ROCKY MOUNTAIN RESEARCH STATION

FOREST RESEARCH IS BEING CONDUCTED ON THIS EXPERIMENTAL PLOT

USDA

2014–2017 STRATEGIC FRAMEWORK

Rocky Mountain Research Station

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High mountain lake at GLEES (Glacier Lakes Ecosystem Experiments Site)

Contents

*Cover photo and right: Ponderosa pine
(Source: Chris Evans, Illinois Wildlife Action Plan – bugwood.org)*

The Executive's Summary: Caring for the Land and Serving People, through Science

One could argue that many of the key challenges inspiring our science today remain largely unchanged since preparation of the Rocky Mountain Research Station's last Strategic Framework Update in 2008. Indeed,

- Fires still burn; larger, longer, hotter, and with more frequency than at any point in recorded history.

- Invasive species still invade while some native plant and animal species struggle to survive.

- Ever-growing numbers of people want to live, work, and recreate in the West; and, they continue to depend on ecosystem services provided by natural landscapes.

- Clean water remains a precious and over-allocated commodity.

- Extreme weather events, symptomatic of changing climates, occur with greater frequency.

- New effects of changing climates continue to emerge, affecting the health, resiliency, and productivity of natural ecosystems and human communities.

- Operational expenses increase while allocated budgets decrease.

- Citizens increasingly find value in the science results and applications we produce.

The challenges facing natural resource-related policy makers, decision makers and community leaders do not just remain; rather, the scope and complexity of challenges continue to grow as the impacts of changing climates, interactions between humans and their ecosystems, and the related ecological thresholds, become more fully understood.

Those we serve – our diverse stakeholders – need our science more than ever.

The Rocky Mountain Research Station remains a committed partner to those who seek and use our science. Our proven abilities to contribute relevant data, new scientific knowledge, and management tools that enhance the resiliency of landscapes and communities form the foundation of our world-renowned reputation. More importantly, our purpose-driven approach shapes the core of our 2014–2017 Strategic Framework Update and the affiliated Strategic Business Plan.We employ, collaborate with, and

provide science to some of the greatest natural resource professionals in the world. And in fact, the International Union of Forest Research Organizations (IUFRO) meets in Utah in late 2014; in addition to co-leading the planning for this meeting, RMRS and our partners will, quite literally, have a world stage on which to present our research findings.

Oddly enough, the key to achieving our vision for the Rocky Mountain Research Station doesn't depend on enhancing our performance in the research arena but rather on re-engineering our business model. Given the foreseeable economic trends, we cannot afford to operate as we have in the past. The Strategic Business Plan affiliated with this Framework Update presents our plans to transition to a financially sustainable business model while continuing to excel in research and delivery of much-needed scientific knowledge.

A diverse group of people join with us to identify research needs, fund and conduct research projects, document and share our work, and apply our findings. They help to create a in network in which I place tremendous faith. And, I value the diversity in both our employees and the public with whom we work. Creating and maintaining an inclusive work environment is critical to unleashing the creativity and productivity that we will need. The research and business management challenges of the future will test our skills and expertise, and I am confident we have the assets – the people, with a wealth of expertise and experiences – to successfully meet those challenges.

Through this Strategic Framework Update, I am pleased to share our operational priorities for the next three years. This is our commitment:

- We will focus on seven strategic research priorities, to best serve those who depend on us for world class, highly relevant natural resource-related science.

- Using the Strategic Research Priorities, we will adopt a new business model that is financially sustainable in the current economic climate, and

- We will accomplish our work safely, with integrity, and with respect for our colleagues and stakeholders.

You can continue to depend on us to develop and deliver highly credible science that enhances the resiliency of landscapes and human communities, and helps sustain our forests and grasslands.

We care for the land and serve people through science. And, we look forward to working with you in this endeavor.

Dr. G. Sam Foster
Station Director —
Rocky Mountain Research Station

"Those we serve – our diverse stakeholders – need our science more than ever."

Our Mission, Vision & Values – and our Challenge — 2014–2017

Mission of Forest Service Research and Development (FS R&D):

- To develop and deliver scientific knowledge and innovative technology to improve the health and use of the Nation's forests and rangelands – both public and private.

Vision of the Rocky Mountain Research Station:

- Rocky Mountain Research Station science informs and inspires; our research enhances the resiliency of landscapes and human communities. We invite you to join us.

A vision statement often describes a future state or condition to which one aspires. Such is not the case for the Station's 2014–2017 Vision. While there is much we want to do to further enhance successful achievement of our Vision, we are well on our way.

- RMRS already produces world-class research by world-renown scientists.

- Our science already informs the decisions of natural resource policy makers, land managers, industry leaders and conservationists around the globe.

- Our staff inspires students to consider careers in science, in natural resources, and in civil service to their country. Our work inspires homeowners, communities and public land users to modify their habits and activities. It inspires research colleagues to join us in pursuit of answers to the next big questions. And it inspires those with natural resources questions to seek our expertise.

- Many examples exist that demonstrate how the new knowledge and tools developed by RMRS scientists directly influence wise decisions and innovative actions. Our science contributes in ways large and small, to the health and resiliency of natural landscapes and of the human communities which depend on those natural ecosystems.

Successful achievement of our vision requires that we modify our existing business processes and research priorities, to shift to a financially sustainable research enterprise. In doing so, we can strengthen the successful achievement of our vision.

Our Challenge

- Our challenge is not to simply achieve this vision, but rather, to maintain and expand our capacity and our accomplishments while operating a financially sustainable research enterprise.

We have a solid foundation from which to achieve greater levels of scientific influence.

The challenge of how best to do this within a financially sustainable business model shapes the scope of our 2014–2017 Strategic Framework Update and the related Strategic Business Plan.

OUR VALUES

QUALITY SCIENCE
Objective, credible, interdisciplinary, independent

QUALITY SERVICE
Responsive, customer-focused, timely, relevant

QUALITY RELATIONSHIPS
Trusting, dependable, conversational

QUALITY WORKFORCE
Inclusive, safe, professional, accountable

Four core values shape how we operate, to successfully contribute to the Mission and to achieve our Vision

Our **Quality Science** value creates a foundation for the Station's credibility, integrity, and reputation. We are a productive, effective and multidisciplinary research organization, committed to staying at the forefront of science, and safeguarding its integrity and objectivity. We combine our solid foundation with new tools to address evolving scientific questions. The Station's use of statistical, technical, editorial, and peer reviews of our programs, study plans and publications provides additional quality assurance. Our scientists and their colleagues embrace the Forest Service's Research & Development Code of Ethics and Quality Assurance/ Quality Control plans.

