 when coal supplanted wood as the most burned fuel. By 1947, however, petroleum had rocketed past coal as the most consumed fossil fuel in the U.S. Seventy percent of all petroleum consumed in the U.S. is used for transportation, and gasoline is the petroleum industry's principal refined product. The rise of suburbia and the subsequent reliance on personal vehicles for transportation have contributed significantly to the huge increase in petroleum consumption across the U.S.[9] [10]

Despite the fact that the U.S. is the world's third-largest oil producer, it imports around 60 percent of the petroleum it consumes. Ever since the U.S. hit peak production of oil in 1972, it has become increasingly reliant on foreign sources of oil. The Arab oil embargo of the 1970s that sent shocks through the American economy is a clear example of the U.S.'s vulnerability from heavy reliance on oil importation. Today, reducing dependence on foreign oil is one of the federal government's top priorities. In June of 2008, President Bush called for an injunction on the executive ban

Figure 2: Conventional Energy Resources in the Rockies



Note: Colorado oil shale resources include the Piceance Basin deposits in west central Colorado. GIS data for the Green River Formation oil shale deposits were not available.

Sources: oil shale - USGS, 2007; coalbed methane - Department of Energy, Energy Information Administration, 2007; coal resources - USGS, 2001; oil and gas resources - Department of Energy, Energy Information Administration, 2001

of offshore drilling on the Outer Continental Shelf, citing that it would increase energy independence. For now, however, interest has turned inland, to the Rockies' energy-rich basins.

The Riches of the Rockies

Over a century ago, prospectors, traders, hunters, and ranchers left the rapidly expanding eastern seaboard in search of plentiful and largely untapped resources of the West. Although each new settler had individual goals in mind, many shared the vision of finding wealth, freedom, and natural beauty. Today, those aspirations still attract new residents, making the Rockies the fastest growing region in the U.S.[11] Yet despite the region's growth, the eight-state Rockies' region remains the wildest and most mountainous land in the lower 48. The vast prairies and basins of the Rockies are home to pronghorn, a big game species that makes the longest land migration of any mammal in the lower 48 and which is the only member of its family in the world. Elk, mule deer, mountain goats, bighorn sheep, and some of the last genetically pure bison also call the various ecosystems of the Rockies home. In addition, the region boasts some of the nation's iconic birds, including bald and golden eagles, great horned owls, greater sage-grouse, and the whooping crane. The wildlife, vistas, wide-open spaces, and 14,000 foot peaks of the Rockies draw recreationists, tourists, hunters, and anglers in droves.

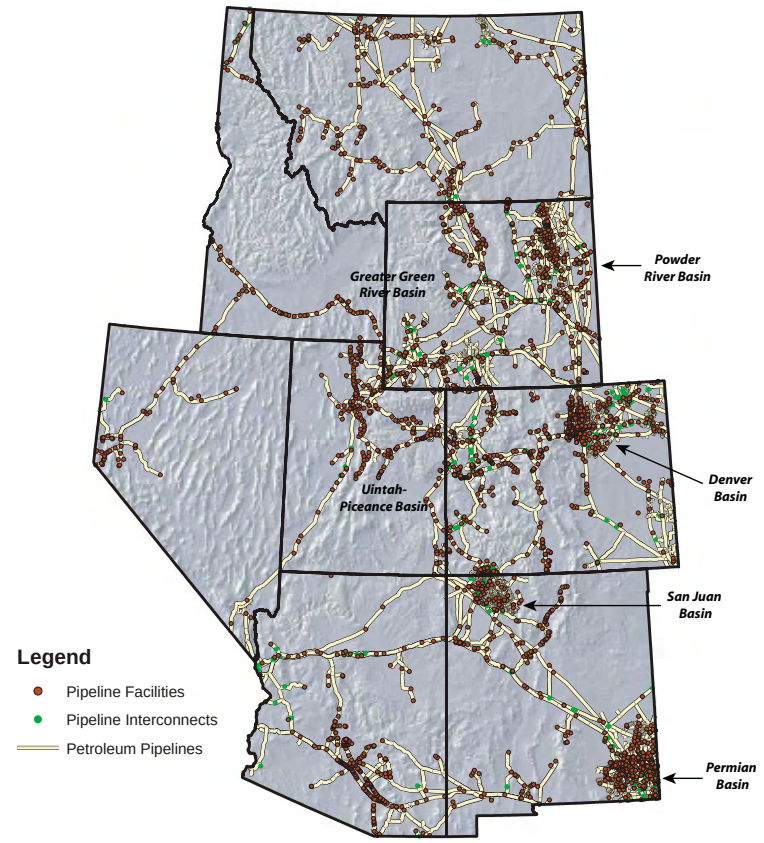
Beneath the natural beauty and snow-capped mountains lie vast energy reserves of fossil fuels. The Powder River Basin of Wyoming and Montana produces more than 35 percent of the nation's coal.[12] The San Juan Basin of Colorado and New Mexico is the single highest producing natural gas field in the country, and the Powder River Basin ranks third, and the Pinedale Field and Jonah Field rank fifth and sixth, respectively.[13] Utah contains three of the nation's 100 largest oil fields and two of the nation's 100 largest natural gas fields. The Rockies are currently the energy storehouse for much of the nation, and the development of these energy resources provides the Rocky Mountain states with enormous tax and royalty revenue. In 2005, Colorado received $132 million in severance tax revenue from oil and gas production.[14] Encouraged by federal policies and the enormous demand for energy, the Rockies region finds itself in the midst of an unprecedented energy boom (See Figure 2, Figure 3 and Figure 4).

But the natural treasures of the scenic Rocky Mountains and the valuable hydrocarbons beneath them do not exist in isolation. All too often, these two very different assets are in conflict with each other. Direct and indirect loss of habitat, habitat fragmentation, and the reduction of high-quality habitat from the expansion of energy development have had negative impacts on wildlife populations. Caught in the middle are the local people of rural areas, where energy exploration and production often occur. Once mainly dependent upon hunting and fishing for revenue and recreation, many rural communities are now faced with the lucrative but potentially unstable industry of energy development. The upward trend in energy development not only threatens sensitive wildlife resources but also the ways of life of residents and the experiences of visitors.

In this section of the *Report Card*, a case study of the Pinedale Anticline in the upper Green River valley ecosystem in southwestern Wyoming serves to illuminate the conflict between energy development and wildlife. This area is already experiencing a lucrative and highly productive energy boom. But these less densely settled areas are also important habitats for species such as mule deer and sage grouse.[15] Development has altered the migration patterns and encroached on the habitats of these species, which must maneuver around traffic, drilling rigs, and barren patches of land in order to move between their summer and winter ranges.[16] Research is now underway in Pinedale to track and monitor wildlife behavior in hopes of finding ways to alleviate the impacts of development on wildlife.

In Pinedale, Wyoming, conflicts among the energy industry, public agencies, conservation groups, and the general public have spurred seemingly endless debate. Those in favor of the energy development argue

Figure 3: Rockies Oil and Gas Infrastructure - Pipelines, Pipeline Facilities, and Interconnects



Source: Pennwell MAPSearch, 2006

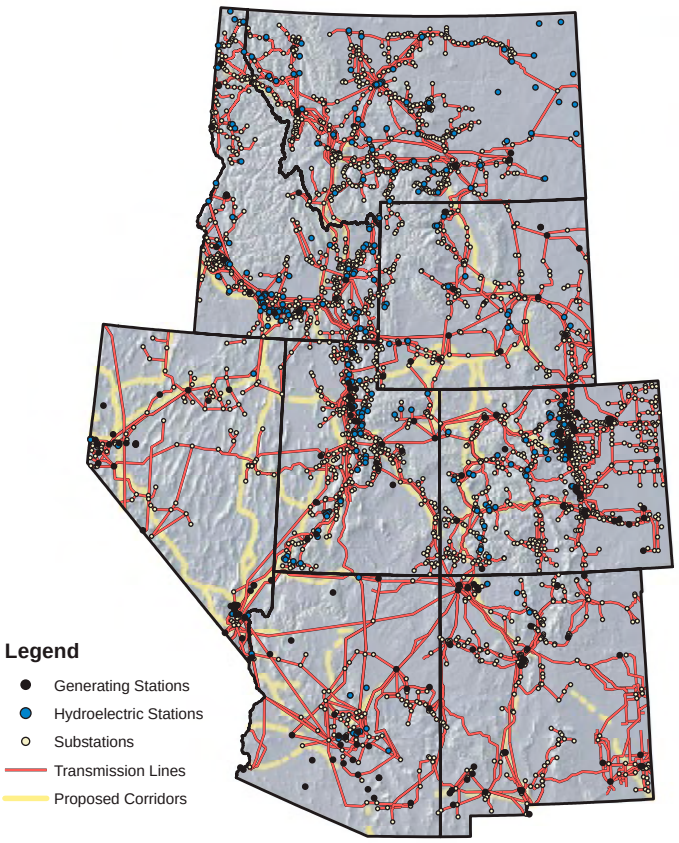
that leasing and royalty revenues are a boon to the people and economy of Pinedale. The natural gas revenue from the Pinedale Anticline, often considered to be the nation's second largest natural gas field,[17] has contributed to the construction of a new aquatic center and sports facility, and every fifth grader in Pinedale received a new laptop.[18] But opponents voice concern that the large influx of workers and the quick pace of development have out-paced the abilities of Pinedale, the sagebrush valley, and wildlife to adapt. Between 2000 and 2004, mule deer populations on the Pinedale Anticline declined by 46 percent, due in part to natural gas development.[19] In 2008, an air quality monitor in Boulder, WY, just south of Pinedale, recorded an ozone value, which averages the fourth-highest reading over an eight hour period per day, at 0.122 parts per million (ppm), higher than the Environmental Protection Agency's limit of 0.08 ppm.[20] Some residents have raised concerns about the health effects of poor air quality. In spite of these concerns, the energy boom continues. The Bureau of Land Management (BLM) is implementing a plan that would allow more than 4,000 more gas wells to be drilled on the Anticline.[21]

Outlook

At a time when energy production nationally is slowing, the Rockies Region has rapidly become America's energy supplier. The Rockies not only contain abundant reserves of coal and natural gas, but 58 percent of the land in the eight-state region is owned by the federal government. Of that 58 percent, nearly half is administered by the BLM, the largest landlord of the federal government.[22] The BLM is tasked with managing all land for "multiple use," defined as the "management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people."[23] This includes recreation, mineral extraction, grazing, timber harvesting, hunting, fishing, and wildlife and cultural resource preservation. Balancing these resources is no simple endeavor because they often overlap, and citizens, interest groups, and corporations often perceive the balance tipped against their favor. Thus, the BLM acts as a rule maker and mediator in the inevitable conflicts of interest that ensue (See Figure 5).

All sides of the debate have legitimate interests and values at stake concerning their position on energy development in the biologically and resource-rich Rockies region. Organizations such as Trout Unlimited, the Theodore Roosevelt Conservation Partnership (TRCP), the National Wildlife Federation, and other hunting, fishing, and environmental groups have teamed up, joining their interests in conserving land and waterways with a reasonable understanding of the necessity and inevitability of energy development. Sportsmen for Responsible Energy Development, an organization that has united over 20 different conservation groups, has written a *Sportsmen's Bill of Rights* that encourages hunters and anglers to commit themselves to habitat conservation and the preservation of public land.

Figure 4: Electricity Infrastructure of the Rockies, Including Proposed Corridors Under the West-Wide Energy Corridor Program



Source: Pennwell MAPSearch, 2006

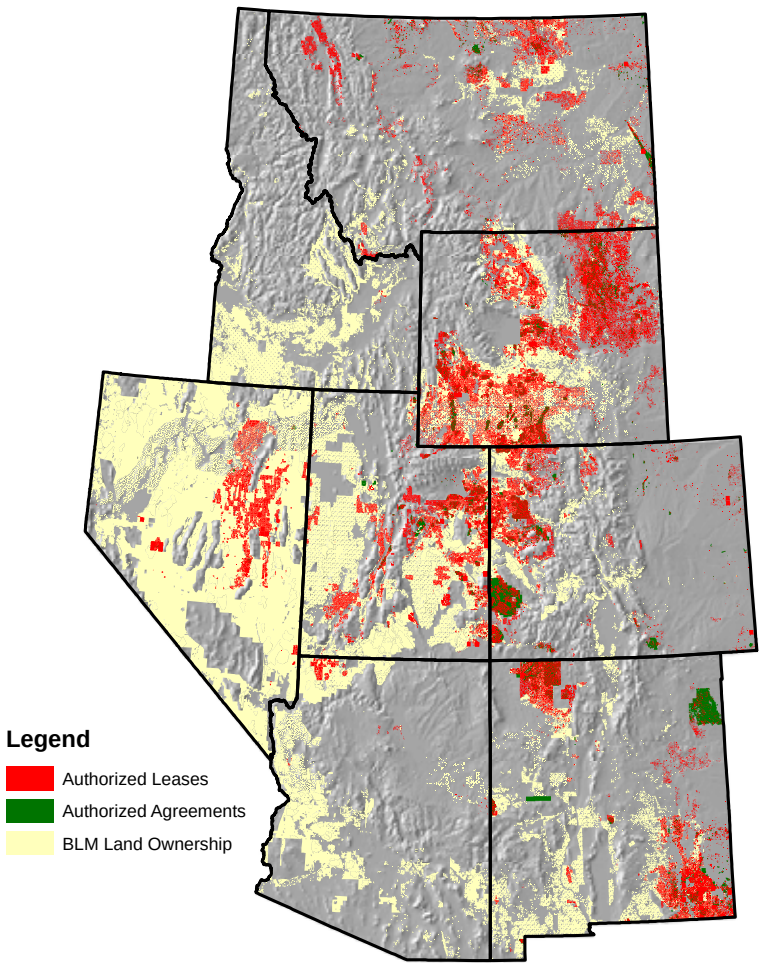
While recognizing the need for responsible energy development, the TRCP, has been one of the most outspoken critics of the BLM's handling of the Rockies' energy boom. Often citing the BLM's failure to uphold a balanced approach to resource extraction, the TRCP has played an important role in grassroots organizing of conservation-minded hunters and anglers, while also maintaining an active role in litigation in Washington, DC. Former BLM biologist and current TRCP Energy Initiative manager, Steve Belinda, has criticized the BLM for failing to implement best available science in land management decisions. Currently, the TRCP is involved in a lawsuit against the Department of Interior, of which the BLM is a part, concerning the mismanagement of energy development on the Pinedale Anticline.[24]

Other conservation organizations active in the Rockies region, including the National Wildlife Federation (NWF), the Colorado Wildlife Federation (CWF), the Wilderness Society, and the Upper Green River Valley Coalition, have made influential requests to the federal government to slow down energy development in sensitive wildlife areas. Some areas, these groups argue, are too precious, too wild, or too valuable for wildlife to be subjected to energy development. Recently, there have been a few notable triumphs for conservation groups in Wyoming and Colorado. In Wyoming, the BLM has implemented new guidelines for coal bed methane development in the

Powder River Basin, in order to protect the greater sage-grouse, a species of upland bird potentially up for listing on the federal Endangered Species List. The Colorado Oil and Gas Conservation Commission has recently adopted more stringent rules on wastewater pits at drilling sites in an effort to curb water well contamination and encourage comprehensive drilling plans.[25]

The corporations involved in the exploration, extraction, and distribution of energy, in this case in the form of fossil fuels, have legitimate reasons to increase development of energy resources. Demands for natural gas, petroleum, and coal have steadily increased both globally and nationally. Failing to increase the supply of energy to meet the demand could prove catastrophic for local and regional economies of the U.S., as the recent hike in oil prices has suggested. As the Rockies region is a storehouse of cleaner burning natural gas and vast reserves of cheap coal, much of the recent energy boom has been localized here. These energy booms are not only responsible for the continual supply of relatively cheap fossil fuels throughout the U.S. but also for the creation of thousands of jobs, many of which are located in less densely populated, rural areas. Wyoming, for example, receives 70 percent of its income from energy production and related industries.[26] The energy industry is enormously lucrative in the Rockies region, but not without vast technological advancements in drilling and extraction technologies.

Figure 5: Federal Oil and Gas Leases in the Rockies



Source: National Integrated Land System, Bureau of Land Management, 2008

New technologies in natural gas drilling and extraction have allowed previously unavailable gas resources, such as those beneath the Pinedale Anticline in Wyoming, to be opened for energy development. At depths of more than 15,000 feet below the surface, Pinedale's rich deposits of natural gas are locked in densely packed sand and shale beds. Hydraulic fracturing, a technique that fractures and then "props up" rock layers, allows an increased flow rate of natural gas to the well heads. Though this method was developed more than a half century ago, it was not until recently that hydraulic fracturing could be used at the great depths required for southwestern Wyoming's gas reserves. In the eastern U.S., energy companies hope to use hydraulic fracturing techniques to access the natural gas in the Marcellus Shale formation that stretches from New York to West Virginia.