Our **Quality Service** ethic helps guide our research priorities and delivery. We focus our research activities on questions and issues relevant to a wide variety of stakeholders. We generate integrated, scientific, cost-effective, and legally-defensible information that is easily accessible and understandable. We deliver solid scientific knowledge used to shape well-informed decisions that contribute to the health and resiliency of natural ecosystems, and human communities.

Our commitment to **Quality Relationships** forms the core of how we do business. Whether working with partners to conduct research, stakeholders seeking new information, or agency colleagues and co-workers, we actively seek and nurture productive relationships with new and diverse partners while honoring decades-old partnerships that continue to serve our stakeholders well.

Our **Quality Workforce** makes everything possible. Our employees are, simply put, our greatest asset. Our appreciation for the diversity of skills, expertise, perspectives, and experiences of our employees, volunteers, and partners supports a culture of learning, inclusiveness, innovation and excellence. Our concern for safety remains the fundamental priority for ourselves, our co-workers, our partners and the public. We facilitate an innovative and respectful work environment for discovery and productivity.

PURPOSE, BACKGROUND, ORGANIZATION & STAKEHOLDERS — 2014–2017

PURPOSE:

The Rocky Mountain Research Station 2014–2017 Strategic Framework Update serves as a communication tool between the Station's Leadership Team and our employees, agency leadership, our colleagues, and our stakeholders.

Through it, we articulate our research approach to helping solve the many challenges faced by natural resource managers. Recognizing that we cannot be experts in all areas of natural resource research, we identify the seven areas of strategic research priorities most critical and appropriate for our scientists and our collaborators to pursue, to address current and future challenges.

The 2014–2017 Strategic Framework Update and the affiliated Strategic Business Plan chart the actions we will take to achieve our Vision, and to meaningfully contribute to the mission of the Forest Service. Neither document offers excessive details; rather, each is designed to provide a general overview and direction for our work. Contact a member of the Station's Leadership Team if you are interested in more details.

The work we do, studies we conduct, and technologies we develop respond to the needs of our stakeholders, within the constraints of our strategic research priorities and our available funding. We remain the first and best point of contact for those seeking help with natural resource-related research questions. If we cannot help directly, through our personal and professional networks, we serve as a conduit to find the best researchers to address research questions that fall beyond the scope of our expertise and capacity.

Background:

As one of seven research stations within the USDA Forest Service (FS) Research and Development (R&D) organization, the Rocky Mountain Research (RMRS) is part of the most extensive natural resources research organization in the world. Throughout this document, you will see references to Strategic Plans of the United States Department of Agriculture (USDA) and the Forest Service at the national level. These strategic plans provide important direction and context for the work we accomplish here at RMRS.
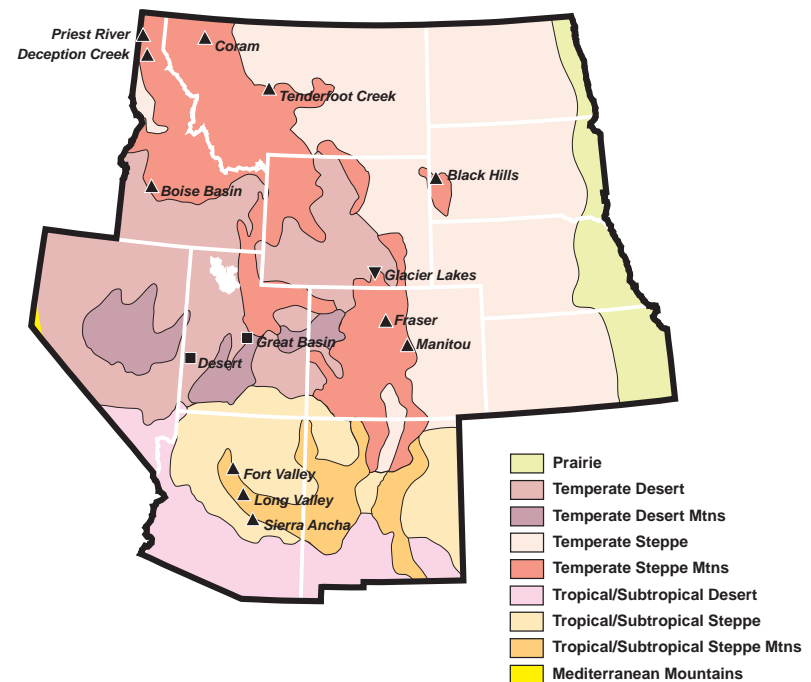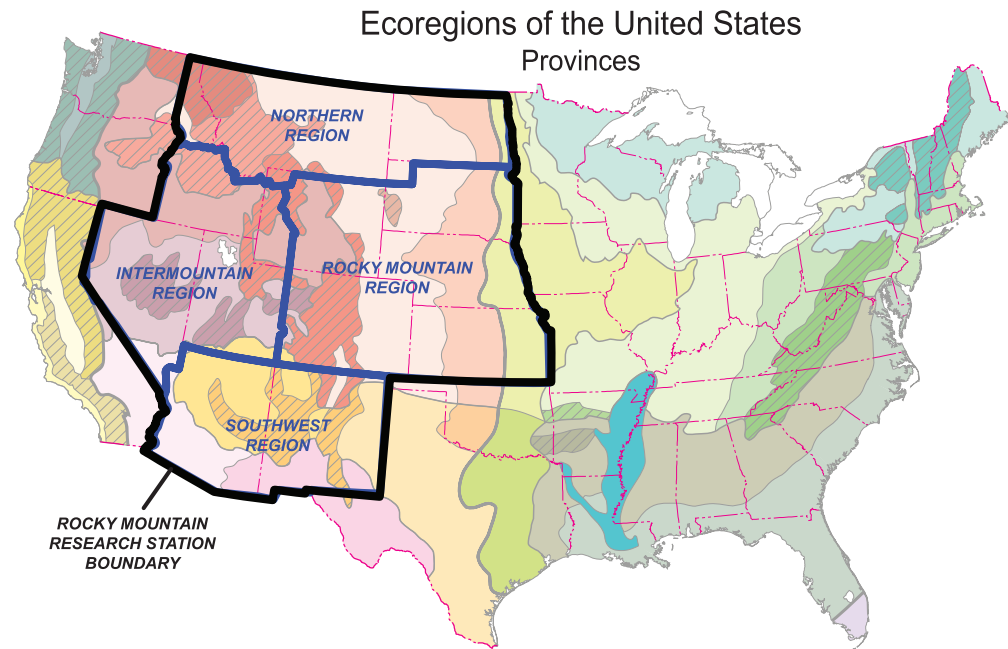
The twelve non-coastal western states comprise the core geography of the Rocky Mountain Research Station.

From Canada to Mexico, from 70 feet above sea level to 14,000+, the 1,171,084 square miles contain 15 distinct ecoregions and four Forest Service Regions.

While anchored in the geography of the Intermountain West, we conduct our natural resource-related research on a global scale.

RMRS maintains 12 Laboratory locations throughout our twelve-state territory encompassing the Great Basin, Southwest, Rocky Mountains and parts of the Great Plains. We share this geography with four Forest Service Regions: Northern, Rocky Mountain, Southwestern and Intermountain West.

Within this geography, we manage 14 Experimental Forests and Rangelands, and co-manage with National Forest System Forests, several hundred Research Natural Areas.

Ecoregions of the United States
Provinces

ROCKY MOUNTAIN RESEARCH STATION BOUNDARY

■	Prairie
■	Temperate Desert
■	Temperate Desert Mtns
■	Temperate Steppe
■	Temperate Steppe Mtns
■	Tropical/Subtropical Desert
■	Tropical/Subtropical Steppe
■	Tropical/Subtropical Steppe Mtns
■	Mediterranean Mountains

OUR STAKEHOLDERS: COLLEAGUES AND CUSTOMERS

Our network of diverse stakeholders helps us understand resource challenges, identify research needs, conduct studies, collaborate on expanding knowledge and understanding, network our discoveries, and apply, monitor and provide feedback on the new scientific knowledge and tools we develop.

While not a comprehensive list, the following stakeholders represent the diversity and scope of people and organizations with whom we work.

- Station Employees
- Other Federal Land Managers & Science Users
    - Bureau of Land Management
    - National Park service
    - U.S. Fish & Wildlife Service
    - U.S. Geological Survey
    - National Aeronautics & Space Administration
    - Environmental Protection Agency
    - Department of Energy
    - Department of Defense
    - Agricultural Research Service
    - Natural Resources Conservation Service
    - National Institute of Food and Agriculture Research
    - Extension Service
    - National Laboratories
    - National Oceanic & Atmospheric Administration
    - Bureau of Reclamation
    - Bureau of Indian Affairs
    - National Institute of Food and Agriculture
- General Public
- Private Landowners
    - Forest
    - Rangeland
    - Agricultural
    - Urban
- Environmental and specific interest non-governmental organizations

- Internal Forest Service Colleagues
    - Policy Makers
    - National Forest Systems
    - State & Private Forestry
    - Research & Development
    - Business Operations
    - International Forestry
- Natural resource managers
    - Tribal
    - State
    - Private
    - Municipal
    - Federal
    - Foreign Countries
- Scientists
    - Local to International
- Elected Officials and Government Entities
    - Tribal, state, county & local governments
    - The Administration & Members of Congress
    - Foreign Governments and agencies
- Industry,
    - Timber
    - Energy and Mining
    - Ranching
    - Recreation, tourism
    - Farming
- Colleges, Universities & High Schools
- Professional Societies
- Media Industry

Left: Prepping a video camera prior to igniting a prescribed burn as part of a study to evaluate next generation fire and smoke computer models.

Studying factors that contribute to the expansion of invasive plants.

Investigating the expansion factors of a recently introduced plant species in a native prairie.

RMRS/RO Assistance Field Trip to the Rio Grande National Forest.

"Working with partners – whether they be science collaborators, management stakeholders or science users – is not just the 'way we do' business at the Station but IS our business. Our collaborators are critical to delivering science results and findings, and helping us identify the relevant and emerging conservation issues moving forward. As our vision states ... 'we invite you to join us.'"

Jan Engert
Assistant Station Director –
Science Application & Integration

"The RMRS Forest & Woodland Ecosystems staff is well aligned to proactively address the Station's Strategic Research Priorities with help of our stakeholders, collaborators and partners. The program's world-class scientists are uniquely positioned to address the challenges outlined in our Strategic Framework, along with taking on newly emerging issues."

DR. ALISON HILL
Program Manager —
Forest and Woodland Ecosystems

A SCIENCE FIRST ORGANIZATION: CURRENT STRUCTURE OF OUR SCIENCE AND OUR CORPORATE/BUSINESS ORGANIZATIONS

Our organization structure consists of the Science Programs and the business and operational Staff Groups listed along the bottom of these two pages. Many of these Programs and Staff Groups have websites which provide additional information; just click on the underlined titles to follow hot links.

Station Leadership currently consists of:

- The Station Director
- Seven Science Program Managers
- Four Assistant Station Directors
  - Science Application & Integration
  - Operations
  - Strategic Management & Accountability
  - Communications & Services
- A Civil Rights Director

CURRENT RESEARCH & DEVELOPMENT STRUCTURE

RESEARCH INSTITUTE:

Aldo Leopold Wilderness

SCIENCE PROGRAMS:

Air, Water, Aquatic Environments

Fire, Fuel and Smoke

Forest and Woodland Ecosystems

Forest Inventory and Analysis

Grassland, Shrubland and Desert

Human Dimensions

Wildlife and Terrestrial Ecosystems

We are a 'Science First' organization. We create, share and apply new scientific knowledge that helps sustain our forests and rangelands. Our success requires a diverse team of:

- highly skilled scientific researchers, professionals and technicians who create and facilitate the application of science and

- a diverse group of highly skilled business and operational support personnel who make it possible for the scientists to do their work as effectively and efficiently as possible.

We recognize and value all our employees and their contributions to our success.

Each of the 450+ permanent, term, temporary, and volunteer people who work for RMRS can draw a direct link between their responsibilities and the production and support of world class science.

"Strategic planning is our roadmap, helping guide us in achieving our mission and allowing us to focus our energy and resources to be successful. The Operations group is proud to support the Station's science and help make the creation of new scientific knowledge possible."