Still, under pressure from the government and the American people, a large portion of research and development in energy technologies has been directed towards cleaner, safer, and more environmentally friendly energy development. One such advancement that has revolutionized natural gas drilling in the Rockies region is directional drilling. Directional drilling makes it possible to drill horizontally and vertically from a single well site. Flexible and jointed drills can extend up to a mile from the drilling rig (in some places, up to four miles), allowing drilling companies to pinpoint specific areas of concentrated gas reserves from a single well pad. Fewer pads translate to a reduced surface footprint, a feature that is warmly welcomed by industry, environmental groups, and the BLM.

Other technologies, such as liquids gathering systems (LGSs) have helped to reduce truck traffic, a major source of indirect habitat loss in and around gas fields. LGSs gather various incidental components of natural gas extraction including condensate, a type of light oil, and water. By consolidating the less desirable liquids and piping them to central facilities, a LGS can reduce emissions of condensate vapor and truck exhaust and eliminate the need for large holding tanks on every well pad, another factor in reducing the footprint of natural gas extraction. In 2008, Questar Corporation, the largest lease holder on the Pinedale Anticline, won the Department of Interior's Oil, Gas, and Geothermal Development Environmental Best Management Practices Award for their implementation of LGS on the Pinedale Anticline.

In spite of these new technologies, the leasing of public lands for energy development has infringed upon prime hunting, fishing, and other recreation areas, encroaching upon the tourism and recreation economies

in the Rockies region. Ten percent of Colorado's state economy is tourism based; 160,000 Colorado workers were employed in travel and recreation in 2005, nearly double the jobs in the oil and gas industry.[27] In Utah, tourists spent nearly $6 billion in 2006.[28] These activities provide a sustainable source of revenue for Rockies states because, if properly managed, the region's stunning geology, world-class trout fisheries, and large big game herds can persist generation after generation. By contrast, oil, gas, and coal reserves are finite.

Dollar for dollar, energy extraction often proves more lucrative for state economies in the short term. As long as the current boom in energy development continues, the Rockies region is poised to add billions of dollars to state coffers. In Colorado, during 2005, oil and gas generated more than double the revenue of recreation and tourism.[29] But will it last? The lifetime of Wyoming's second largest natural gas field, the Jonah Field, is expected to be 40 to 50 years.[30] Wyoming's recoverable coal reserves are the largest in the country, and yet with current mining technologies, these reserves are only expected to last approximately 124 years.[31] Until then the energy boom continues to provide much needed jobs and revenue for state and local governments.

Historically, however, the West has been plagued by the boom and bust cycles so often associated with energy development. Many residents of Garfield County in western Colorado, for example, recall the day in May of 1982 when Exxon pulled the plug on oil shale operations, leaving 2,000 people jobless. Before May 2, 1982, which has also become known as Black Sunday, the towns of Rifle, Grand Junction, Parachute, and others were in the midst of the largest energy boom in recent western Colorado history. *High Country News* editor Ray Ring has described the depression of a small town in south central Wyoming. Small towns in the Rockies, such as Wamsutter, WY, are often unable to foster a healthy community in part due to the transience of the workforce and the industry. Wamsutter, Ring wrote, is an "amenity-less place" that will witness the end of its last gas boom six years from now.[32] For those workers who have traveled from as far away as Florida to work on well-paying rig crews, a pull out by the energy industry when the wells run dry is just another characteristic of life as a roughneck. But for others, relocating a family to follow the boom and bust cycle of energy work brings headaches and hardship. As long as the American people demand cheap and abundant fossil fuels, the cycle will continue.

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Case Study: Pinedale, WY

From atop a small rise among the rolling sagebrush hills of the Pinedale Anticline, a complex web of dirt roads stretches as far as the eye can see, connecting drilling pads, producing wells, and compressor stations. These roads comprise the arteries and veins of America's second-largest natural gas field, handling tens of thousands of truck trips each year and linking 342 different well pads across nearly 200,000 acres of prime sagebrush habitat. In the winter months, rigs are often juxtaposed against thousands of pronghorn and mule deer that cross the Anticline along the longest land migration route in the lower 48 states. These animals, as well as moose, raptors, golden eagles, and bald eagles travel to the Anticline, its river corridor, and surrounding riparian areas.

Pinedale History

Before the drilling of the Jonah Field in 1995, Pinedale was a traditional ranching and outdoor recreation town. Situated between the idyllic Wind River Mountains to the east and the Wyoming Range to the west, Pinedale drew trappers and traders in the late nineteenth and early twentieth centuries. Ranchers followed, seeking cheap and plentiful land. Pinedale also became renowned among hunters for both its upland bird species and its vast herds of big game, such as pronghorn, and mule deer. The greater sage-grouse, the largest species of grouse and one of the West's most emblematic birds, may have once numbered in the millions. Lewis and Clark described them as "the cock of the plains," and early settlers claimed that when roused from the safety of the brush, the birds would darken the sky.[1]

The town of Pinedale, population 1,846, is small by most standards. Residents boast about the town's absence of a traffic light. But since drilling for natural gas on the Anticline began in 2000, the town has grown by 30 percent.[2] Sublette County, where Pinedale is located, was the fifth-fastest growing county in the nation between 2006 and 2007.[3] This growth, and the influx of a large, temporary workforce brought in to support the gas industry, has strained the town's basic infrastructures such as housing, transportation, sewage, and water services. Processions of 4x4 pickups have created heavy traffic on Pine Street, and real estate values have jumped since the gas boom, with many studio apartments renting for $1,500 per month or more.[4]

For many people, Pinedale is still a small western town, where traditional values still exist. During the second weekend of July, Pinedale celebrates its yearly Rendezvous festival, commemorating its rich history of mountain men, Native Americans, and homesteaders. But there is no doubting that the gas boom has made this once remote and quiet town into an active boom town.

Energy Development

Wyoming is no stranger to energy development. The Powder River Basin in northeastern Wyoming is the country's largest coal-producing region, producing more than twice as much as the second-largest producer, West Virginia.[5] However, as cleaner fuels such as natural gas become America's fossil fuel of choice, intense development and production makes sense for companies wanting to take advantage of the increasing demand for and skyrocketing prices of cleaner fuels. New drilling technologies have allowed the Pinedale Anticline's reservoirs of gas to be developed and extracted. Together, the Pinedale Anticline and the neighboring Jonah Field contribute approximately 2.5 percent of annual natural gas production in the entire U.S. Sublette County, as a whole, is responsible for more than 30 percent of Wyoming's total gas production.[6]

Greater sage grouse © James Ownby

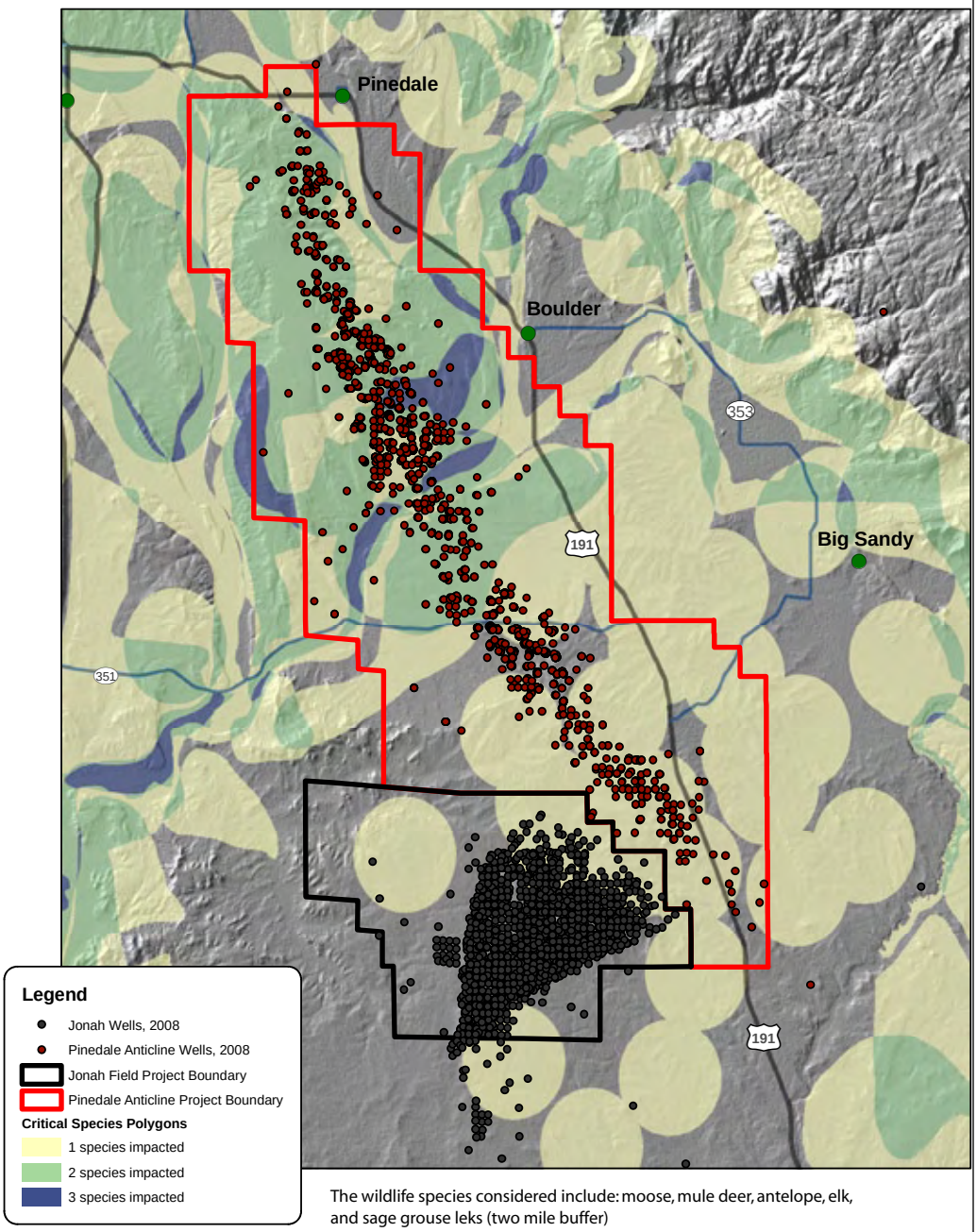
But Pinedale's energy resources are buried deep below some of the West's greatest reserves of wildlife. Southwestern Wyoming has one of the largest sage-grouse populations left in the state and is a stronghold for breeding individuals.[7] In the winter, the grouse survive exclusively on the sagebrush's nourishing summer growth. Throughout the year, around 100,000 big game animals also use the Upper Green River Valley ecosystem (See Figure 6). On their way from summer range, 3,500 mule deer and 4,000-5,000 pronghorn migrate through the Pinedale Anticline Project Area (PAPA) to crucial winter ranges on and around the PAPA.[8] Some pronghorn summer in Grand Teton National Park and migrate 200 miles, across the PAPA, to their wintering grounds in the Upper Green River Basin. The vast herds of mule deer, elk, pronghorn, and sage-grouse that drew hunters and trappers to Pinedale a

century ago continue to draw hunters and wildlife watchers to the area, helping the Upper Green live up to its pseudonym as America's Serengeti. Today, however, the sagebrush hills are rapidly transforming into the roads, pipelines, and well pads that comprise the infrastructure of energy development. The juxtaposition of wildlife and energy resources on the Pinedale Anticline represents the central conflict inherent in the exploitation of America's domestic energy supplies: How can domestic energy be produced while preventing dramatic degradation of the environment?

The potential for energy development to impact wildlife has always been a concern of land managers, conservationists, and those who admire and respect the land's natural heritage. The passage of the Federal Land Policy and Management Act of 1976 aims to ensure "multiple use and sustained yield" of all the lands' resources. The BLM is mandated to maintain "balanced … uses that take into account the long term needs of future generations."[9] Any impacts on wildlife, water, air quality, and recreational opportunities rest ultimately on the shoulders of the BLM.

Since its "rediscovery" in 1993, the Jonah Field has been aggressively developed for natural gas extraction; it is strewn with drill pads and gravel roads. Despite recent improvements in environmental mitigation, the Jonah Field, which lies directly on a big game migration corridor, is wanting of wildlife. Because of the Jonah Field's dense well clustering and the vast network of roads, compressor stations, and other infrastructure, the Wyoming Outdoor Council likens the development of the Jonah Field to "planning an industrial sacrifice zone."[10] Blame has been placed on the BLM, and conservation groups are worried that the PAPA could follow a similar path, although so far development there has been less hurried (See Figure 7).

Figure 6: Pinedale Anticline and Jonah Field Oil and Gas Well Locations and Critical Wildlife Species Impact



The wildlife species considered include: moose, mule deer, antelope, elk, and sage grouse leks (two mile buffer)

Sources: Wyoming Oil and Gas Conservation Commission, 2008; Wyoming Fish and Game, 2008

BLM Management Decisions

The BLM signed the first record of decision (ROD) outlining the future development of the PAPA in 2000, following the release of the first draft environmental impact statement (DEIS) in December 1999, In the ROD, the BLM opted for the "resource protection alternative" that allowed for drilling up to 900 wells in the next 10-15 years, but with guidelines to use "best management practices" and "adaptive environmental management" (AEM) to mitigate deleterious effects on wildlife, air quality, water quality, and the landscape. The ROD followed recommendations from the DEIS to establish development stipulations that would prohibit certain types

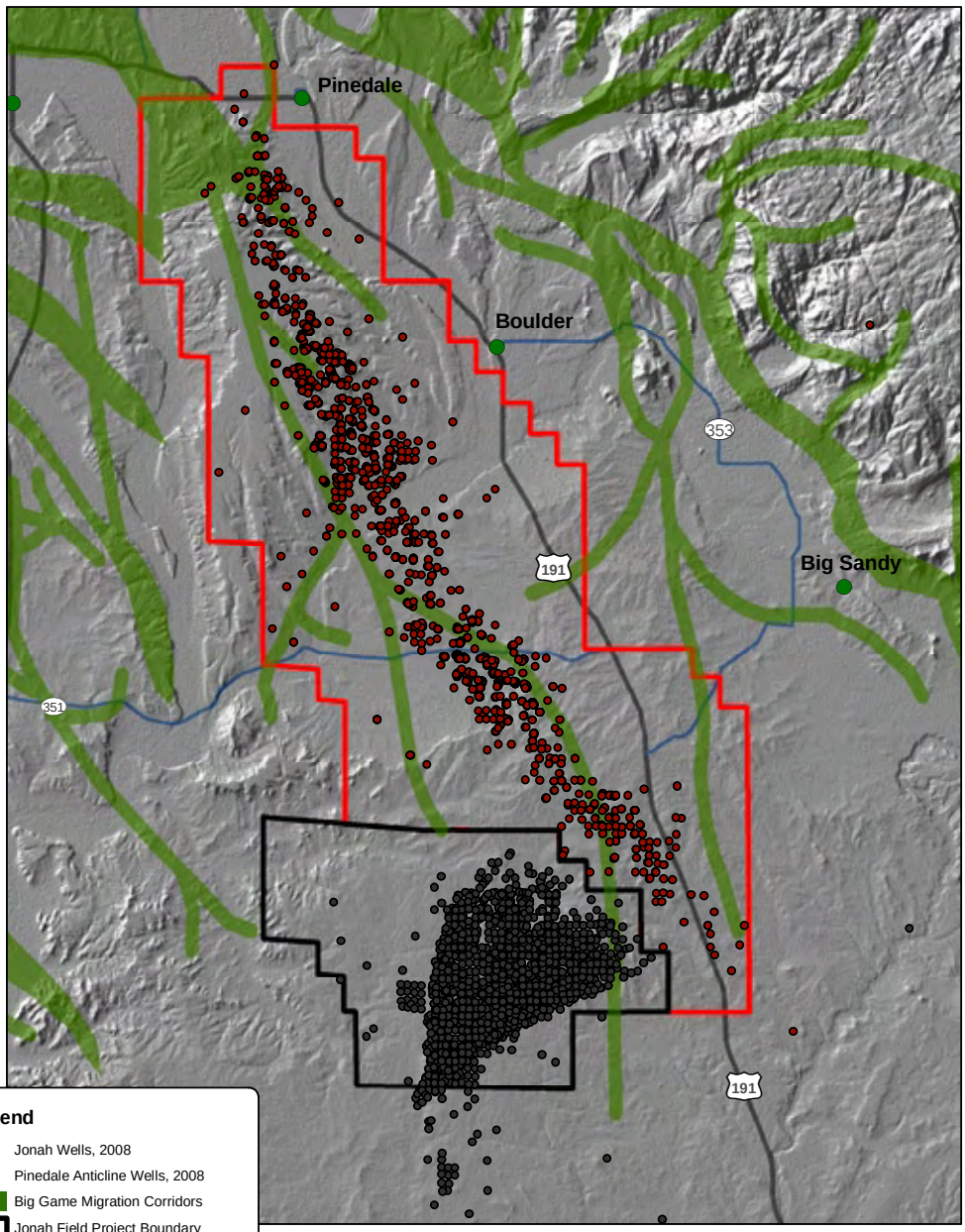
of activity during highly sensitive periods for many species. These included forbidding surface disturbance within 0.25 miles of a sage-grouse lek (display area), barring surface activity between midnight and 9:00 AM within a 0.5 mile radius of an active lek during strutting season, and prohibiting surface activities from November 15 through April 30 within certain crucial winter habitats for big game species. The ROD also outlined other seasonal stipulations aimed at mitigating potential impacts on raptors and bald eagles.[11]

To investigate the "movements patterns and population characteristics" of Sublette County's mule deer herd, the Wyoming Cooperative Fish and Wildlife Research Unit initiated the Sublette Mule Deer Study in 1998.[12] Funded largely by Questar Exploration and Production Company and Ultra Petroleum, the study was an important step in assessing the environmental impacts of natural gas drilling on the Anticline, required by the National Environmental Policy Act (NEPA). Led by Hall Sawyer from Western EcoSystems Technology, Inc., the study documented a 46 percent decline in mule deer during the first four years of natural gas development on the PAPA mesa (long known to residents as "the Mesa") from natural gas development and other causes.[13]

According to the study, mule deer changed their preferred habitat locations in response to increased human activity on the Mesa. In a paper published in the "Journal of Wildlife Management," Sawyer *et al.* wrote, "that some areas categorized as high use (by the deer) before development, changed to low use as development progressed, and other areas initially categorized as low use changed to high use."[14] In other words, as development increased, mule deer moved off their more favored high-use areas to less suitable habitat. This type of movement is the result of both direct and indirect habitat loss. Direct habitat loss, such as that resulting from building roads and well pads in habitat areas, has an immediate impact on the availability of productive feeding locations and can drastically affect the carrying capacity of a habitat area. Indirect habitat loss, though posing a less immediate threat, can impact a far greater area than direct habitat loss. Deer may avoid areas around human activity because of noise, light, or air pollution, causing them to avoid not just the well pads and drilling sites themselves, but also bordering land regardless of its productivity. More and more drilling will lead to further direct and indirect habitat loss for mule deer and other species.