CLOETTA SCHROEDER
Assistant Station Director —
Operations

CURRENT CORPORATE AND BUSINESS/OPERATIONS ORGANIZATION

SCIENCE APPLICATION AND INTEGRATION:

- Human Factors and Risk Management
- Science Application and Integration
- Wildland Fire Management

COMMUNICATIONS:

- Public and Internal Affairs and Communications
- Legislative Affairs
- Conservation Education
- Publishing Services
- Acquisition Management
- National Forest Service Library

STRATEGIC MANAGEMENT AND ACCOUNTABILITY:

- Statistics
- Management Analysis
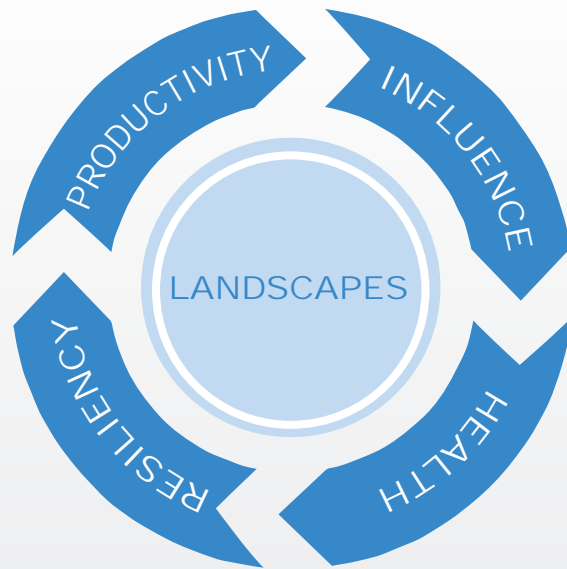- Accountability and Year-End Reporting

CIVIL RIGHTS

OPERATIONS:

- Administrative Operations
- Budget and Finance
- Engineering and Facilities Support
- Grants and Agreements
- Human Resources Liaison
- Safety and Wellness

PRODUCTIVITY · INFLUENCE · LANDSCAPES · HEALTH · RESILIENCY

*The **2012 Forest Service Planning Rule**, created to guide management decisions on all 193 million acres of National Forest System lands, requires the responsible official to use the best available scientific information to inform the assessment, the development of the plan, and the monitoring plan, and to document how science was used.*

RMRS Research Priorities — 2014–2017

From increasing intensity of wildfires, to invasive species, to a growing human population and all the associated demands on forests, the management of the national forests and grasslands presents resource managers with major challenges if they are to sustain the ecological and societal values forests provide. Sound management depends on sound science.

Our Approach:

The Rocky Mountain Research Station seeks solutions to today's complex resource management problems by applying its unique knowledge and expertise to the most critical science questions. Station scientists contribute individually to solving problems through basic and applied studies. As an organization, we bring diverse teams together using an integrated framework with the goal of providing managers and citizens with the best and most current scientific knowledge and tools for the effective management of natural resources. We emphasize collaboration, cooperation and integration across disciplines, among RMRS science programs and FS Research Stations, and with our science partners.

Changing climates and **human-ecosystem interactions** can generate profound effects on the health, resiliency and productivity of ecosystems throughout the Intermountain West. These effects are further compounded by disturbances like drought, bark beetles, diseases, invasive species and fire. While each exerts a powerful influence independently, the two are not unrelated.

Carbon storage studies in Rocky Mountain National Park, CO.

Changing Climates

Healthy, traditionally-functioning ecosystems of the Interior West provide water and its storage, flood prevention, biological carbon sequestration, recreational opportunities, favorable conditions for diverse plant and animal communities, food, fiber and energy production, and many other commodities and amenities commonly referred to as 'ecosystem services'.

Climate changes alter temperatures and precipitation, and influence the scale, intensity and severity of disturbance events. Whether more expansive-than-normal beetle infestations or wildfires that routinely exceed all previous records for duration, size and intensity, these changes have a direct affect on the ecosystems' abilities to function within an expected range of resiliency and productivity.

The Forest Service Global Change Research Strategy 2009–2019 helps define the Agency's climate change policy and establishes best management practices for urban/rural/wildland forests and grasslands. The goal, 'to increase understanding of forest, woodland, and grassland ecosystems so that they can be managed in a way that sustains and provides ecosystem services for future generations', provides the structure for the agency's, and thus the Station's research related to the effects of a changing climate.

The four research elements articulated in the Agency's Strategy also guide RMRS' work in Climate Change:

1. **Research to Enhance Ecosystem Sustainability (Adaptation)**. Advances management options under a changing climate to enhance ecosystem health and sustainability; ensure the flow of ecosystem services, such as water, wildlife, biodiversity, recreation, forest and grassland products; and reduce losses of ecosystem function from climate-altered disturbances, such as wildfire, insects, and invasive species.

2. **Research to Increase Carbon Sequestration (Mitigation)**. Assists managers in enhancing carbon sequestration via actions that could increase forest growth rates and area of forested lands; enhancing biomass extraction and utilization research; and understanding long-term carbon product storage pools.

3. **Research to Provide Decision Support**. Integrates the first two research elements by developing decision-support tools and approaches for policymakers, planners, and land managers.

4. **Shared Research Needs: Infrastructure, Scientific Collaboration, and Science Delivery**. Incorporates the research and applications in the first three elements into natural resource planning and management.


In addition, RMRS works closely with line officers and resource specialists to address the 10 elements of the Forest Service Climate Change Scorecard; our engagement focuses on:

a. Element 1: Employee Education

b. Element 4: Integrate Science and Management

c. Element 6: Vulnerability Assessments

d. Element 7: Adaptation Activities

e. Element 8: Monitoring

f. Element 9: Carbon Assessment

Human–Ecosystem Interactions
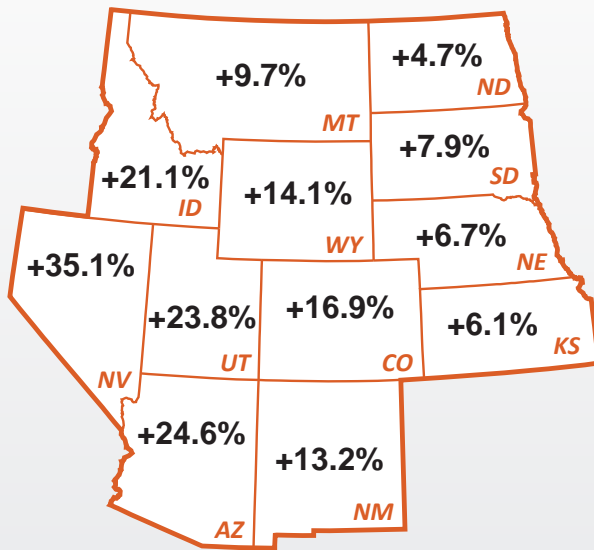
People – their population numbers and their use and expectations of the Interior West landscapes – continue to increase dramatically. The public cares deeply about the health, productivity and accessibility of open spaces and the associated natural resources. Residents and visitors support healthy forests (although the perception and definition of 'support' varies greatly), clean air and water, wildlife populations, endangered species, and scenic vistas. However, encroaching human developments create fragmented forests, deserts, grasslands, shrublands, and riparian areas leaving less available habitat for wildlife, fish, and plants. The growing demand for access to and use of the West's natural resources can create conflicts among users and affect the resources themselves.

Human populations within each state in our geographical footprint increased during 2000-2010:

- Four Intermountain West states top the nation in population growth, with growth rates over the past decade reaching 20% or higher

- Five of the fastest growing states in the nation are located in the interior West

- Overall growth averaged 13.6% per state over this ten year period.

Managers are trying to respond to the changing and often increasing use of public lands and resulting concerns about resource degradation and user conflicts in a way that:

- Balances uses with sustainable, healthy landscapes

- Provides the goods and services humans value in a sustainable way, and

- Provides adequate maintenance and expansion of infrastructure needed to protect users' safety and the resources.

RMRS remains uniquely positioned to provide relevant interdisciplinary research because of our ability to conduct both basic and applied research on human use, values, and attitudes across a large geographic area that includes urban, exurban, wild, and rural areas. Our research results support land managers' and communities' efforts to plan for growing and shifting demands for ecosystem services provided by the nation's forests and grasslands.

Welcome, Neighbor!

Changes in population between 2000-2010

MT +9.7%
ND +4.7%
ID +21.1%
WY +14.1%
SD +7.9%
NE +6.7%
NV +35.1%
UT +23.8%
CO +16.9%
KS +6.1%
AZ +24.6%
NM +13.2%

Left: Logo for "The Human Side of Restoration" webinar series – just one of many webinars hosted by RMRS to ensure our science reaches the hands of our stakeholders. Visit our website at www.fs.fed.us/rmrs for info on this and other webinars.

The Rocky Mountain Research Station's Strategic Research Priorities

Within the backdrop of changing climates and an increasing human footprint, RMRS took a methodical approach to look at our current research portfolio to see where we needed to expand and also where our portfolio should contract. By taking this holistic approach our research continues to provide relevant insights into the health, resiliency and productivity of ecosystems throughout the Intermountain West.

In the process of developing strategic research priorities we compiled, for the first time, a thorough inventory of all lines of then-active (as of 2011) research occurring at the Station. Those several hundred Personal Research Assignments (PRA's) were grouped into 30 Research Sub-Elements, which then fit within 7 Strategic Research Priorities.

Our seven Strategic Research Priorities:

- Disturbance Ecology
- Fire Sciences
- Human-Landscape Interactions
- Inventory & Monitoring
- Resilient Landscapes
- Species Endangerment
- Water & Watersheds

These priorities address broad areas of current concerns for, and thus reflect the greatest potential for us to positively influence, the health, resiliency, and productivity of natural landscapes and communities. As such, these priorities drive our future research investments.

RMRS Strategic Priorities and Strategic Elements

Disturbance Ecology (DE) Strategic Priority – Disturbance Ecology (DE) Strategic Priority – Knowledge discovery, knowledge development, modeling and synthesis to understand causes, consequences and interactions of fire, invasive species, insects, pathogens, climate change, and other disturbances and stressors, and ecological responses and outcomes of land uses and management actions. This priority answers the question of what to expect from natural and anthropogenic disturbances, exploring why disturbances occur, characterizing their spatial and temporal distribution, and elucidating disturbance outcomes and consequences.

Sub Elements:

(DE 1) **Climate Change and Variability** (Climate Change). – Detect, assess, characterize and model ecological effects of past, present and future climate change on physical environments, plant and animal species, ecosystems and landscapes, carbon flux and stocks, and socio-economic systems to support the assessment of vulnerability and development of adaptation management actions.

(DE 2) **Fire as a Disturbance Agent** (Fire). – Detect, assess, characterize and model causes and impacts of wild fires in relation to fire history, frequency, severity and intensity and with respect to responses at multiple ecological levels (ecosystems, watersheds, communities, and species) and at different spatial and temporal scales.

(DE 3) **Native Species as Disturbance Agents** (Native Pests). – Improve understanding of the ecology and role of *native* species, diseases and pathogens as disturbance agents. Detect, assess, characterize and model causes, impacts and outcomes of environmental changes resulting from insect outbreaks (e.g., bark beetles), diseases and pathogens. Responses are assessed at multiple ecological levels and temporal and spatial scales.

(DE 4) **Disturbance Interactions** (INTERACTIONS). – Determine, characterize and model how interactions among different types of disturbances influence ecosystem and watershed function and structure, community dynamics and diversity, and species and population vulnerability, demography and responses

(DE 5) **Non-native Invasive Species** (Invasive Species). – Detect, assess, characterize and model causes and consequences of *non-native* invasive species, diseases and pathogens. Consequences involve the detection of responses at multiple ecological levels including ecosystems, watersheds, communities and species' populations, and over different temporal and spatial scales.

(DE 6) **Land Use, Restoration and Management** (Land Use). – Using experimentation, assessments and modeling, improve understanding of beneficial and unfavorable responses to environmental changes resulting from land uses, resource extractions, and management actions. Emerging issues such as energy and urban developments and vegetation treatments for restoration as well as traditional uses such as logging and grazing are addressed. Results are used by managers to reduce unintended effects and improve stewardship approaches (i.e., adaptive management) and maintain long-term sustainability.
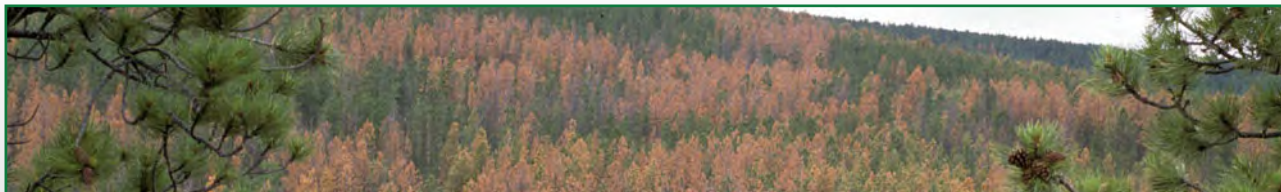
Mountain Pine Beetle damage. (Source: Rocky Mountain Region Archive – bugwood.org)

Reviewing a prescribed fire.

Fire Science (FS) Strategic Priority – Knowledge discovery, knowledge development, modeling, and synthesis as they relate to the understanding of physical fire processes, fuel science, and emissions source-strength.

[The National Cohesive WIldland Fire Management Strategy](#) provides important context for much of our work in wildland fire.

Sub Elements:

(FS 1) **Physical fire processes** — the fundamental, multi-scale, physical processes that govern fire behavior, including combustion processes, heat and energy transfer processes, and fuel-fire-atmosphere interactions and dynamics in complex fuel beds and environments.