Indirect habitat loss poses an even greater threat for the greater sage-grouse. The grouse, unlike many big game species, use the PAPA year-round. This conspicuous bird, known for the males' elaborate

Figure 7: Pinedale Anticline and Jonah Field Oil and Gas Well Locations and Big Game Migration Corridors



Sources: Wyoming Oil and Gas Conservation Commission, 2008; Wyoming Fish and Game, 2008

mating dance or "strut," once lived in 16 states and three Canadian provinces. However, due to habitat disturbance and loss, the bird's range has contracted to 11 states and two provinces.[15] The grouse is particularly sensitive to disturbances around its strutting and mating grounds, called leks.[16] Matt Holloran, a scientist with the University of Wyoming, found "the total maximum number of males declined 51% on heavily impacted leks from the year prior to impact to 2004 (control leks declined 3% during the same time period). Further, the total maximum number of males on three heavily impacted leks situated centrally within the developing field declined 89%, and two of the three leks were essentially inactive in 2004."[17] In Canada, three leks that were disturbed by oil and gas activity between 1983 and 1985 are still inactive today.[18]

Although Holloran found that adult females generally did not alter nesting habits in response to increased development, "subsequent generations avoided gas fields."[19] Furthermore, Holloran noted that "the results suggest that male and female greater sage-grouse displacement from developing natural gas fields contributes to breeding population declines."[20] In any case, the sharp decline in sage-grouse on the PAPA indicates that current stipulations on energy development activity "are inadequate in order to protect the greater sage-grouse."[21] Kellie Roadifer, planning coordinator for the BLM in Pinedale, noted that "we cannot effectively maintain sage-grouse habitat in a gas field, at least one with that intensity of development. The resources don't go together; they can't occupy the same space."[22]

In 2004 the BLM granted Questar Exploration and Development Co.'s request to initiate year-round drilling in certain areas for a period of nine years.[23] Some previously identified areas of crucial winter habitat for mule deer will experience year-round drilling, with no seasonal protections in place. Despite the fact that lifting seasonal restrictions on activity was supposed to be an exception to the rule outlined in the ROD, between 2000 and 2006, 80 percent of industry requests to lift seasonal stipulations were granted.[24] Industry representatives have argued that allowing drilling all year will allow them to "get in and get out," avoiding the "seasonal boom and bust" that is good for neither the town nor the rig workers. On the other hand, the BLM is frequently giving the go-ahead for new drilling projects and pipeline construction. Recently, the BLM approved a plan to allow drilling of up to 4,399 more wells on the Anticline. Furthermore, since August 2005, 26,302 permits to drill were received by the state of Wyoming, of which 98 percent were approved.[25]

The Final Supplemental Environmental Impact Statement (FSEIS) was finalized in June, 2008 to address the long-term environmental impacts of a number of proposed development alternatives. (The original EIS from 2000 did not anticipate both the extent of the hydrocarbon resources below the Anticline and the environmental impacts associated with the fast-paced development; thus a supplemental EIS was needed.) According to the FSEIS, the current development has already exceeded certain air-quality thresholds, and any further development would likely exceed the limits set by the 2000 ROD. In September of 2008, the new Record of Decision announced that Alternative D had been chosen. Alternative D allows for the construction of new well pads, expansion old well pads, and new roads and pipelines to continue though 2023.[26] Drilling will continue through 2025 and wells are expected to produce through 2065. Using a process called "concentrated development," the ROD expects to recover an estimated 25 trillion cubic feet of gas from no more than 600 well pads.[27] No Surface Occupancy (NSO) restrictions will remain in place, but seasonal restrictions will be lifted, allowing for year round development and delineation activity with big game and greater sage grouse seasonal use areas.[28]

Drilling Rig, Pinedale © Liz Kolbe

In June 2008, the TRCP filed suit against the Department of Interior, arguing that the BLM had failed to "implement effective 'adaptive environmental management' (AEM) and mitigation requirements established in a July 2000 record of decision (ROD)."[29] Adaptive environmental management requires the BLM and industry to adopt the most current science in wildlife management, mitigation, and drilling practices to reduce negative environmental impact to the greatest possible extent. According to the TRCP, the BLM's failure on behalf of the wildlife, recreationists, and citizens of Pinedale has amplified the harmful impacts of energy developments. While working in conjunction with the BLM, the TRCP has stated that the BLM has rejected many requests and recommendations on how to effectively balance development with wildlife resources. For instance, most sage-grouse scientists recommend increasing sage-grouse lek buffers from one-

quarter mile to 3.1 miles.[30] This suggestion has yet to be formally adopted by the BLM.

The findings of Sawyer's mule deer research and Holloran's grouse studies indicate a clear lapse in AEM implementation. Rusty Kaiser, a wildlife biologist with the Pinedale BLM, noted that he is so entrenched working on "permit to drill" applications that he has a hard time keeping up with other wildlife projects.[31] Steve Belinda, a biologist for the TRCP, quit his job with the Pinedale BLM because, as he told a National Public Radio correspondent, "we had literally prioritized oil and gas over everything else to the point where programs like wildlife and fisheries management were getting no attention."[32]

Of even greater concern to the TRCP, however, is that the AEM for the PAPA is being touted as a model for development in the rest of Wyoming and the Rockies region. In Pinedale, the AEM process, to many, is clearly defective. According to "Pinedale Anticline Litigation FAQs" from the TRCP, "this model [AEM] has been proven not to work locally and therefore should not be pursued elsewhere without consideration of the deficiencies identified by the TRCP."[33] To quote Dr. Rollin Sparrowe of the TRCP, "we cannot afford what is happening here to happen elsewhere."[34] Furthermore, TRCP argues that because public land belongs to all Americans, energy developers should not be given a disproportionate right to manipulate the land for the singular purpose of extracting its resources. As new development is proposed and AEM is not effectively utilized, drastic consequences loom for the Anticline's wildlife and recreational resources. However, not all agree that development has proceeded irresponsibly.

Pinedale © Walt Hecox

Mitigation

Liquid Gathering

Industry representatives have argued that environmental mitigation practices have been mostly successful. In 2005, the same year permanent year-round drilling requests were granted, Questar voluntarily implemented a liquids gathering system to collect and transport produced water and other chemicals by pipeline. This system reduces truck traffic by an estimated 25,000 trips per year.[35] The decrease in year-round truck activity has helped lessen somewhat the stress placed on mule deer and pronghorn. To protect birds against the highly toxic produced-water holding ponds located on most drill pads, many companies stretch long strings of multicolored flags across the ponds to deter birds. Unfortunately, these flags are easily ripped from their fasteners and require regular maintenance. Eventually, the birds become accustomed to the flags and land in the ponds despite the colorful warning, causing a headache for the drilling companies and death for the birds.

Land Reclamation

Some companies have spent thousands of dollars on land reclamation and protection to reduce the amount of habitat lost in the drilling process. On the Jonah Field, instead of clearing off top soil, EnCana Corporation places 8 by 12 foot oak mats directly over vegetation (see photo on facing page). Because the top soil is not as disturbed or compacted from the wooden planks as it would be from the usual blading and removal of both soil and vegetation, plant reestablishment occurs more easily. This experimental method of reclamation has cost EnCana nearly $10 million and can reduce disturbance by up to 60 percent compared with traditional techniques.[36] However, because of cost, EnCana uses the mats for just 20 to 25 percent of the new wells drilled on the Jonah Field.

Shell Oil, one of the larger lease holders on the Anticline, uses a specially developed seed mixture to reclaim drilling pads. Instead of laying down mats, Shell blades off the topsoil and moves it into large mounds at their PAPA drilling sites, essentially saving the topsoil from compaction. This ensures that the soil will be a better medium for seed growth once reclamation begins. Still, this process reduces the health of the topsoil significantly. Large mounds do not maintain ideal growing conditions for beneficial microorganisms such as bacteria and

Oak mats, Pinedale © Porter Friedman '09

fungi. Eventually the organisms in the soil die, and much of the nutrient value of that soil is lost. Nonetheless, Shell does make attempts to reclaim drilling sites after the drilling crews move off the pad. Shell praises the seed mixture that they use in surface reclamation, noting that it contains a variety of shrub, grass, and forb species. Even Kevin Williams, manager for Questar Exploration Co., is excited about Shell's seed program. "It helps everyone out by sharing information. Shell's seed mix is great, and it's something that we will start implementing throughout our reclamation process."[37] Although Shell touts their reclamation efforts as highly effective, observation of a four-year-old reclamation site suggests it is not nearly as productive or diverse as the surrounding undisturbed habitats.

Shell's voluntary practices may help wildlife populations become accustomed to energy development, but ultimately small changes, such as "camo" painted well heads, are not replacements for slow-paced development and AEM. Part of the problem is that many of the environmental mitigation efforts are voluntary rather than mandated by the BLM. Although the BLM states in the 2000 ROD that "all reclamation is expected to be accomplished as soon as possible after the disturbance occurs," it never outlines exactly *how* reclamation should occur. Nor does the BLM delineate to what specific quality the land should be returned. "Proper erosion and sediment control structures and techniques will be incorporated by the Operators into the design of well pads, roads, pipelines, and other facilities," instructs the ROD. But to what extent should these "control structures and techniques" be incorporated?[38]

In other words, the operators are left to interpret the BLM's vague guidelines to their own specifications, which may or may not be based on the best available science. For example, the BLM does not require the inclusion of sagebrush in a reseeding mixture even though nearly every organism on the PAPA from sage-grouse to mule deer depends on a healthy sagebrush ecosystem. The BLM recommends certain proportions of grasses and shrubs depending on the habitat, but does not require a specific vegetation density after reclamation. To its credit, Shell includes sagebrush seeds in their mixture in an attempt to return bare well pads to their previous conditions, but other operators may or may not. In some cases a fully reclaimed site looks like the side of the highway, with low vegetation density and an abundance of weedy species. The lack of requirements gives leeway for industry operators to proceed at their discretion. Aimee Davison, Natural Resources Advisor for Shell, says that she wants to do her best, but at the same time she points out that "ultimately the goal is to get the gas out of the ground and make a profit, but there are a lot of steps in between that can be shared [with other operators]."[39]

Gas Production

Industry does profit. Every year, EnCana extracts 255 billion cubic feet of gas from the Jonah Field,[40] [41] and gas prices are set to increase as power plants switch from burning coal to burning cleaner natural gas.[42] As prices continue to increase, so too will the drilling. The Pinedale gas boom is not going anywhere for the time being. On July 7, 2008, Questar updated its probable reserves estimate for the Pinedale Anticline to include a deeper, natural gas containing formation called the Rock Springs formation.[43] To date, the Rock Springs formation, which extends downwards from 20,000 ft., has yet to be explored, which could mean that any plan to "get in and get out" will be postponed until this deeper reservoir is fully exploited. Shell and Questar expect a 40 to 60-year lifespan of their gas wells on the Pinedale Anticline.[44] However, those wells are drilling into the shallower Lance Formation, not the Rock Springs Formation. Currently, the cost of drilling a 20,000 ft. deep well does not outweigh the economic benefits of the potential gas produced. If Questar's estimates are correct, the Pinedale Anticline could be a producing field well into next century.

The prospect of energy development continuing longer than first expected on the Pinedale Anticline may be exciting for industry, but poses a threat for the long-term well being of Pinedale's wildlife. If the first four years of intense activity on the Anticline contributed to a 46 percent decrease in the mule deer herd that winters there, subsequent years of activity could further this already dramatic loss. The loss of sage-grouse habitat in one of the iconic bird's last real strongholds in Wyoming could pose an indirect threat to the species all across the country.

Further development might cause extirpation or warrant the listing of sage-grouse as an endangered species. If the grouse were listed as endangered, hunters, ranchers, energy developers, and *anyone* who uses land where sage-grouse live would be required by the Fish and Wildlife Service to drastically alter their actions and behavior. Hunters would be denied the rights they have had for centuries to hunt the magnificent upland bird. Hunting guides could be put out of business. Ranchers could be forced to alter their livestock grazing patterns. Energy developers might have to stop expanding drilling operations or relocate completely. The listing of the sage-grouse would demonstrate a major fault in planning, implementing, and adapting to changing science and management techniques by the BLM, the governing body for much of the West's public lands. In addition, a listing of the grouse would indicate that energy resources and wildlife species were not kept in balance, a promise the BLM guaranteed to Americans more than 30 years ago with the passage of the Federal Lands Policy and Management Act of 1976.[45] But perhaps most importantly is that a listing of the greater sage-grouse would be an admission by the federal government that the forces of habitat alteration and destruction, such as those caused by fast-paced energy development, were given a higher priority than the interests of other people, who own and have a stake in as much of the public land as anyone else.

Of course, Sublette County's mule deer, elk, pronghorn, and sage-grouse may bounce back. Returning to historic numbers is unlikely, especially given the modification development has had on the sagebrush environment. No one will argue that Americans do not need the gas. In the market-driven economy, it is America's demand for natural gas to fuel power plants, vehicles, and gas burning stoves that ultimately creates the need for natural gas exploration and development.

Throughout the years, federal and state governments have established a regulatory framework to control not only how energy is extracted and distributed, but also how recreationists can hunt and fish. It is up to the governing agencies to ensure that neither the supply of grouse and pronghorn for hunting nor the supply of gas falters or fails. In Pinedale, the difficulty in maintaining these multiple uses is a powerful example of how the West is a stronghold of so many valuable and treasured resources, both finite and renewable. The finite fossil fuel resources will one day vanish, but with careful management, wildlife may never meet that fate.

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Case Study: Powder River Basin

A land of rolling hills, grasslands, and freshwater rivers and streams, the Powder River Basin of Montana and Wyoming is an iconic landscape of the West. Bordered by South Dakota's Black Hills to the east and the Bighorn Uplift to the west, the basin's grasslands and sagebrush support white-tailed deer, mule deer, sage grouse, and one of the few remaining herds of plains elk. The rivers and streams contain rainbow trout, shovelnose sturgeon, and catfish. In 2006, Montana received nearly $43 million from the sale of hunting and fishing licenses, or 53 percent of the revenue for Montana's office of Fish, Wildlife and Parks, that year.[1] These valuable wildlife resources and the people that hunt, fish, and enjoy them have been engaged in a long-standing conflict with another vast resource found in Montana: fossil fuels.

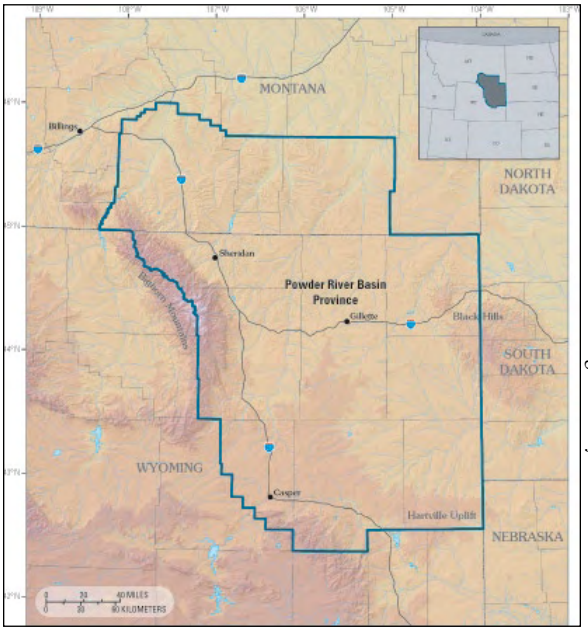
Montana's portion of the Powder River Basin comprises approximately 25 percent of the entire Powder River Basin, an area rich in coal and coalbed methane deposits that extends from southeastern Montana into northeastern Wyoming. Drilling for coalbed methane has been increasing rapidly in the Wyoming portion of the Powder River Basin since the 1990's; however Montana has seen a much slower increase in drilling activity due to heavy litigation. Despite Montana's slower development, the state is poised to begin drilling at an accelerated rate, a process that will threaten an iconic western landscape and the wildlife that it supports. The Bureau of Land Management (BLM) estimates that between 10,000 and 26,000 new wells will exist in Montana's Powder River Basin by 2020.[2] When included with the new-well predictions for Wyoming, the Powder River Basin could see as many as 76,000 wells by 2020.