(FS 2) **Fuel science** — assessment and characterization of the spatial variability and temporal dynamics of both living and dead wildland fuel, including the phenology and chemistry of living vegetation as it relates to ignitability and combustion.

(FS 3) **Emissions source-strength** — characterization of smoke emissions from wildland fire, including chemical speciation, rate(s) of production, and plume dynamics from the surface/source to the point in the atmosphere of neutral buoyancy.
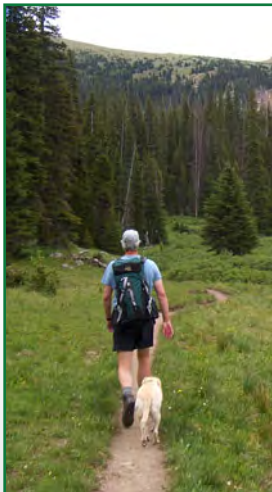
Hiking on the Arapaho-Roosevelt National Forest. (Source: Wendy R. Magwire – USDA Forest Service Find-A-Photo)

Human-Landscape Interactions (HLI) Strategic Priority - Natural disturbances and human demands for goods and services have altered the world's forest and rangeland ecosystems. Human – Landscape Interactions is knowledge discovery, knowledge development, modeling, and synthesis as they relate to the understanding of the interface between the health of the natural resources and the wants and demands of a growing human population base.

Sub Elements:

(HLI 1) **Resource Allocation and Risk Management** – This HLI strategic element involves resource forecasting, tradeoff analysis, optimization across natural and human systems, and risk management.

(HLI 2) **Resource Valuation** – This HLI strategic element explores valuation of market and non-market natural resources and their use and valuation of forest and rangeland ecosystem services.

(HLI 3) **Social Acceptance of Ecosystem Change** – This HLI strategic element explores social and economic drivers behind ecosystem change and services and societal response and acceptance to forest and rangeland management alternatives.

(HLI 4) **Multi-Stakeholder Collaboration** – This HLI strategic element explores collaboration in addressing changing ecosystems and cultural settings.

(HLI 5) **Wilderness as Benchmark** – This HLI strategic element explores the role of wilderness as a setting for measuring and conveying ecosystem services and as a benchmark for tracking ecosystem and human change.

Inventory & Monitoring (IM) Strategic Priority – The Inventory and Monitoring strategic priority involves the acquisition and analysis of information related to characterizing natural resources at different scales as well as the interaction of those resources with human values and interests. It targets both current resource status as well as trends over time in the context of changing climate, different management strategies, and natural disturbance processes. It includes the development of new inventory and monitoring methods and techniques – such as plot-based, remote sensing, or genetic approaches – as well as the application of various methodologies to local- and broad-scale assessments. A major element of this strategic priority is the Interior West unit of the Forest Inventory and Analysis (FIA) national program. Major elements include components measured, approaches used, time frame, geographic extent, and scope of inventory.

Sub Elements:

(IM 1) **Terrestrial ecosystems** (flora/habitat). – Includes terrestrial flora and the geographic and geologic setting; and terrestrial fauna habitat conditions; and in addition, species of interest may be categorized as Common, Invasives, or Rare (to include threatened and endangered.

(IM 2) **Fish and Wildlife** (fauna). – Includes specific species of interest or grouping/aggregates of species

(IM 3) **Water** – Includes both water as a habitat for aquatic species, water as a resource for human or other uses, aquatic habitats, and water quality and quantity.

(IM 4) **Air Quality** – impacts on natural resources (ozone, etc.) and people

A forest inventory specialist entering data in a pinyon-juniper woodland.

Managing Resilient Landscapes (MRL) Strategic Priority – This science area helps us understand how ecosystems respond to various pressures and in what situations these pressures result in tipping points or thresholds where the status changes in an undesirable and irreversible way. It will help us understand how to maintain and restore resilient landscapes under a changing climate. It involves integrating knowledge discovery and development, modeling, and syntheses to create adaptive management strategies to help maximize and sustain ecosystem and landscape integrity, function, and resilience into the future. This also means it will integrate information on the effects of multiple interacting stressors on species, populations, landscapes and ecosystems and utilize plant, animal, and vegetation ecology, entomology, pathology, genetics, soils, remote sensing, and monitoring information.

Sub Elements:

(MRL 1) **Landscape modeling** – This sub-element will develop, synthesize, and deliver a framework for incorporating knowledge to help with understanding and quantifying long term, interactive, and cumulative effects to develop adaptive management strategies. This incorporates information on climate change, fire, invasives, insect and disease, sensitive species, human-environment landscape, disturbance/stressors, land use, and management objectives for decision-making.

(MRL 2) **Adaptive management strategies supporting restoration** – This sub-element will develop vegetation treatment strategies, techniques, and silvicultural prescriptions, assessments, and management to maximize and sustain landscape and ecosystem resilience and reduce negative restoration impacts (damage to soil/soil crusts, etc). It will focus on developing the basic biological knowledge of select species important for restoration efforts; understanding the successional pathways and thresholds, processes, and trajectories; understanding dynamics and relationships across spatial scales; and understanding long term, interactive, and cumulative effects. This knowledge will then be integrated into decision support tools to provide guidance on prioritizing, designing, and implementing species recovery and restoration treatments and locations, and incorporate risk and adaptive management into restoration efforts.

(MRL 3) **Evaluating and predicting system resilience**. This sub-element will focus on understanding of equilibrium states and pressures, tipping points, and thresholds of the forces that control them, and how changes can create alternative states or novel ecosystems.

(MRL 4) **Ensure the availability of quality native plants** – This sub-element will develop and improve methods to ensure that native plant materials are available in sufficient supply on the landscape and the nursery. It will identify, collect, develop, test, and produce genetically appropriate plant materials well-adapted to local conditions; develop nursery procedures and seed production protocols; species selection guidelines, seed transfer zones, screening procedures for insect and disease resistance.

(MRL 5) **Understanding of the genetic variation and gene flow across the landscape** – Provides science to understand the genetic processes and characterize patterns of variation, gene flow across the landscape, and effective population size; understand and manipulate resistances, tolerances, and plasticity of both beneficial and injurious organisms under current and future environmental conditions of changing climate, exotic species invasions, and land management activities. Understand how landscape properties, like fragmentation, correlate with the genetic variation in plants/animals; explore the genetic relationship between resistance and susceptibility and genetic control of host-pathogen or herbivore relationships; identify adaptive genes in wild populations and understand the genetic-based adaptive capacity of insect and other pest populations; and develop genetics tools to predict/prevent potentially invasive forest pathogens. Initiate assisted migration research to provide guidelines.

Aspen Regeneration on the Caribou-Targhee National Forest. (Source: Bud Alford – USDA Forest Service Find-A-Photo)

Species Endangerment (SE) Strategic Priority – Species Endangerment research is knowledge discovery, knowledge development, modeling, and synthesis as they relate to the understanding of vulnerability, habitat relations, population ecology, and recovery.

(SE 1) **Vulnerability** — Assess population status and viability of species of management concern. Work with stakeholders and managers to understand the impacts of various habitat alteration alternatives on population viability. Identify factors correlated with species endangerment, and focus on research that understands limiting factors that causes current vulnerability status.

(SE 2) **Habitat Relations** — Understanding habitat correlates at multiple spatial and temporal scales is essential for an agency largely responsible for land management. This requires the development and application of new tool, approaches, and methods to correlate species distributions and detections with both habitat and environment. Related to the research of identifying habitat correlates is understanding the habitat requirements for species connectivity among essential habitats, as habitat used for either seasonal or generational movement is often different than daily/yearly use habitat. Habitat relations also include research on the effects of changing human land-use patterns and natural disturbances on habitat and connectivity needs of wildlife at multiple spatial and temporal scales.

(SE 3) **Population Ecology** — Quantify demographic parameters to evaluate which are most vulnerable. Estimates of many population parameters such as age-specific survival and reproduction, population size and density, dispersal, finite population change and others require combinations of field and laboratory methods. Develop and apply new analytical approaches for robust estimates of population parameters. Use conservation genetic and genomic tools where appropriate to evaluate demographic parameters and estimate abundance. Evaluate patterns of connectivity, gene flow, meta-population structure and movement using molecular genetic and genomic tools as well as conventional wildlife techniques. Assess levels and patterns of genetic variation and effective population size to compare with historical conditions. Evaluate the historical patterns of substructure and genetic variation prior to natural and anthropogenic disturbance to evaluate how far current population conditions are from historical conditions. Develop and apply new field methods, analytical approaches and genetic tools to quantify population status and trend in a cost-effective manner at an appropriate spatial and temporal scale(s).

(SE 4) **Recovery** — Identify where and how to facilitate species recovery. This includes identifying correlates of population recovery to provide baseline expectations of population trajectories for species that have gone through population bottlenecks. Collaborate with managers, stakeholders, and collaborators to develop conservation assessments that provide managers with options for implementing appropriate actions leading to recovery. Identify natural and anthropogenic threats that are impeding species recovery and work with stakeholders and mangers to mitigate these threats.

A Mexican spotted owl watches a live mouse on the forest floor.

Water and Watersheds (WW) Strategic Priority – Discover and develop knowledge, models and syntheses that predict responses to changing conditions, describe watershed processes, and assess effects of landslides and erosion. The 2011-2016 Strategic Plan for Forest Service Research & Development – Water, Air, and Soil Strategic Program Area establishes relevant context for our work in the Water and Watersheds Strategic Priority area.

Sub Element:

(WW 1) **Responses to changing conditions** – Predict physical and biological responses of watersheds, water availability and water quality to changing landscape and climate conditions.

(WW 2) **Processes that sustain diversity** – Describes the physical, chemical and biological watershed processes that sustain aquatic biodiversity.

(WW 3) **Landslides and erosion** – Develops methods to assess geomorphic effects of landslides and erosion on aquatic habitats.

Cebolla River, CO.

Dr. Sam Foster, RMRS Station Director

West Glacier Outlet at GLEES (Glacier Lakes Ecosystem Experiments Site)

Looking, and Leaning, Forward — 2014–2017

The vision and approach outlined in our 2014–2017 Strategic Framework Update require action.

The Strategic Business Plan prepared in conjunction with this Framework outlines the five Strategic Actions, already initiated, to utilize our updated research priorities, address our primary challenge, and achieve our vision.

To ensure successful implementation of both the Strategic Framework Update and the Strategic Business Plan, we will:

1. Establish a financially sustainable business model

2. Link budget to strategic priorities and sub-elements

3. Optimize locations and uses of RMRS facility assets

4. Establish a state-of-the-art web platform

5. Proactively enhance functionality, effectiveness, and cohesion of the RMRS Leadership Team

In conclusion, our commitment to our internal and external stakeholders is:

- To focus on seven strategic research priorities, to best serve those who depend on us for world class, highly relevant natural resource-related science.

- To adopt a new business model that is financially sustainable in the current economic climate, and

- To accomplish our work safely, with integrity, and with respect for our colleagues and stakeholders.
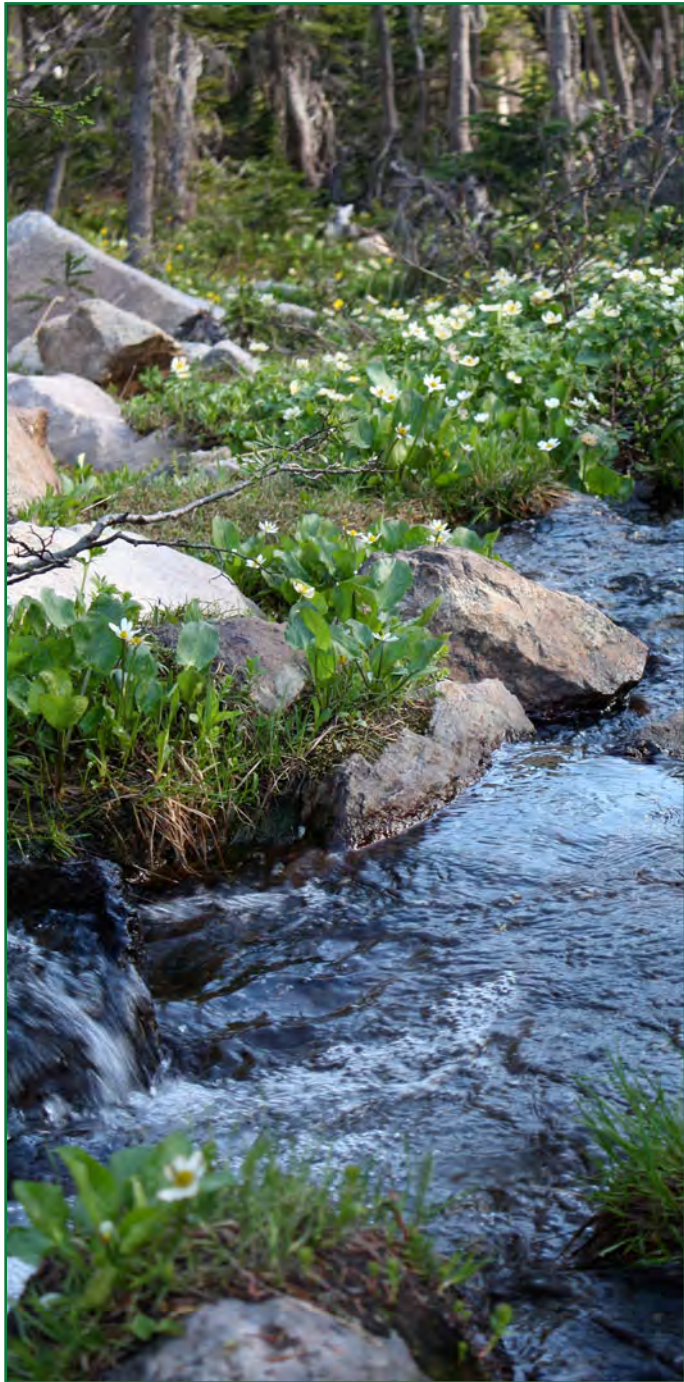
We care for the land and serve people through science. And, we look forward to working with you in this endeavor.