Coalbed methane stays trapped in coal seams due to the intense pressure of water found in underground aquifers surrounding the coal. When the water is pumped out of the aquifers, the gas can be extracted. As such, water is an inevitable and unavoidable byproduct of producing coalbed methane, and it must be disposed of responsibly. Moving north through the basin, the water quality in the aquifers becomes increasingly saline, making disposal more problematic. In Montana, the water that must be removed prior to gas production is mostly of more marginal quality than that in neighboring Wyoming, due to high salinity and sodium content. Highly sodic water can damage soils, plants, and the organisms that depend on them.

Scientists Brett Walker and David Naugle have studied the effects of coalbed methane development on the sage grouse of the Powder River Basin in Montana and Wyoming. According to their report published in the *Journal of Wildlife Management*, sage grouse "leks [display areas] in coalbed natural gas fields had 46% fewer males per active lek than leks outside of coalbed natural gas fields."[3] Oil and gas wells require vast networks of roads and pipelines that can often destroy or fragment areas of previously suitable habitat. Furthermore, Naugle, in another study, found that across four populations of greater sage grouse in Montana, Wyoming, and Alberta, Canada, West Nile virus had decreased female sage grouse survival rates by 25 percent.[4] Wastewater ponds from coalbed methane development can harbor mosquito larva and may account for the increase in West Nile virus.

Sage grouse are considered a good indicator species for the health of the sagebrush habitat. The decline in number of this symbolic bird, which may soon be placed on the endangered species list, indicates that development and destruction of sage brush habitat is taking a toll on the species. Naugle and Walker found that the current lease specifications for coalbed methane well sites are inadequate for ensuring the viability of leks and the sage grouse breeding populations, and recommended that the industry "rapidly implement more effective mitigation measures"[5] to protect the sage grouse.

Seasonal stipulations in drilling activity aim to protect the grouse during crucial strutting periods between March 1 and June 15. In the summer of 2008 federal lawmakers took the protection even further by preventing most coalbed methane activity in one million acres of sage grouse "core areas." The new protections came in response to the hastening decline of sage grouse and the threat of the being listed on the endangered species list. Were the sage grouse to be listed under the Endangered Species Act, continued energy development in the Powder River Basin, and elsewhere across the West, would be seriously hampered. While the debate continues, so does drilling.



Powder River Basin, U.S. Geological Survey

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Wildlife Management

Facilitating safe and sustainable habitat and wildlife populations in the Rockies

By Scott Wozencraft

Key Findings

• In the Rockies, wildlife related expenditures as a percent of state GDP is 3.2 percent; the highest in the nation.

• The percent of the Rockies' population with a hunting license peaked in 1972 at 17.7 percent. In 2007 only 6.8 percent of residents held a hunting license.

• The Rockies recieves 0.36 percent of its GDP from hunting revenues; the third highest in the nation.

• Montana and Wyoming earn the most per capita hunting license revenue of any state in the country. Each state earns over $25 per resident.

About the author: Scott Wozencraft (Colorado College '09) is a student researcher for the 2008/09 State of the Rockies Project.

Wildlife Management in the Rockies Region

Wildlife management in the eight-state Rockies region presents unique social, economic, and ecological challenges. Aside from preserving wildlife purely for its intrinsic value and for future generations, wildlife also has significant economic value and many argue deserves preservation and consideration on those merits alone. Wildlife-related recreation accounts for 3.2 percent of the regional economy (regional GDP), the highest in the nation (See Figure 1). Only 1.8 percent of the entire U.S. economy comes from wildlife related activities; no other census region comes within a percentage point of the Rockies in terms of wildlife revenue as a percentage of state of state GDP (See Figure 2).[1] Hunting alone in 2007 brought $166,577,530 in revenue to the Rockies region, more than to any other region in the U.S., especially considering the relatively small population of the Rockies region (See Figure 3 and Figure 4).

At the same time though, the Rockies has experienced intense human-wildlife conflicts. Historically, agriculture and energy development, major players in the region's economy, have opposed most wildlife conservation measures that may impact their industry. Agriculture in the Rockies accounts for approximately 4 percent of the region's economy and is heavily affected by the presence of certain wildlife species (See Figure 5).[2] According to an agricultural study of several states in the Rockies, average farms and ranches around the Rockies region spent approximately 67.8 hours and $2,460 per year trying to mitigate or repair wildlife damage (Rockies Region is defined differently by Conover than the State of the Rockies Project, see footnote)[3]. The rest of the U.S. on average spent only 35.4 hours and $627 to prevent or fix wildlife-related damages.[4]

Energy development also plays a pivotal role in the Rockies' economy and the nation's energy supply. Oil and gas extraction accounts for 2.3 percent of the regional economy and is continuing to expand its economic presence.[5] The Rockies region produced approximately 26 percent of the nation's natural gas in 2005[6] and possesses large reserves in the Pinedale Anticline[7] and Jonah natural gas fields, which are yet to be fully developed.[8] Pressure to develop the region's energy resources has intensified, creating a spike in the number of drilling permits and further straining the relationships among oil and gas companies, conservation agencies, and the federal government.[9] As these groups vie to have their values determine the use of the land, wildlife managers are caught in the middle, attempting to mediate conflicts, preserve wildlife, and act in the interest of the region.

Wildlife management is defined as "the act of influencing or modifying the wildlife resource to meet human needs, desires, or goals."[10] In the Rockies, where those needs, desires, and goals are diverse, politicized, and polarized, wildlife agencies must balance the interests of wildlife, conservationists, and hunters against the interests of farmers and ranchers, the energy needs of the nation, and the regional population growing at four times the national average.[11]

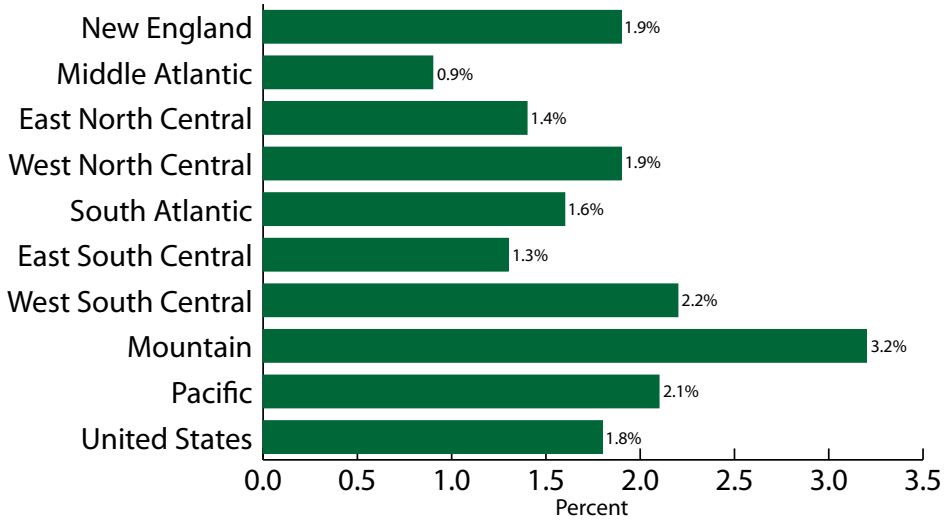
History: The Evolution of Management

Modern definitions of wildlife management almost always acknowledge the influence of human desires and objectives in the field. The number of stakeholders and diversity of interests in wildlife have increased through time. Subsequently, the number and variety of goals, as well as the tools employed by wildlife managers, have also evolved, from one goal, survival, and one tool, hunting, to dozens of goals with dozens of tools to achieve them.

Prehistory Management

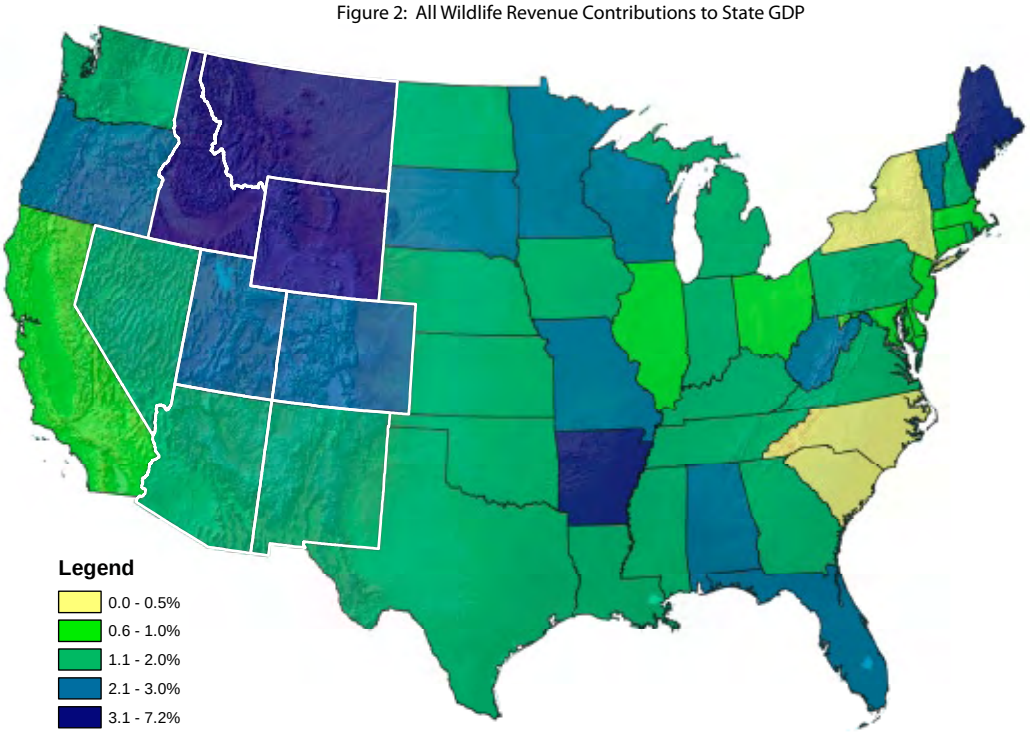
Wildlife populations have been managed, since the beginning of ecological competition and pre-dates human presence, with predator-prey relationships, disease, and resource limitations keeping wildlife within the carrying capacity of their ecosystem. Since the advent of humans, however, people have increasingly become the principal managers of wildlife. Aside from our role as a predator species in predator-prey interactions, humans have "purposefully" been managing wildlife since Cro-Magnon man around 35,000 B.C.[12] Thinking beyond opportunistic hunting, early modern humans and Neanderthals gradually practiced selective harvests that aimed to continue and expand future yields. Some even believe that these early tribal taboos determined which tribes survived. Those with

Figure 1:
Wildlife Related Expenditures as a Percent of State GDP, by Census Division, 2006



Source: North American Industry Classification System (NAICS), 2007

Figure 2: All Wildlife Revenue Contributions to State GDP



Source: U. S. Fish and Wildlife Service, 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, 2006; U. S. Department of Commerce, Bureau of Economic Analysis, 2006

the taboos that were most successful at preserving wildlife may have had a better chance at survival. The first recorded wildlife management practices, arguably, come from Mosaic Law. In these, Moses asserts that those who follow the lord will not take both the hen and the eggs, but consume the eggs and leave the hen alive so that she can reproduce again. Thus, "thou mayest prolong thy days."[13] Although this first "purposeful" management seems very basic compared to today's "terrarium curator" management practices, it marked the beginning of human manipulation of wildlife for our needs, wants, and desires.

Modern wildlife management before the 1800's

Modern wildlife management can trace its roots mostly to feudal England. One noteworthy example of modern wildlife management practices even before this however was the Mongol empire ruled over by Kublai Khan. Kublai Khan did not just regulate the season, means, and animals which could be taken, he also set-up reserves and instituted cover control aimed at increasing the supply of game species.[14] Western wildlife management is largely based on the game management instituted a century later than Kublai Khan in feudal England. In feudal England Henry VIII was the first to institute written laws protecting wildlife from taking during specific seasons. Later on in the time of feudal England others in power would expand on the list of animals to be protected, the seasons in which they were to be protected, and by what methods.[15]

Game laws in America were heavily influenced by these earlier actions in Great Britain. Laws like The Act for the Preservation of Deer passed by the Vermont Legislature in 1779, limiting the taking of bucks, does, and fawns to between January 10 and June 10 were common in most states by the early 1800s.[16] The principal difference between European and American game management arose out of the American ideology that wildlife was a publicly managed good. In Europe, wildlife was privately owned, and thus the objective was to improve hunting "for and by the private landowner."[17] Since wildlife in America was publicly owned, the objective of wildlife management was to perpetuate hunting and allow access to it. With this objective, however, came the possibility that wildlife in the U.S. might be over-harvested and thus could not be sustained, eventually disappearing.[18]

The mindset of wildlife as a finite resource perpetuated regulatory management: "There was a general recognition that wildlife was a steadily dwindling resource that must be rationed. Regulations thus were designed to extend the period before the fateful day when the last deer, duck, and grouse might be shot."[19] It was not until recently that wildlife was acknowledged as a renewable resource that could be sustained indefinitely with proper management.[20]

Thus, wildlife managers continued to enact regulations with only limited goals in mind. As Eric Bolen and William Robinson have noted, "The regulations, however, were not made with any assessment of population sizes, nor did the laws consider the reproductive potential of each species in relation to shooting pressure. Moreover, habitat was neglected by the lawmakers of the day, and no attempt was made to preserve or restore the food, cover, and water needed by the wildlife. In short, ecological knowledge and its applications did not exist in the realm of wildlife management."[21]

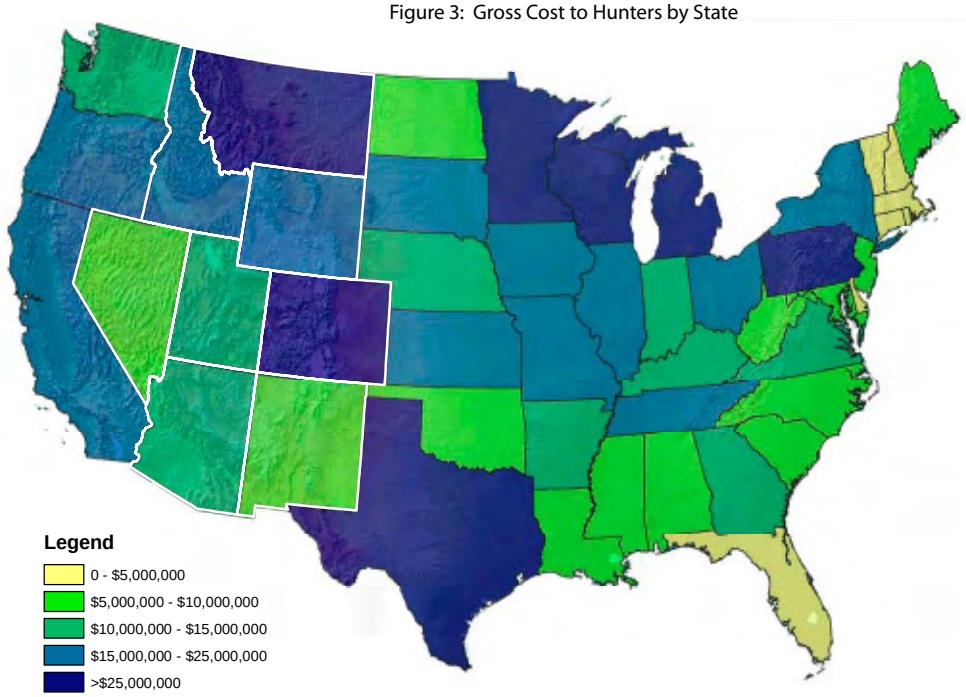
Late 1800's

Ecological principles like population monitoring and habitat preservation were not incorporated into wildlife management until the late 1800's at the behest of Theodore Roosevelt and Gifford Pinchot. Pinchot pioneered professional forestry in the U.S., and was a close friend of Roosevelt, even convincing Roosevelt and

Congress to transfer control of forest reserves to the Division of Forestry, of which he was chief.[22] Roosevelt, who was heavily influenced by Pinchot and his ideas, believed that the U.S. wildlife resources "might last forever if they were harvested scientifically and not faster than they reproduced."[23] Roosevelt also promoted conservation (a term he first applied to the preservation of natural resources and wildlife[24]) as a social responsibility and thus bringing a whole new group of advocates to wildlife management: the American public.[25] With the arrival of this new stakeholder group, wildlife management legislation was pressed to answer to a more diverse and demanding constituency. No longer were the laws governing the health and taking of wildlife populations only a concern to a select few hunters, trappers, and biologists; Teddy Roosevelt reminded every American that wildlife was owned by the public and that conservation was our collective responsibility. Theodore Roosevelt's emphasis on conservation during his presidency propelled wildlife management into a vital transitory period.