Visit our website at www.fs.fed.us/rmrs to learn more about the Rocky Mountain Research Station.
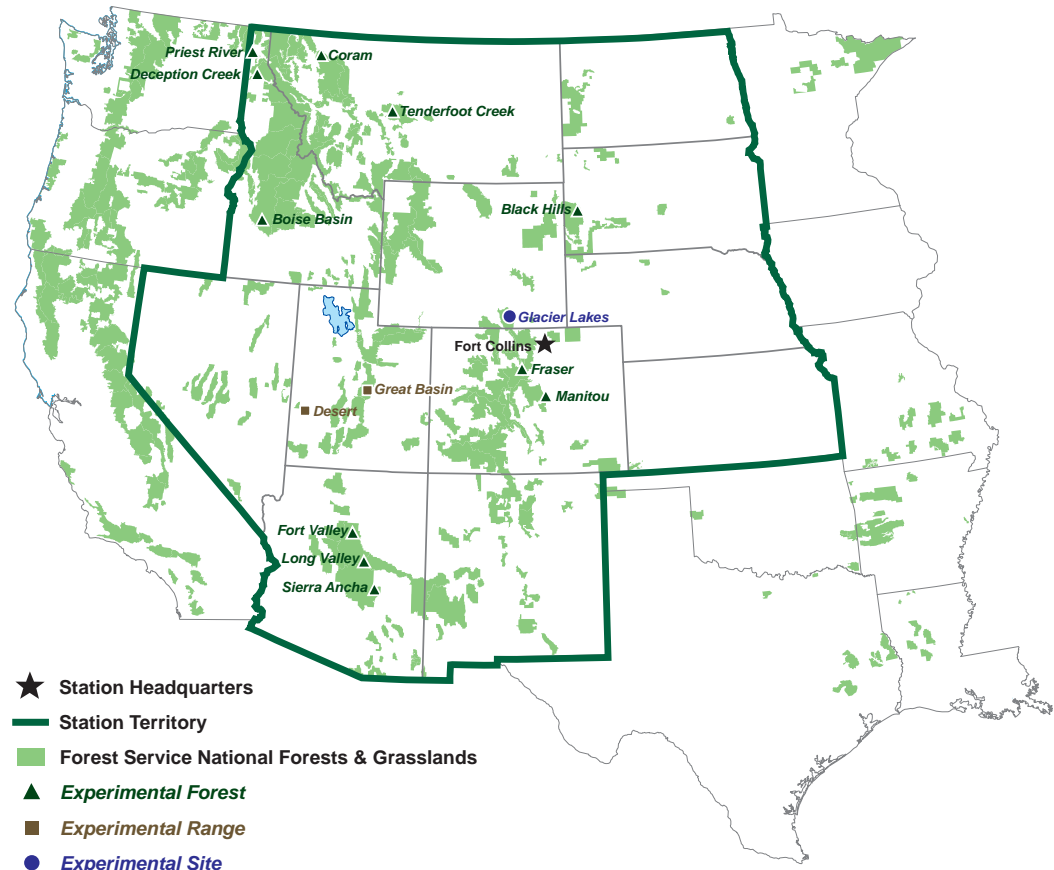
To learn more about RMRS

Web: www.fs.fed.us/rmrs
Twitter: www.twitter.com/usfs_rmrs
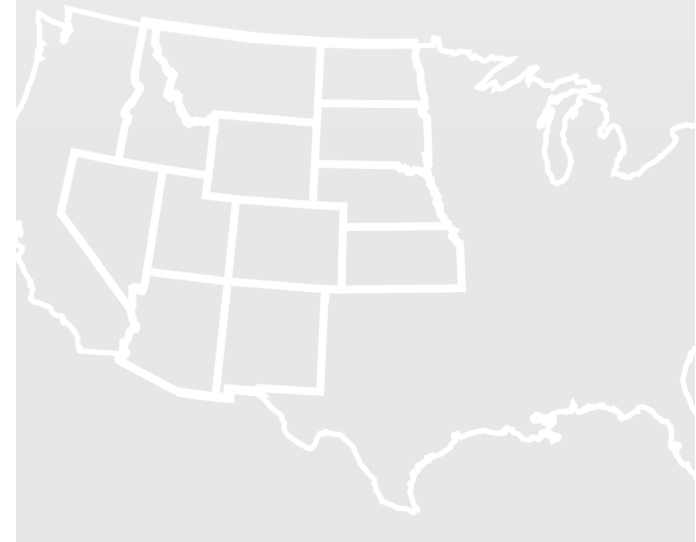
Left and opposite page: A stream at GLEES (Glacier Lakes Ecosystem Experiments Site)

National Forest lands within the Rocky Mountain Research Station territory.

Legend:

★ **Station Headquarters**

━ **Station Territory**

▊ **Forest Service National Forests & Grasslands**

▲ *Experimental Forest*

■ *Experimental Range*

● *Experimental Site*

Map labels:
- Priest River ▲
- ▲ Coram
- Deception Creek ▲
- ▲ Tenderfoot Creek
- Black Hills ▲
- ▲ Boise Basin
- ● Glacier Lakes
- Fort Collins ★
- ▲ Fraser
- ■ Great Basin
- ▲ Manitou
- ■ Desert
- Fort Valley ▲
- Long Valley ▲
- Sierra Ancha ▲