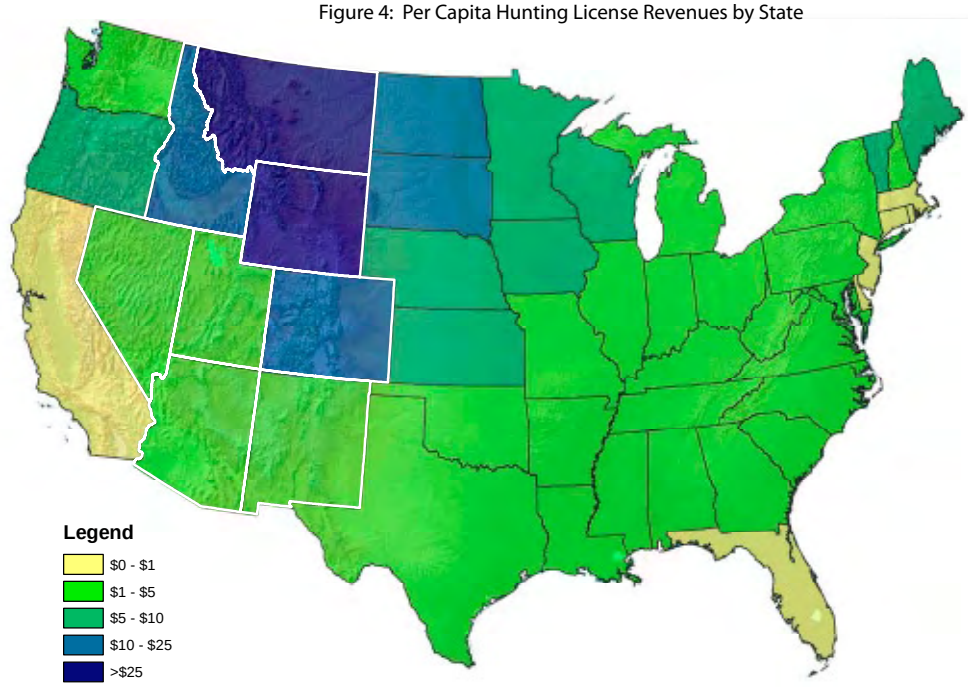
Only gradually did the U.S. public find its voice in wildlife management; Roosevelt could not instantaneously implement the organizations and infrastructure necessary for wildlife managers to become receptive to the wishes of the American public. Over the decades, however, wildlife management has begun to be more and more influenced by its ever growing and diversifying array of stakeholders. These stakeholders have begun not just to expect but demand more of a central role in wildlife management.[26] It is no longer just game species, or even endangered species that have a voice, the more diverse the stakeholders and the more they expect to be heard, the more diverse wildlife species being protected will become.

Figure 3: Gross Cost to Hunters by State



Source: U. S. Fish and Wildlife Service, National Hunting License Report, 2007

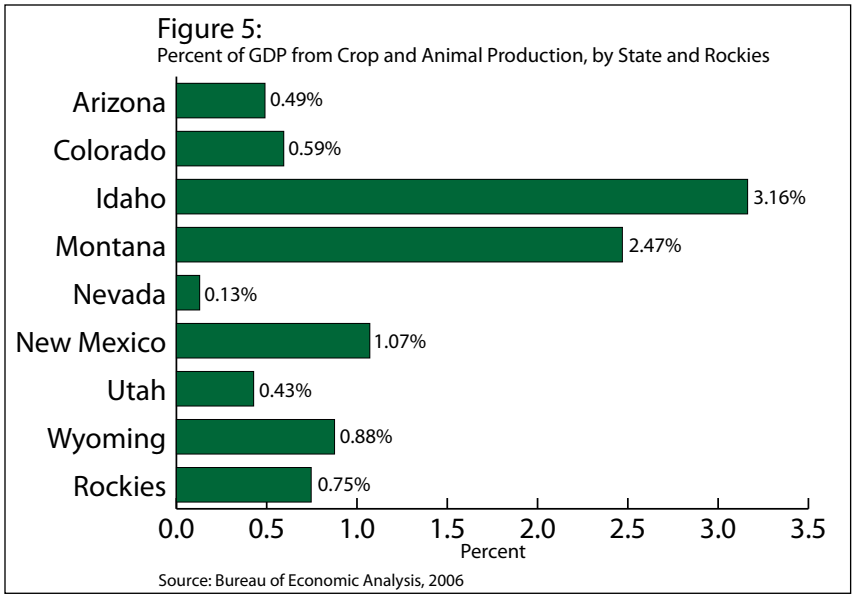
Figure 4: Per Capita Hunting License Revenues by State



Source: U. S. Fish and Wildlife Service, National Hunting License Report, 2007

Wildlife Management Tools and Techniques

This report focuses on eight common forms of wildlife management (See Table 1). Though preservation of habitat is an effective and important way to indirectly manage wildlife, it is not included in this study. The tools chosen represent a variety of the techniques that wildlife managers use on a day-to-day basis (harassment, translocation, and winter feeding), as well as the historical tools of choice (hunting and harassment), and the cutting-edge of wildlife management (predator reintroduction,



enhancement of migration corridors, contraception, and disease management).

Hunting

Hunting has been one of the primary population management tools since the first predators roamed the earth. This practice, dating back to prehistory, has only recently come under scrutiny as a wildlife management tool. Hunting, like all management tools, has positive and negative impacts, but is simply is too cost-effective and too engrained in our culture to lose favor among wildlife managers at this time.

Hunting is no longer the unquestioned and sole wildlife management tool. Opposition to hunting has risen in recent decades, and the number of Americans participating in hunting has been declining since 1972 (See Figure 6). Today, many people are searching for alternative management techniques to give animals a second chance – a mentality not applicable to hunting.[27] Wildlife managers, while realizing the importance of hunting as a fund source, acknowledge its limitations.

Hunting generates most of state wildlife agencies' revenues. In Colorado for example, taxes on hunting equipment and license sales generate over 70 percent of the funds for the Division of Wildlife's budget. Hunting revenue allows state wildlife agencies to employ other management strategies such as contraception, predator reintroduction, and translocation that do not yield any profit. Beyond state wildlife agencies, the Rockies' economy benefits from hunting (See Figure 7).

While hunting is cost effective, it is not bullet-proof. Compensatory reproduction is the ability of a species to increase its reproduction rates in times of abundant food or times of favorable conditions. For example, some species have the ability to rapidly increase their litter size or birth rate when food is abundant. This is true in coyotes, which when hunted compensate for declines in population by taking advantage of the freed-up food resources and increasing their litter size. This behavior makes it very difficult to control coyote populations through hunting.[28] Compensatory reproduction has also been observed in mountain goats in the Absaroka Mountains. The mountain goat population trends could not be explained through hunter success and size of harvest. This indicated that there was a reproductive response to hunting that negated culling impacts on the population.[29] Similar results have also been seen in prairie dogs[30] and bison.[31] Compensatory reproduction only protects populations to a certain point following hunting. Intensive hunting (removing 30 to 40% or more of the population) will eventually decimate herds and cause populations to decline.[32]

Another barrier preventing hunting from further animal population controls is its possible danger to humans. Hunting is not legal in national parks, nor is it practical or legal in urban areas. In national parks however, the National Park Service can hire sharpshooters to cull a population. Although this practice addresses population problems, it does not create funds for state wildlife agencies, eliminating one of the principal benefits of hunting. In urban areas, for both legal and practical reasons, hunting of nuisance wildlife or overabundant populations is not allowed.[33]

Hunting will remain a primary tool of state wildlife agencies for its utility and revenue, but as people increasingly recreate and build houses in open space, the safety and acceptance of hunting may decline. If hunting becomes further restricted, other tools will need to be ready to contribute.

Harassment

Another technique, used for thousands of years, since the domestication of crops and livestock, is harassment. Harassment is effective as a management tool in farming and predator deterrence, but is not appropriate for handling larger wildlife management population concerns (e.g., it would be difficult to harass a population back under the carrying capacity of the land). Harassment

is effective because wildlife is naturally risk-averse.[34] A deer or elk looking for forage is less likely to choose a rancher's alfalfa if there is a scarecrow, a horn sounding, or a dog roaming the area.

The effectiveness of harassment varies based on the targeted animal and situation. Harassment is most commonly employed on farms and ranches to protect crops from herbivores and to deter predators from livestock. Harassment on farms and ranches includes everything from the classic scarecrow to advanced olfactory and chemical stimuli. For the most part though, the various methods share similar advantages and disadvantages. In the short term, which can vary from a few days to over a month depending on the tool, the deterrents are effective and will keep unwanted foragers away. However, animals eventually habituate to these devices and begin to engage again in the unwanted behavior.[35] Animals will habituate to a simple scarecrow very quickly, often just a few days. A kite that portrays the image of a large predatory bird combined with auditory stimuli may keep wildlife away for over a month. Generally, coupling fear-provoking stimulants or stimuli that are erratic, moving, or noisy on an inconsistent basis will work best. In general though, for a situation like the few days between when a crop is ripe and when it is harvested, harassment can be very effective and cost efficient.[36]

Harassment of predators has long been used to keep down predator-livestock and predator-human conflicts. Various methods are used to keep predators away from livestock, ranging from guard dogs to electric fences to shock-collaring wild animals. Though there is some debate, most ranchers have reported that guard dogs are a cost-efficient and successful way of controlling livestock-predator conflicts.[37] The merits and cost effectiveness of more modern techniques, like shock collars and electric fences, are more disputed, but show promise. Although still not widely used, electric fences have proven successful at lowering predation rates of coyotes on sheep.[38]

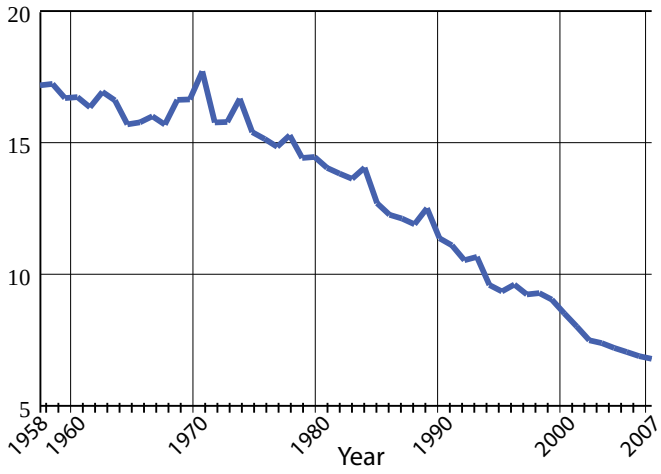
Contraception

Though it is a relatively new (the National Wildlife Research Center only began developing them in 1991), contraception has several clear advantages over hunting.[39] For one, contraception can be implemented in areas where hunting is prohibited such as national parks and urbanized areas. Additionally, as public favor is turning away from hunting, contraception is gaining favor.[40] Contraception also eliminates the possibility for first-generation compensatory reproduction because there is no freeing up of food resources, until the herd size shrinks for lack of replacement. Sterile animals eat, too. Even so, previous studies have shown that it may not be effective in managing the populations of larger species who reproduce at a slower rate and have fewer offspring.[41]

Contraception also has several weaknesses. The two largest, aside from costs, are the delivery of the fertility control and the behavioral impact of it. Currently, biobullets and treated bait are used to deliver contraceptives, though each has its drawbacks. First, biobullets are more difficult to shoot than regular bullets, which can result in labor/time intensive "hunts." which are more expensive. Treated bait presents even more problems: the bait could be poorly accepted, consumed after the breeding cycle or at the wrong time in the reproductive cycle, consumed in the wrong doses, and may even be consumed by the wrong species. Surgical sterilization, though generally safe, is not practicable in the wild.

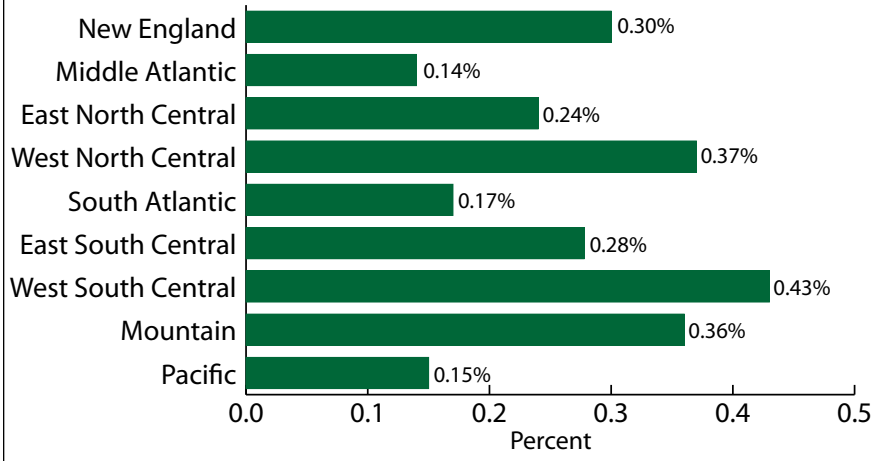
In addition, contraceptives have behavioral impacts on animals. While all wildlife management efforts will impact an animal's behavior to a certain

Figure 6:
Percent of Population with Hunting Licenses, Rockies Region, 1958 - 2007



Source: National Hunting License Report, 2007

Figure 7:
Percent of GDP from Hunting Revenue, by Census Division



Source: Survey of Hunting, Fishing, and Wildlife Recreation, 2006

degree, fertility controls tend to have larger impacts than many other types of methods. An animal that is shot at, trapped, or handled will likely change its behavior to avoid these situations. Those changes are desired. When fertility controls are imposed on an animal they inhibit one of the primary functions and behavioral determinants of the animal: its reproductive cycle or desire to reproduce. Impacting the cornerstone of an animal's life can have severe and often unpredictable behavioral impacts.[42] Depending on the contraceptive agent used, there could be a prolonged but unsuccessful breeding cycle, an elimination of the breeding cycle and associated behavior, or due to a lack of estrogen, elimination of the mother-young bond (for current offspring).[43]

At this time, contraception is likely most efficiently used in combination with hunting (or some other removal method). Contraception can help reduce the impacts of compensatory reproduction on hunting's effectiveness. Culling a population and then using contraceptives on some of the remaining herd could be a more effective and cost-efficient way to incorporate expensive fertility controls.

Predator Reintroduction

After years of predator extermination campaigns, predator reintroduction is a strongly favored wildlife management tool among residents of the Rockies region.[44] The reintroduction of predators garners public support because it is viewed by many in the general public as reconnecting a natural ecosystem process, which has many tangential benefits. Predators do not just help control prey populations (frequently elk or mule deer); they also force these populations to redevelop instincts to avoid predation, a phenomenon known as behaviorally mediated impacts. For example, the reintroduction of wolves helps

Table 1: Management Tools

Tool	Brief Description	Current Status
Predator / Prey Interaction	Predator – Prey Cycle feasible in large, natural settings: controls populations of both predators and prey	Marginalized by removal of predators & human intrusions; prey populations frequently become too large for carrying capacity, disease, stress set in
Subsistence Hunting / Trapping	Hunting for basic survival purposes	Uncommon, especially in the U.S. / Rockies Region, though still isolated examples
Trophy / Recreational Hunting	Hunting for sport: trophy heads often paramount but meat maybe consumed; hunters not solely dependent upon the hunt for survival	Common, likely most widespread of all wildlife management tools. Barred from certain land-use designations, i.e. National Parks, Wilderness Areas, and urban areas
Culling (through hunting or trapping)	Hunting neither for survival nor sport, but to maintain healthy wildlife populations; often requires professional expertise	Common, used frequently in areas where trophy / recreational hunting is not allowed (National Parks, Wilderness Areas)
Harassment	Initially used to keep aggressive predators at bay; now more often used to keep wildlife off of private property	Common, used frequently by farmers attempting to protect crops and urban areas to displace overcrowding
Winter Feeding	Feed left out in harsh weather to preserve populations of affected animals	Common in certain areas, especially with large ungulates and migratory birds, losing favor due to perpetuation of non-natural conditions
Translocation	Removal and transportation of nuisance animals to new habitat	Common, especially as lethal wildlife population controls lose favor
Predator Reintroduction	Introduction of previously extirpated predator's into former habitat, used with hope that new predators will control an overly large prey population	Infrequently used, although gaining favor as support for the idea of a more "complete ecosystem" grows
Enhancement of Migration Corridors	Preservation of land vital for wildlife to move from their summer feeding grounds to winter feeding grounds	Infrequently used, although as more evidence has been presented demonstrating its importance it has begun to garner more support
Contraception	Fertility control drugs / surgeries implemented to control overgrown wildlife populations	Uncommon, expensive and impractical to implement, support is growing however as anti-lethal control sentiment rises
Disease Management	Vaccination to Control or prevent epidemics in wildlife, especially endangered or threatened wildlife	Uncommon, expensive and impractical currently, but likely to grow in importance as technology improves

Source: Developed by the State of the Rockies Project, 2008

control elk populations, but also forces the herd to remain mobile, which reduces site-intensive grazing.[45] The presence of predators also keeps elk and other mega-fauna from lingering in riparian areas where cover is dense and predators can hide in wait. This trophic cascade reduces soil erosion, preserves riparian vegetation, and improves overall stream health.[46] In addition, predators are also likely to target weakened and diseased animals, which may significantly reduce cases of chronic wasting disease in populations of elk and mule deer.[47]

The benefits to predator reintroduction are numerous, but there are also potential drawbacks. For example, the release of predators can negatively impact humans around the release site. Ranchers may lose livestock, and homeowners may lose family pets, and in some cases even worry for their safety.[48] This situation has created a schism between overall public views favoring predator reintroduction and the views of those most likely to have to deal with the consequences of the reintroduction; this schism can make legislation supporting predator reintroduction difficult to pass.

Translocation

Translocation is gaining popularity as a moral alternative to lethal control for nuisance animals. People generally want to "give the animal a second chance,"[49] but translocation, despite its popularity, has several weaknesses as a wildlife management tool. There are three main problems with translocation: strong homing instincts, philopatric behavior, and a relatively high rate of mortality from handling, transporting, and the stress of living in a new ecosystem.

For species with strong homing instincts, translocation is often wasted time and money. For example, translocating a black bear is likely to be ineffective. Nearly 50 percent of black bears translocated fewer than 120 km, and 20 percent of black bears relocated farther than 220 km, returned to their capture site.[50] Species without homing instincts, like white-tailed deer, are translocated more effectively. Studies have shown that deer often stay within 15 km of their release site.[51] With such varied degrees of homing instincts among species, the usefulness of translocation is limited to wildlife populations with poor or no homing instincts.

Philopatric behavior means that if you remove a problem population from an area, it will not be quickly repopulated by other animals of the same species.[52] Again, the money and effort expended to remove a problem animal or population is essentially wasted, unless the species exhibits philopatric behavior. It is also important that different sexes and ages of a species may exhibit varying degrees of philopatry. For example, female deer may be very philopatric, but if males are causing the problem and are much less philopatric then male deer may simply recolonize an area after other deer are removed.[53]

In addition, there is still the high mortality rate associated with translocation. Animal mortality due to extrication and transporting ranges between zero and 30 percent depending on the species and tranquilization method used. If the mortality from stress as the animal struggles to adjust to a new ecosystem is factored in, the mortality rate can be nearly 100 percent. This is especially true of animals that are translocated from urban to rural areas. These animals have a much higher mortality rate from the rigors of the new ecosystem. For example, deer translocated from urban to rural environments show a much higher mortality rate than the native deer populations, mostly due to hunting and automobile collisions. Some species show a greater resilience to the stresses of translocation. Raccoons, grizzly bears, and wolves seem to handle translocation better than black bear or deer, for example.[54]

Last, the cost of translocation compared to hunting and other tools cannot be ignored. The labor hours associated with operating a successful deer hunt (in circumstances when translocation is also an option such as urbanized areas) is 1.8 hours. Depending on the method of capture employed, simply catching a deer in the same general area requires between 3 and 8.5 hours.[55] The cost to operate a deer hunt according to another study on urban deer removal was around $74, but to capture the deer alive, the cost would be around $412, not including transportation costs.[56]

Enhancement of Migration Corridors

Not all wildlife management tools control population numbers. Migration corridors help maintain genetic diversity and reduce the stresses of winter on animals.[57] Without migration corridors, populations

Table 2: Management Success Stories

	Management Implemented	Successful Example
Arizona	Restoration: Working with partners to bring back wildlife and natural areas – bald eagle recovery	Portions of the State Wildlife Grants in Arizona are going towards monitoring and banding bald eagles. State agencies, local agencies, and the Southwestern Bald Eagle Management Committee are collaborating on the project. The information gained about the bald eagle population and distribution will help biologists make future management decisions regarding the bird.
Colorado	Management: Proactive measures that benefit wildlife and people – Gunnison Sage Grouse Citizen Stewardship Program	Colorado Audubon Society and the Colorado Division of Wildlife have worked together to establish a local citizen group that will assist in the monitoring of the Gunnison sage-grouse. Due to the variety of land management groups in the Gunnison Sage-Grouse habitat, the group has also worked on reaching out to ranchers and the BLM, advocating good land stewardship and conservation.
Idaho	Research: Gathering information to take action – pygmy rabbit population status	State Wildlife Grants in Idaho were used to gather baseline data on the pygmy rabbit population, range, and dispersal. The information gathered provided Idaho with information used to decide that pygmy rabbits did not need to be listed as an endangered species. Success stories like this are at the heart of the State Wildlife Grants goal for cost-effective management of all wildlife species.
Montana	Research: Gathering information to take action – finding fish in Montana's "fishless" streams	Thousands of miles of Montana's prairie streams had never been surveyed for fish. Now though, using State Wildlife Grants Montana has begun surveying these streams and found startling results. Streams thought to be "fishless" were found to contain 48 different species of fish (30 of them native), five different amphibian species, and 10 different reptilian species.
Nevada	Restoration: Working to bring back wildlife and natural areas – sustaining agriculture's benefits to the long-billed curlew	State Wildlife Grants in Nevada were used to examine the impacts of ranches on the long-billed curlew, an imperiled species. The results were surprising; ranches generally had a positive impact on populations. As a result, some state wildlife grants will go to building a landowner incentive program to ensure the continued health of the long-billed curlew.
New Mexico	Research: Gathering information to take action – short grass prairie bird conservation	The Rocky Mountain Bird Observatory and New Mexico Game and Fish Department have teamed up to establish an inventory and monitoring system for grassland birds using State Wildlife Grant funds. The data collected will help in a regional monitoring effort.
Utah	Conservation: Protecting imperiled land, water, and wildlife – implementation of sensitive species program	A portion of Utah's State Wildlife Grant funds were used to hire five wildlife biologists to participate in a wildlife rehabilitation program. In addition to these responsibilities, these biologists are looking at wildlife diseases and their potential to affect humans.
Wyoming	Research: gathering information to take action – amphibian assessment	Insufficient information has made managing amphibians in Wyoming costly and ineffective. State Wildlife Grant funding in Wyoming has been used to compile baseline data on amphibians and with this information the state hopes to develop long-term, cost-effective management plans. The information has potentially saved Wyoming from unnecessarily listing three amphibian species as endangered.

Developed by the State of the Rockies Project, 2008

Case Study: The Valles Caldera

The Valles Caldera National Preserve has been referred to as the Yellowstone of New Mexico because of its expansive natural beauty. The Preserve, however, could also be appropriately referred to as America's federal land management laboratory.[1] The Valles Caldera is the first federally owned land managed through a trust. According to its 2000 directive from Congress, the Valles Caldera Trust is to manage the preserve and be financially self-sustaining by 2015, although the trust may apply for extended federal funding.[2] To meet this goal, the Valles Caldera is allowed administrative liberties not typically permitted at other federally managed lands. Most notably, the Valles Caldera is to function as a working ranch (allow livestock grazing) where consistent with other purposes. Other revenue-generating activities include elk hunting, cattle grazing, fishing and hiking permits, wagon rides, horseback riding, van tours, and cross-country skiing.[3] In addition, scientific research and educational activities make up a significant portion of public activities on the Preserve; for example, in 2008, the Preserve hosted 32 research projects totaling over $1.6 million in outside grant funding.[18]

Eight years into this land management experiment, the preserve is still searching for a balance of sound environmental practices, ranching operations, and a self-sustaining budget.[4] The Valles Caldera Trust is currently recovering about 20 percent of its operating cost through user fees. In 2008 the ranch generated $690,000 in revenue, more than double the $321,000 generated in 2002; however operating costs were approximately $3.6 million for 2008.[5] Only 21 percent of the preserve's costs are covered by preserve revenues, and yet, no concrete plan is in place to move forward and achieve financial autonomy.

The preserve's directive calls for "operation of the Preserve as a working ranch," *where consistent with* "the protection and preservation of the scientific, scenic, geologic, watershed, fish, wildlife, historic, cultural and recreational values," and "multiple use and sustained yield of renewable resources within the Preserve."[6] This leaves ranchers, hunters and anglers, and recreationists all with legitimate but sometimes conflicting claims for access to the Preserve.

Hunters, anglers, and recreationists might point out that they are the most logical primary use for meeting revenue goals. Of the $750,000 in revenue the preserve generated in 2007, 73 percent came from recreation programs, with elk hunts alone generating $330,000.[7] Grazing, on the other hand, only generated $5,800 and is thought to be ecologically harder on the preserve than any of the other uses except the potential of future energy development.[8] In 2008 the grazing program generated $58,000, by quadrupling the number of steer from less than 500 to nearly 2,000. The increase in revenue came with a parallel increase in complaints and requests for refunds by recreationists whose experiences were impacted by the presence of so many livestock. Also in 2008 recreation proved king of revenue generation bringing in 91% of all revenues. However the recreation program also accounted for 22% of planned expenditures. For the preserve to meet its directive to be financially independent by 2015, it may have to rely heavily on increasing its hunting and angling revenues.

However, prior to becoming the Valles Caldera Preserve, this area was the Baca Ranch; used for grazing sheep and cattle for over a century. Cattlemen argue that the history and cultural value of the land is vested in ranching.[9] Ranching, though, has only turned a small profit for the preserve once in the last eight years, however, placing it at odds with one of the preserve's most important directives, to be financially self-sustaining. It is noteworthy that the Trust recoups nearly $6,000 for every elk hunted on the Preserve, and almost $40 per day for every fisherman, while the revenue from a steer is only $30 a year – yet livestock grazing remains the controversial focus and emphasis of the Preserve's Board of Trustees. Whether infuriating, funny, or ironic, one "unofficial" sign posted just outside the Preserve says, "Access for cows $1.50 for six weeks; Access for people $10 an hour." While the real entry costs are 25 cents per day per cow and $10 per day per person, the sign clearly makes the point. Rest assured, the Valles Caldera will have plenty of input from all sides as they continue to rework their financial and operational strategies.

[1] Yablonski, Brian. "Valles Caldera National Preserve: A New Paradigm for Federal Lands?" PERC Reports: Vol. 22, no. 4 (December 2004). http://www.perc.org/articles/article521.php?view=print.

[2] Valles Caldera Trust. 2007. State of the Preserve, 2002-2007. Valles Caldera Trust, Jemez Springs, NM. 105 pp. December 2007. http://www.vallescaldera.gov/about/trust/docs/trust_SOPDecember2007ExecSum.pdf

[3] Valles Caldera Trust. 2007. Report to Congress for Fiscal Year 2007. http://www.vallescaldera.gov/about/trust/docs/AnnualReportCongress2007.pdf

[4] Valles Caldera Trust. 2007. State of the Preserve, 2002-2007

[5] Valles Caldera Trust. 2007. Report to Congress for Fiscal Year 2007.

[6] Valles Caldera Trust. 2007. State of the Preserve, 2002-2007.

[7] Valles Caldera Trust. 2007. Report to Congress for Fiscal Year 2007.

[8] Valles Caldera Trust. 2007. State of the Preserve, 2002-2007.

[9] Valles Caldera Trust. Listening Session #5. Ghost Ranch Dining Room, March 10, 2001. Summary of Discussion Facilitator/Recorder: Lucy Moore.

Valles Caldera © Julia Head

become isolated. With no flux or interaction of animals with other populations, the genetic pool is constricted. This small gene pool slows evolution through natural selection and increases the chance for gene mutation from inbreeding.[58] Also, without migration corridors, many animals will not be able to reach their wintering grounds. Wintering at higher elevations can be stressful for animals. In addition to the scarcity of forage, animals expend more energy trudging through deep snow. This seemingly minor difference is a significant contributor to winter die-off.[59] Blocking migration corridors results in more winter die-off or necessitates more winter feeding, which comes with its own set of issues (See Case Study: National Elk Refuge,in the Wildlife: Range and Condition Section).

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Enhancing migration corridors is unlike most other wildlife management tools discussed in this paper; it requires the preservation of open space. When land is preserved as a migration corridor, many other potential uses of that land are eliminated, which often generates its own set of conflicts. When land is preserved as a migration corridor it often interferes with energy development, livestock grazing, and development. This is especially true in the Rockies region where all three of these land uses are important to the regional economy.[60]

These pressures make preserving migration corridors difficult, but the wildlife do not help themselves. Mitigation tools such as highway underpasses, and overpasses are often ineffective because wildlife see them as potential risks.[61] For example, "often deer and elk are reluctant to use the overpass or underpass because they want to avoid areas where they could be vulnerable to predators. Both underpasses and overpasses provide potential ambush sites for predators."[62]

In addition, since migratory animals can travel more than a hundred miles along these long thin corridors to their summer or wintering grounds, crossing a variety of land, owned or controlled by various people and agencies, it can be difficult to protect the entire migration route. Just one non-cooperative landowner or government agency can effectively ruin the protection of the corridor.[63] These challenges make migration corridors difficult for wildlife managers to maintain.

Winter Feeding

Wide-scale winter feeding was first implemented in 1911 in Jackson Hole, Wyoming at the current site of the National Elk Refuge. Though winter feeding is still practiced, its merits are constantly debated.[64] It is heavily favored by the public but draws criticism from many wildlife managers.

Winter feeding creates economic and social benefits but rarely benefits the ecosystem. For example, a larger elk herd sustained by winter feeding can provide economic benefits by increasing gains from the hunting season and wildlife viewing. Feeding also keeps wildlife away from private lands, where it may destroy crops or gardens, and assuage public concern for the safety and health of animals.[65] In none of these instances does the wildlife itself directly benefit, but wildlife management requires balancing interests and managing wildlife for human goals and expectations. In this regard winter feeding may be successful.

Disadvantages of winter feeding are mostly shouldered by the animals being fed and the ecosystem. Without predators to regulate population, harsh winter conditions normally act as a significant limiting factor to populations. When artificial feeding removes winter die-off, the population is allowed to further expand, "thereby creating ever-increasing demands for both artificial and natural foods."[66] Negative impacts of this are felt by both the animal and the ecosystem. Local plant communities are degraded, the spread of disease is facilitated, and the animals diets are harmed (animals' digestive systems do not respond well to sudden increases in nutrient values).[67] In addition, when a species is maintained above the carrying capacity of the land, it has the potential to degrade the land beyond its regenerative capacity. This will negatively impact vegetation and any other species in the ecosystem that is dependent upon it.

On top of all this, winter feeding is expensive, which can dampen the earlier mentioned economic benefits. Depending on seasonal conditions, the cost of elk winter feeding in the mid-1990s ranged between $35 and $112 per elk. During this time Wyoming was feeding almost 25,000 elk; spending between $875,000 and $2.8 million.[68]

Disease Management

Infectious disease management is a recent addition to the repertoire of wildlife managers, but its importance is already being realized. Disease has come dangerously close to wiping out some of our most endangered wildlife, such as the black-footed ferret.[69] Little research has been done on the effectiveness of current disease management techniques because it is such a new field and is often only

implemented during a crisis.

Disease management can be aimed at several targets: the infected animals, threatened animals, reservoir hosts, or the ecosystem. Disease management of the infected animal is usually impractical, and not often attempted. Managing the infected animal leaves no opportunity for blanket treatments. Treatments or vaccines are often manually administered, which is more labor and time intensive. Because treatments may have to be repeated several times to ensure complete effectiveness, it is an inefficient process, and therefore a tool used only in the most dire situations for the most important animals, such as endangered species.[70] In these instances it is often more practical to trap the few remaining animals and treat them in captivity, as was the case with the black-footed ferret.[71]

Vaccinating threatened hosts is more feasible, but still often used only in crisis situations when disease risk is imminent. As a result, little research can be done prior to implementation, making it difficult to evaluate how successful these programs are, since there is no benchmark, unvaccinated population for comparison. There are, however, a few documented examples where vaccinating potential hosts has had no or little impact. For example, black-footed ferrets did not produce the expected protective antibody response when given a vaccine to Canine distemper virus. As a result, the vaccination was ineffective and the black-footed ferret population continued to decline.[72]

Treating the reservoir host is easiest and has thus far proven to be most effective. It is easier to administer vaccine to the reservoir host because in most instances it is a domesticated animal. Treatment can be as simple as mandating the vaccination of all dogs or cattle at birth. At worst it could entail forcing all the livestock and dogs in an area to get vaccinations, if the threat is immediate.[73] Vaccinations of reservoir populations have proven somewhat more successful than attempts to vaccinate wild populations. For example, through controlling Rinderpest in cow populations in Africa, the disease was eliminated amongst wildlife.[74]

Perhaps the most effective form of disease management is to treat the ecosystem. Here, treating the ecosystem means culling or vaccinating reservoir hosts and the threatened populations. This limits the amount of contact that both would have with each other and the likelihood that the disease will spread between the two. However, this practice is sometimes socially unacceptable. Culling domestic dogs has never been attempted and likely would not be accepted.

State Wildlife Grants

(See Figure 8)

In 2000 Congress passed the Wildlife Conservation and Restoration Program and the State Wildlife and Tribal Grants, starting wildlife management in America down a new and exciting path.[75] The passage of these two programs could facilitate "an important culture shift in many of the of the state fish and wildlife agencies."[76] The State Wildlife and Tribal Grants "provide federal money to every state and territory for cost-effective conservation aimed at preventing all wildlife from becoming endangered."[77] The programs aim to be proactive about wildlife conservation and to develop plans to aid non-endangered and non-game wildlife in peril. Eighty percent of wildlife does not fit into either the endangered or game designations and thus receives less attention from wildlife managers.[78] The Wildlife Conservation and Restoration Program and State Wildlife and Tribal Grants will provide support for the Endangered Species Act (ESA) by protecting species before they reach critical "endangered" status. These new programs are pre-emptive protection; a perfect complement to the ESA.

Early Legislation

Prior to these programs, an obvious gap in legislation and funding existed between protected game and endangered species and other types of unprotected wildlife. The Pittman-Robertson Act of 1937 provided game species with protection and the Endangered Species Act provided protection for species in peril. The Pittman-Robertson Act funded wildlife agencies by levying a user fee, in the form of an excise tax, on hunting equipment; the proceeds were specifically mandated to be used to conserve game species and their habitat.[79]

Loading a bear for translocation © Deb Robinett

In 1950 a similar act, the Sport Fish Restoration Act, was passed to supply similar protection to fisheries. Like the Pittman-Robertson Act it placed an excise tax on all fishing equipment and employed the revenue toward protecting game fish and fisheries.[80] The success of these laws has kept game species at the forefront of state wildlife agency agendas for the past 70 years.

Endangered species have also been a priority for the wildlife managers and the U.S. Fish and Wildlife Service. Passed in 1973, the blanket objective of the Endangered Species Act (ESA) was to conserve wildlife designated as endangered or threatened, and the habitat they depend upon. The Act prohibits the "taking, possession, sale, and

transportation" of endangered species and is perhaps the nation's most comprehensive environmental law.[81]

The remaining 80 percent of species (those not classified as endangered or game species) have historically not been so generously provided for. The only legislative protection afforded for these species were the inadequate and underfunded state wildlife diversity programs and The Fish and Wildlife Conservation Act ("Nongame Act").[82] The state wildlife diversity programs, established in the mid-1970's, had vague goals and at best "unpredictable and inadequate" funding.[83]

The "Nongame Act" attempted to do for all wildlife what the Pittman-Robertson Act did for game species: find a consistent and substantial tax base. The original ideas included an excise tax on recreational equipment.[84] No funds were ever reallocated to the "Nongame Act," and the recreational equipment tax was never implemented, rendering the program a failure.[85] In the end, these programs did little to help wildlife managers implement conservation measures for non-endangered and non-game species.

Recent Legislation

The Teaming with Wildlife Coalition was formed in the early 1990's to find a consistent source of sizeable funding for the "Nongame Act." Soon though, the Teaming with Wildlife Coalition refocused itself to the passage of the Conservation and Reinvestment Act (CARA), which ultimately failed in the Senate .[86] CARA called for $3.1 billion in annual funding that "would enable communities all across the country to expand parks and recreation, preserve open space farmland, protect wildlife and endangered species, and preserve historic buildings."[87] The wildlife funding section, Title III, of CARA had three goals: 1) to prevent species from becoming endangered, 2) to enhance the outdoor experience, and 3) to foster a responsible stewardship ethic through education efforts. CARA did not pass.[88] The bill received more than 300 votes in the House, but stalled in the Senate, possibly because Congress was reluctant to lose the offshore drilling taxes that were proposed as the source of funding for CARA.[89]

State Wildlife Grants

With the defeat of CARA, Teaming with Wildlife worked to find a short-term solution to Congress's apprehensions about CARA. The compromise was the State Wildlife and Tribal Grants Program and the Wildlife Conservation and Restoration Program. In 2000, Teaming with Wildlife successfully pushed legislation through Congress that would provide funding and direction for the protection of all wildlife.

The Wildlife Conservation and Restoration Program encompassed all of the goals put forth by Title III of CARA: prevent species from becoming endangered, enhance the outdoor experience, and include an educational element.[90] The State Wildlife Grants were focused solely on the first goal, preventing species from becoming endangered. Funding for the Wildlife Conservation and Restoration Program was only promised for a year (despite the fact that it is a permanent program) and has not received any appropriations since 2001.[91] While the Conservation and Restoration Program sits idle, the State Wildlife Grants have currently received over $485 million.[92]

The two main requisites for states to receive funding required the completion of a comprehensive wildlife management strategy (hereafter referred to as the state wildlife action plan) and to match at least a quarter of the federal funds received.[93]

The state wildlife action plans required each state fish and wildlife agency to prepare a state wildlife action plan by 2005. These wildlife action plans have eight required elements. The plans require states to 1. include information on the "distribution and abundance" of wildlife and specifically identify low and declining populations; 2. provide descriptions of the locations and the relative condition of critical habitat for these species; 3. identify potential problems and threats to wildlife; 4. propose conservation action plans for species identified as having low or declining populations; 5. put monitoring plans in place for habitats, species, and the effectiveness of conservation actions; 6. review their wildlife action plans every ten years; 7. coordinate with federal, state, and local agencies in developing plans; and 8. include the public in the development and implementation of the plans.[94] Forcing each state to collect and compile all the information required by these eight requisites has the potential to improve the management of non-game and non-endangered species. Identifying at risk populations and those on the decline, combined with the requirement to identify potential threats to these populations and their habitats, is a step in the right direction. Even with no current funding, wildlife managers for the state will know where and how to direct any future funding and research.

The last two requirements allow for private and public organizations to claim a stake in the wildlife action plans. A variety of government and non-government organizations have taken an interest in and helped create the action plans. With the assistance of these groups, the Association of Fish and Wildlife Agencies, an organization that represents all of the U.S. fish and wildlife agencies and emphasizes interagency coordination, legislation, and international affairs, provided the necessary support to ensure that each state had an adequate wildlife action plan.[95] Not only did these last two requirements help the state wildlife agencies complete the other six, they also gave them the contacts that the state would need to match the funds provided by the federal government.

Some have referred to this as "facilitating buy-in"[96]; the more people that buy-in and take a stake in the success of the State Wildlife Grants and non-game species,

Case Study: Diamond G Ranch

The Diamond G Ranch sits on the north end of the DuNoir valley, just outside of Dubois Wyoming. DuNoir Creek flows through the picturesque property in a valley used as an elk migration corridor between Yellowstone and the East Fork of the Wind River. Because of the wide, bare valley and surrounding, forested hills, the DuNoir valley is also among the best grizzly and wolf habitat in the state. The existence of predators makes ranching tricky, as Stephen Gordon, owner of the Diamond G Ranch, and Jon and Deb Robinett, the ranch's managers, can attest. For twenty years Gordon owned the grazing rights to the adjacent DuNoir allotment, during which time predators took between 200 and 250 calves.[1]

Pressure on ranches from grizzlies and other predators is expected, and ranchers like Jon and Deb have become adept at identifying peak bear use areas and moving cattle away during certain times of the year. For the Robinetts and Gordon, grizzlies are not the problem, however. Since 1999, the ranch has lost eight percent of its cattle to predators every year, and has also seen weight loss and decreased conception rates because of predator stress on the cattle.[2] The increase in depredation and livestock wellness correlates directly with the resurgence of the wolf population in Wyoming.

Wolves, extirpated in the area for several decades, have experienced a healthy population increase since reintroduction measures began in Yellowstone National Park in 1995. The Diamond G Ranch is located only 20 miles southeast of the Park, and the Ranch and surrounding areas have been adopted as prime wolf habitat. The Diamond G struggled to receive compensation for wolf kills of livestock, sometimes resorting to killing (with permission and licenses issued by the Fish & Wildlife Service) the alpha male in the pack.

In March, 2008, with the help of the National Wildlife Federation, the problematic DuNoir allotment was permanently retired from grazing. In exchange for retiring the allotment, the ranch received fair market value for the grazing rights. The National Wildlife Federation's grazing allotment buyout program has met little opposition. Since its inception in 2002, the program has spent about $2 million on 27 grazing allotments, accounting for almost 550,000 acres.[3] Rarely do these retirements generate much controversy; the National Wildlife Federation only solicits allotments that have seen constant battles between ranchers and wildlife. Often, ranchers have been quite willing to trade wolf or grizzly populated allotments for compensation to purchase grazing allotments elsewhere. Hank Fisher, coordinator for the conservation group, says he can think of only one instance where the owner of the purchased grazing allotment did not buy a less contentious right in a more favorable location.[4] Stephen Gordon and the Diamond G Ranch, however, are not planning to purchase another allotment. Their allotment was right next to their ranch, and they do not feel that they can make the financial commitment to truck their cattle to another, non-adjacent, allotment. Even though Gordon was happy to work with the National Wildlife Federation on the DuNoir grazing allotment, he is not sure that his operation will remain solvent without it.[5]

WY game and fish inspecting a possible wolf kill © Deb Robinett

© Deb Robinett

Wolf captured at the Diamond G Ranch

[1] Tharp, Francisco. "Yellowstone Grazing Allotments." High Country News. http://www.hcn.org/articles/17600. March 21, 2008. Accessed 1/12/2009.
[2] Robinett, Jon, Presentation at Colorado College. December 1, 2008.
[3] Tharp, 2008.
[4] *Ibid.*
[5] Gordon, Stephen. Personal Interview, July 11, 2008. Diamond G Ranch, Wyoming.

the more likely both are to succeed. In addition, the extra funding now, and especially in the future, could play a large role in the continued success of the program. These last two requirements have helped state wildlife agencies acquire necessary funds. For example, Rhode Island has only received $3.7 million in federal funds, but state and private organizations have contributed $6.3 million, representing close to a 200% match on federal funds.[97]

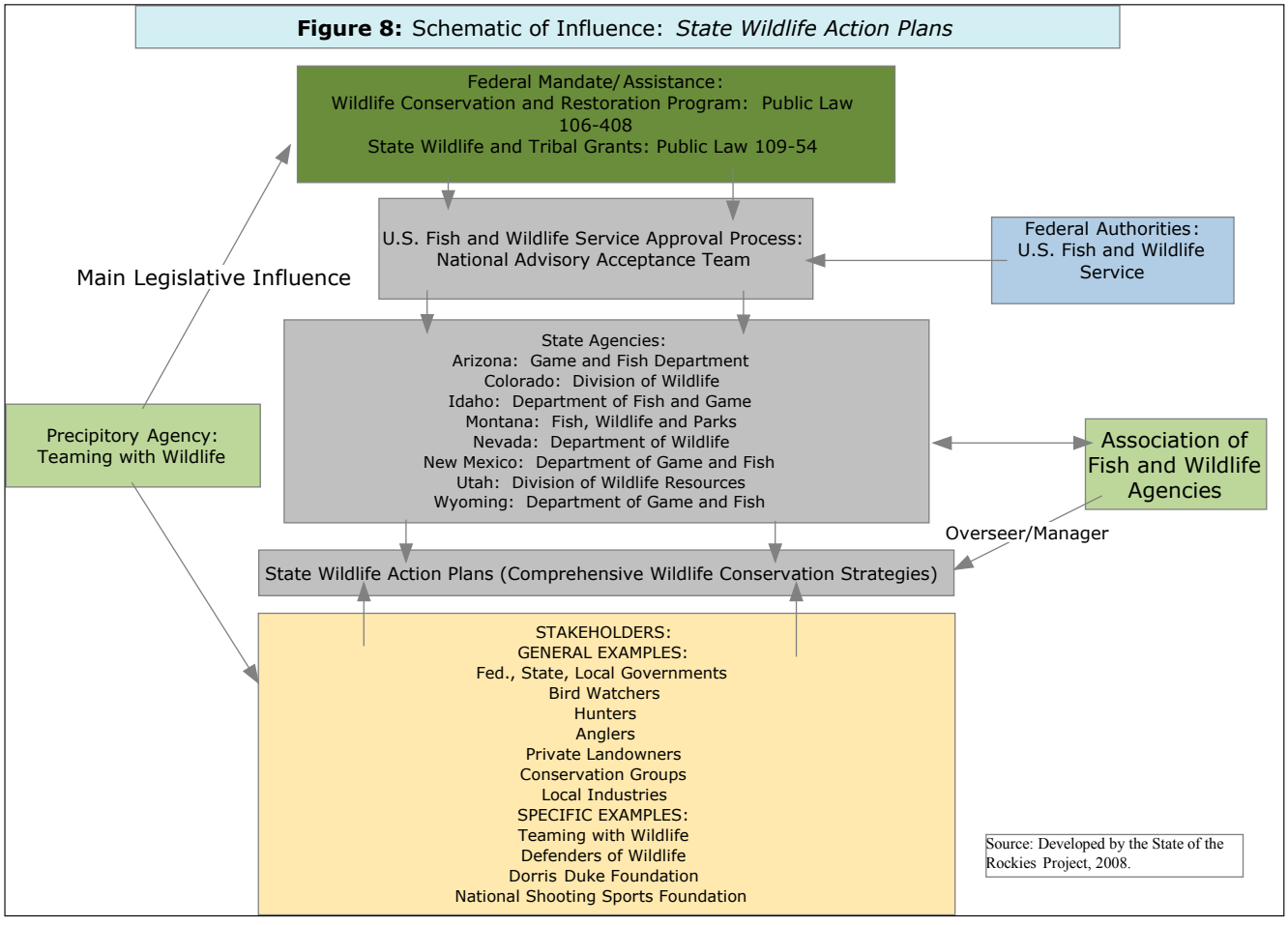
According to the National Wildlife Federation, "The best way to protect species is to protect habitat, create and implement recovery plans with broad stake holder involvement, and *provide necessary funding* (emphasis in original)."[98] The State Wildlife Grants have helped states to fulfill nearly all of these requisites. The state wildlife action plans are the most comprehensive wildlife recovery plans yet, focusing the sometimes scattered directives of state wildlife agencies. The final requisite, provide necessary funding, is logistically the most important and the weakest area of the State Wildlife Grants. Funding is consistent but inadequate; the Teaming with Wildlife Coalition anticipated three times the appropriations it initially received. The Coalition settled for less than $100 million in each of the first nine years of funding,[99] which has been adequate to complete the research and planning associated with the state wildlife grants.[100] To successfully implement these strategies, however, larger appropriations will be necessary. The outside funding facilitated by the requirement for state wildlife agencies to cooperate with other areas of the government and private interests helps, but in only rare instances (like that of Rhode Island) have outside funds been substantial enough to have a dramatic impact.[101] "We have sowed the seeds and we have healthy seedlings. Now we need to turn them into trees with deep roots. *Money* is the water [emphasis added],"[102] reasoned the Doris Duke Foundation.

For the state wildlife grants to garner more appropriations, several steps are necessary. Primarily, plans need to be implemented and successes need to be communicated. A few high-profile successes that are visible to the public would go a long way towards turning Congress' appropriations committee towards their favor. In addition, success stories would likely convince more investors from the private sector to provide funding (See Table 2).

Conclusion

The Rockies region is home to one of America's last great reserves of wildlife. Fortunately or unfortunately, it is also home to a variety of other resources that the country depends on, and which, at times, can negatively impact the region's wildlife. Managing these conflicts is the job of wildlife managers. Wildlife managers employ various tools to keep these conflicts to a minimum, while still preserving the region's wildlife resource. Tools ranging from conservation easements to hunting to winter feeding are employed to keep the demands for resources in balance with the need to preserve wildlife. The role of wildlife managers has changed dramatically from that a century ago, when wildlife was generally seen as an obstacle that somehow,

Figure 8: Schematic of Influence: *State Wildlife Action Plans*



unless valued by hunters, had to be eradicated to facilitate development. The evolution of wildlife management is still not complete. In fact, many argue that its evolution is just beginning. More stakeholders are bringing more diverse interests to wildlife management. With more stakeholders and more diverse goals, the field will continually and rapidly evolve to meet the new challenges to the region and its wildlife reserves.

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[1] 2006 National Survey of Fishing, Hunting, and Wildlife Associated Recreation. U.S. Fish and Wildlife Service. Appendix A, pg. 98. AND Bureau of Economic Analysis, U.S. Department of Commerce. http://www.bea.gov/regional/gsp/.

[2] Bureau of Economic Analysis, U.S. Department of Commerce. "Gross Domestic Product by State (millions of current dollars) Crop and animal production (Farms), 2006." http://www.bea.gov/regional/gsp/.

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Case Study: Vermejo Park Ranch

The Vermejo Park Ranch, encompassing nearly 600,000 acres in northern New Mexico, is trying to turn ranch lands back to what they were before European settlement.[1] Large herds of elk, deer, and bison call the land home, black bear and mountain lions are common sights, and wolves may someday roam Ted Turner's majestic ranch.[2] The Turner Endangered Species Fund (TESF) plays a large role in making this lofty goal a reality. Ranch managers use money from the Turner Fund and other outside sources to reintroduce endangered and extirpated species on Turner's ranch, which is used in part as a hunting retreat, but like many of Ted Turner's ranches, as an environmental management laboratory.[3]

Most notably on the Vermejo Park Ranch, the Turner Endangered Species Fund is working to reintroduce the black-footed ferret,[4] one of America's most endangered mammal that was once considered extinct.[5] As an obligate predator, black-footed ferret populations struggled when their prey, prairie dogs, experienced their own population decline due primarily to disease and loss of habitat.[6]

The Vermejo Park Ranch has cultivated its prairie dog colonies to eventually self-support black-footed ferrets. Between 1997 and 2008, prairie dog colony acreage on the ranch grew from 500 acres to over 6,700 acres.[7] From 2005-2007 TESF temporarily released ferrets onto select prairie dog colonies to determine if VPR was suitable as a potential ferret recovery site and to provide high quality pre-conditioned ferrets for release elsewhere. Most ferrets are pre-conditioned in large terrariums that simulate the outside world. The Vermejo Park's pre-conditioning program provides the ferrets with a more realistic training ground and also teaches biologists how to monitor ferrets in the wild. Ferrets pre-conditioned in field sites, like the one on Vermejo Park Ranch, have a higher rate of survival than ferrets raised in other types of training facilities.[8]

As the Turner Endangered Species Fund identifies,

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bringing native species back to the West is not easy: "Private stewardship of biodiversity is new, the problems are complex, and effective solutions require broad-based biological, sociopolitical, geographic, and fiscal considerations."[9] Hopefully, by implementing broad-based, "ecosystem level" thinking, the Vermejo Park Ranch managers and the Turner Endangered Species Fund can see their reintroduction programs through to success.

[1] Vermejo Park Ranch. History. Accessed 11/12/2008. http://www.vermejoparkranch.com/history.htm
[2] Vermejo Park Ranch. Welcome. Accessed 11/12/2008. http://www.vermejoparkranch.com/index.htm
[3] Turner Endangered Species Fund. An Introduction. Accessed 11/12/2008. http://tesf.org/turner/tesf/intro/
[4] Turner Endangered Species Fund. 2004 Annual Report. Accessed 11/12/2008. http://tesf.org/turner/tesf/reports/.
[5] Black-footed Ferret Recovery Program. History. Accessed 11/12/2008. http://www.blackfootedferret.org/facts-history.html.
[6] Christine Aschwanden. "Learning to Live with Prairie Dogs." National Wildlife Magazine vol. 39, no. 2 (April/May 2001). http://www.nwf.org/nationalwildlife/article.cfm?articleid=327&issueid=34
[7] Long, Dustin. Personal Correspondence. 1/20/2009.
[8] Truett, Joe. "Ferrets Test Freedom at Vermejo Park Ranch." Endangered Species Bulletin. Vol. XXXI, no. 1 (March 2006). U.S. Fish and Wildlife Service. http://www.fws.gov/endangered/bulletin/2006/es%20bulletin%2003-2006%20with%20links.pdf
[9] Turner Endangered Species Fund. An Introduction.

Case Study: Rocky Mountain National Park

Rocky Mountain National Park has struggled to manage elk populations for decades. The elk population is above the park's natural carrying capacity, and due to a lack of predators, the herd is less migratory and more concentrated than it would be under natural conditions. As a result, the negative impacts of the elk population are compounded; the willow and aspen communities on which the elk feed have been severally degraded. This ecosystem disruption has induced a cascade of disruption to other species and habitats throughout the park. For example, the beaver population in Moraine Park (a subsection of the Rocky Mountain National Park) has declined by 90 percent since 1940, presumably due to a lack in suitable (mature) willows for damming. Beaver, through the dams they build, are essential to maintaining surface water levels. Since 1940, when beaver populations began to decline, surface water has decreased by 70 percent in Moraine Park. [1]

As a result of vegetation and species diversity loss, in 2007 the National Park Service (NPS) decided that the elk population in the park needed to be reduced to its natural levels. The Elk and Vegetation Management Final Environmental Impact Statement (FEIS) was prepared to determine which wildlife management tool or program could best accomplish this, while still accommodating the goals and directives of the park. According to the FEIS, law and the park's resource management objectives obligate it to "maintain and restore, to the extent possible, the natural conditions and processes."[2] The National Park Service's preferred alternative is the gradual culling of elk to the higher end of natural population variability. This alternative was selected because "it best meets the general management objectives of the National Park Service for protecting park resources and values while being consistent with the park's enabling legislation, purpose, mission, and goals."[3] Additionally, according to the FEIS Record of Decision, gradual culling would be more cost effective than rapid culling and have a higher likelihood of success than the fertility control and predator reintroduction alternatives.[4]

The reintroduction of wolves to Rocky Mountain National Park was selected as the environmentally preferred option, but was not implemented because of logistical challenges.[5] However, the FEIS noted that the absence of a predator population is outside its normal population and behavioral ranges. Previous studies have demonstrated that using predators to manage elk not only decreases the elk population, but alter elk behavior.[6] In the presence of wolves, elk herds are forced to be more mobile, less dense, and to linger less in riparian areas. All of these behavioral changes have positive impacts for the montane willow ecosystem.

Gradual culling and reintroduction of wolves are both feasible ways to reduce the size of the Rocky Mountain National Park elk herd. Reintroducing wolves would create the desired behavioral changes but may not be economically or socially feasible, placing it outside the parks directive. Gradual culling, on the other hand, at least in the manner outlined in the FEIS, will be economically and socially feasible, but will struggle to change the behavior of the elk. The Record of Decision is flexible, open to changes after the effectiveness of the current program is evaluated after a few years. For now, elk population in Rocky Mountain National Park remains an intriguing and multi-faceted wildlife management experiment.

[1] Final Environmental Impact Statement. 2007. Elk and Vegetation Management Plan: Rocky Mountain National Park, Colorado. National Park Service (U.S. Department of the Interior).
[2] *Ibid.*
[3] Final Environmental Impact Statement Elk and Vegetation Management Plan: Record of Decision. National Park Service (U.S. Department of the Interior). Approved: Michael D. Snyder.
[4] *Ibid.*
[5] *Ibid.*
[6] Halofsky, Joshua and William Ripple. 2008. Linkages between Wolf Presence and Aspen Recruitment in the Gallatin Elk Winter Range of Southwestern Montana, USA. Forestry Advance Access Publication.

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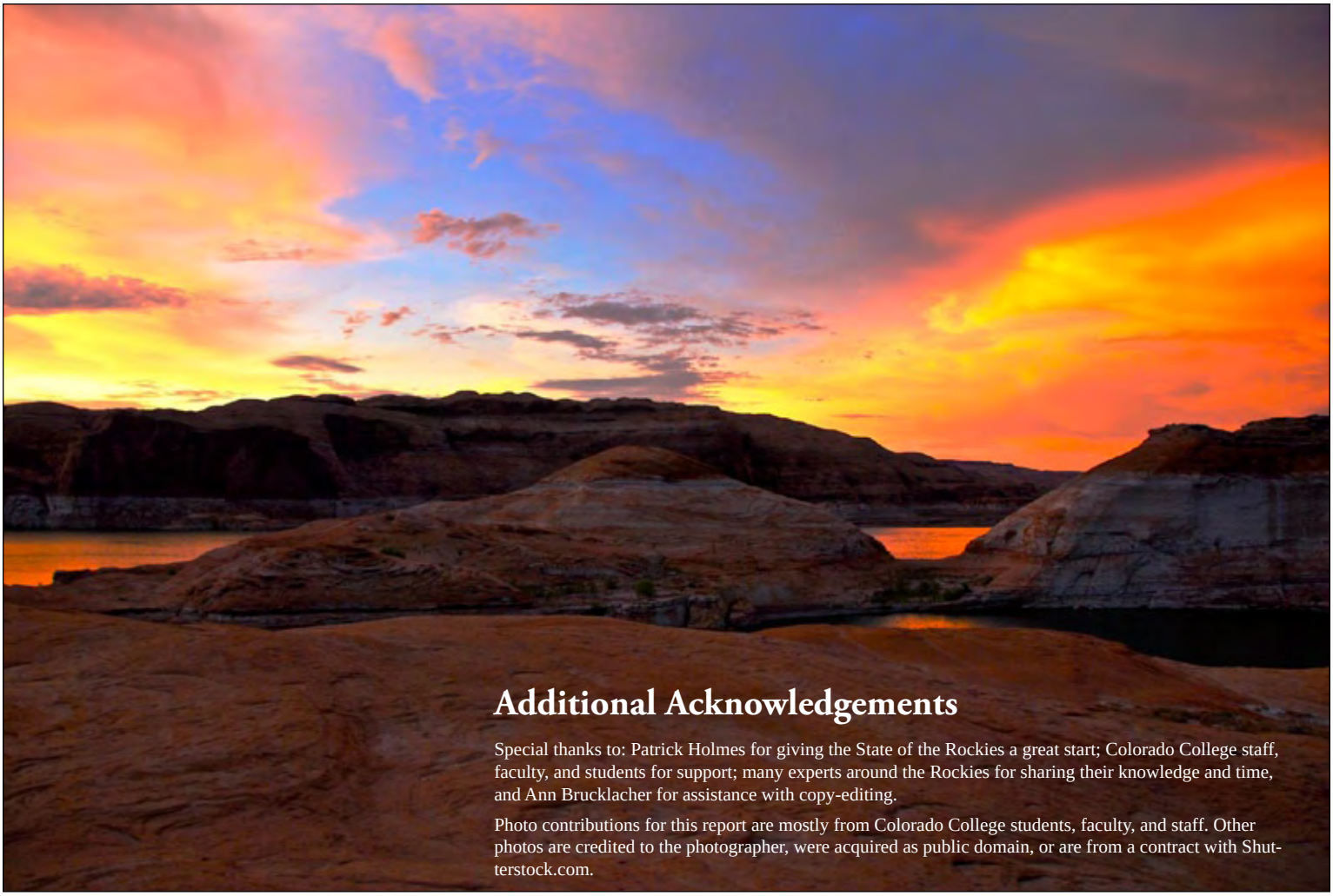

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Photo contributions for this report are mostly from Colorado College students, faculty, and staff. Other photos are credited to the photographer, were acquired as public domain, or are from a contract with Shutterstock.com.

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Julia Head is a student researcher for the 2008/09 State of the Rockies Project. From Marlborough, Massachusetts, she will graduate in May 2009 with a double major in biology and studio art. Julia grew up in Massachusetts, but has fallen in love with the Rockies region since moving west for college. Outside of the academic realm, Julia's favorite ways to enjoy the Rockies are bicycling, backpacking and skiing. As a researcher for the State of the Rockies Project, she is engaging her interest in wildlife biology.

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Chris Jackson is a contributor to the *2009 State of the Rockies Report Card*. Chris served as program coordinator for the Rockies Project from 2006 through 2008, and was co-editor of the 2007 and 2008 *Report Cards*. He graduated cum laude from Colorado College in May 2006 with a B.A. degree in International Political Economics. Chris currently resides in Ouray, Colorado, and enjoys recreating in the San Juan Mountains.

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Elizabeth Kolbe is the 2008/09 Program Coordinator for the State of the Rockies Project, and co-editor of the *2009 Report Card*. When working as a student researcher for the 2007/08 State of the Rockies Project, she wrote a report on Renewable Energy in the Rockies. In May 2008, she graduated cum laude from Colorado College with a B.A. degree in Environmental Science. Her senior thesis focused on the environmental, political, and economic climate and energy efficiency of ethanol production in Iowa, her home state. Liz is also a volunteer assistant coach for the Colorado College women's basketball team.

John MacKinnon is a guest contributor to the *2009 State of the Rockies Report Card*. He graduated from Colorado College in August 2006 with a B.A. in economics, and was a researcher for the 2007/08 State of the Rockies Project. During his time at CC, John focused primarily on macroeconomic issues, and wrote a thesis concerning the potential monetary and social effects of Medicare Part D. After college, John took steps to integrate his lifelong passion for the outdoors into his career, and was elected to the board of directors of the watershed conservation group, Animas Riverkeeper. In the fall of 2008, he began law school at Lewis and Clark College in Portland, Oregon.

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Sarah Turner is a student researcher for the 2008/09 State of the Rockies Project. From Wayne, Pennsylvania, she is currently an Environmental Science major at Colorado College, with particular interest in international environmental issues. Having spent a semester in Madagascar in Fall 2007, where she studied ecology and conservation and their intersection with society and culture, she is excited to study the interplay of the environment and society here in the Rocky Mountain Region. Her interests include hiking and backpacking.

Stephen G. Weaver is an award-winning photographer with over 30 years experience making images of the natural world and serves as technical director for the Colorado College geology department. Educated as a geologist, Steve combines his scientific knowledge with his photographic abilities to produce stunning images that illustrate the structure and composition of the earth and its natural systems. As an undergraduate geology student, he first visited the Rocky Mountains where he fell in love with the mountain environment and the grand landscapes of the West. Steve currently photographs throughout North America with a major emphasis on mountain and desert environments. His use of a 4x5 large format view camera allows him to capture images with amazing clarity and depth.

Alex Weiss is a student researcher for the 2008/09 State of the Rockies Project. From Rockville, Maryland, he took a year off after high school and worked on an organic farm and winery outside of Corvallis, Oregon. There, he developed an interest in agriculture, food and plant ecosystems. During summer 2007 Alex worked as an intern on the CC farm, where he helped to establish a sustainable agriculture system for Colorado College. During the fall of 2007 Alex traveled to China and studied language, culture and the medicinal plants of the Bai people. As a Biology major, Alex studies botany and ecology at Colorado College and after graduation hopes to go into research in plant ecology of marsh ecosystems.

Scott Wozencraft is a student researcher for the 2008/09 State of the Rockies Project. A native of Arlington Heights, Illinois, Scott's interest in environmental issues was cultivated during a National Outdoor Leadership School Semester in the Rockies. He will graduate in May 2009 with a degree in Environmental Science. His particular academic interests lie in wildlife management and land use/development in the Rocky Mountain Region. Extracurricular interests include sports, backpacking, climbing and canoeing.

Colorado College State of the Rockies Project

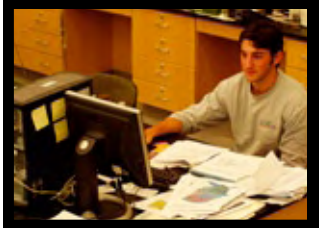
Students Researching, Reporting, and Engaging:

The Colorado College *State of the Rockies Report Card*, published annually since 2004, is the culmination of research and writing by a team of Colorado College student researchers. Each year a new team of students studies critical issues affecting the Rockies region of Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming.

Colorado College, a liberal arts college of national distinction, is indelibly linked to the Rockies. Through its Block Plan, students take one course at a time, and explore the Rockies and Southwest as classes embark in extended field study. Their sense of "place" runs deep, as they ford streams and explore acequias to study the cultural, environmental, and economic issues of water; as they camp in the Rocky Mountains to understand its geology; as they visit the West's oil fields to learn about energy concerns and hike through forests to experience the biology of pest-ridden trees and changing owl populations. CC encourages a spirit of intellectual adventure, critical thinking, and hands-on learning, where education and life intertwine.

The Colorado College State of the Rockies Project dovetails perfectly with that philosophy, providing research opportunities for CC students and a means for the college to "give back" to the region in a meaningful way. The *Report Card* fosters a sense of citizenship for Colorado College graduates and the broader regional community.

Research
During summer field work, the student researchers pack into a van and cover thousands of miles of the Rocky Mountain West as they study the landscape, interview stakeholders, and challenge assumptions. Back on campus, they mine data, crunch numbers, and analyze information.



Report
Working collaboratively with faculty, the student researchers write their reports, create charts and graphics, and work with editors to fine-tune each *Report Card* section. Their reports are subjected to external review before final publication.

Engage
Through a companion lecture series on campus, the naming of a Champion of the Rockies, and the annual State of the Rockies Conference, citizens and experts meet to discuss the future of our region.

Each *Report Card* has great impact: Media coverage of *Report Cards* has reached millions of readers, and the 2006 report section on climate change was included in a brief presented to the U.S. Supreme Court. Government leaders, scientists, ranchers, environmentalists, sociologists, journalists, and concerned citizens refer to the Colorado College *State of the Rockies Report Card* to understand the most pressing issues affecting the growing Rockies region.

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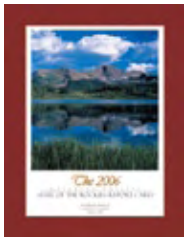

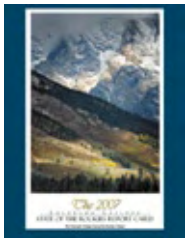

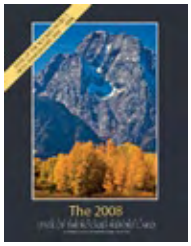

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