The Rocky Mountain Research Station–Region 4 Science Partner Program: Partnering Science and Management for Beneficial Outcomes

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ABSTRACT.—The Rocky Mountain Research Station (RMRS) and Intermountain Region (R4) of the USDA Forest Service are actively improving the science-manager relationship paradigm with an exciting new effort: the RMRS–R4 Science Partner Program. These programs complement existing grassroots science-manager relationships by improving coordination and learning at the project and programmatic levels as well as deploying science resources where needed. We showcase a model for helping the Forest Service achieve its goal of leveraging best available science toward beneficial land management outcomes at meaningful landscape scales.

Incorporating science into management decisionmaking is important for many reasons. The challenges and rationale associated with doing this at meaningful scales is a subject of continued discussion and interest (Beier 2017). The Research and Development (R&D) branch of the Forest Service is integrated as part of the Forest Service mission, providing independent and credible science for agency land managers, while contributing to scientific knowledge globally. While much effort has been put into connecting scientists in managers over the last several decades, there is still more work to be done to create meaningful connections between agency land managers and scientists.

To begin to address this, we have developed an innovative model for interconnecting Forest Service land management with agency science to support knowledge co-production and integration of best available science into land management applications. The Rocky Mountain Research Station (RMRS)–Intermountain Region 4 (R4) Science Partner Program launched in 2015 to enhance collaboration opportunities between RMRS researchers and Intermountain National Forest System (NFS) managers. After several years, not only is the Science Partner Program thriving, it is yielding cost savings, specific advances in management, and the development of meaningful relationships between Forest Service scientists and managers.

Within the Science Partner Program, there are currently 15 discrete Science Partner groups. Each group is comprised of at least one R4 land manager and one RMRS scientist, often including many other collaborators. Each Science Partner group focuses on a specific management challenge or the development of innovative approaches to managing National Forests and Grasslands. As Table 1 depicts, these collaborations range from developing regional goal-efficient monitoring of rare mesocarnivores (e.g., lynx) to supporting Forest Plan revision community collaboration around socioeconomic questions.

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The Science Partner Program goes above and beyond informal or ad hoc scientist-manager relationships with a framework that encourages accountability and forward momentum. Several ingredients have been key to our success:

- The program is co-led by RMRS and R4 staff, which anchor it to the Intermountain Region and Rocky Mountain Research Station Science Programs.
- Quarterly check-in calls with groups provide accountability for continued collaboration;
- Travel funds have been offered annually to support face-to-face interactions and scientists and managers working together.
- The competitive BeSMART microgrant program provides seed money for innovative, collaborative science-manager projects.
- An annual partner workshop is held to support sharing information among the group and with Regional and Station leadership and to evaluate the program model as it evolves.
- We are widely sharing what we are learning with other Forest Service Regions, Stations, and external partners.

Each of the 15 Science Partner groups have achieved or are working toward distinct outcomes, yielding tangible results. We illustrate with the following examples:

- The Boreal Toad Science Partner Group (https://www.fs.usda.gov/rmrs/projects/region-4-science-partner-program-detecting-boreal-toads-using-environmental-dna, accessed February 24, 2020) developed a reliable eDNA marker for boreal toad (*Bufo boreas)*, a western toad species listed as a species of greatest conservation need in New Mexico, Colorado, Utah, and Wyoming. Reliable and sensitive methods for delineating distributions of western toads are critical for monitoring the status of the species and prioritizing habitat conservation efforts. An RMRS wildlife ecologist teamed up with the fisheries biologist on the Dixie National Forest to co-develop appropriate sampling protocol for the complex habitats in which these toads reside. This approach greatly simplifies detection efforts by allowing a single sample to indicate presence across complex wetlands. This innovation is easily deployed to the field and will result in significant cost savings while eliminating the need for time intensive, costly, and inaccurate visual toad surveys. The peer-reviewed publication (Franklin et al. 2018) of this eDNA toad detection methodology lends credibility with regulatory agencies such as U.S. Fish and Wildlife Service (USFWS) and can be an essential piece of rare species planning and management.
- The Climate Change Science Partner Group (https://www.fs.usda.gov/rmrs/projects/region-4-science-partner-program-integrating-climate-change-research-manti-la-sal-plan, accessed February 24, 2020), comprised of a forest biologist, regional sustainability and climate coordinator, and research hydrologist, worked together to make climate change data more understandable and useable to national forests. The team organized a 1-day climate workshop on the Manti-La Sal National Forest to inform the Forest Plan revision process. Down-scaled climate change maps were created for the Manti-La Sal to use in their revision process, and using this process, maps were then developed for all national forests in the lower 48. "National Forest Climate Change Maps: Your Guide to the Future" (https://www.fs.fed.us/rm/boise/AWAE/projects/national-forest-climate-change-maps.html, accessed February 24, 2020) employed state-of-the art science to generate readily available maps that

predict precipitation, air temperature, and snow for individual national forests. This team was an integral part of the Intermountain Adaption Partnership (http://adaptationpartners.org/iap/index.php accessed February 24, 2020) and the resulting General Technical Report (Halofsky et al. 2018a, 2018b).

- Project-level planning, restoration, and forest management, when overlapping with rare forest mesocarnivores such as Canada lynx and fisher, have been highly complex across many Forest Service Regions. Because these species are wide-ranging, occur in low density, and are difficult to detect, having effective monitoring is critical but lacking in many cases (Golding et al. 2018). To address this uncertainty, one Science Partner partnership, the Mesocarnivore Modelling Science Partner Group (https://www.fs.usda.gov/rmrs/projects/region-4-science-partner-program-developing-meso-carnivore-models-across-multiple-regions, accessed February 24, 2020), is developing reliable, goal-efficient monitoring of Canada lynx and other rare mesocarnivores. This partnership effort is leading to more sustainable and less resource intensive monitoring to replace previous failed efforts. The key is to pinpoint where they are and utilize resources appropriately. This project has major implications for future Northern Rockies lynx management direction and subsequent timber harvest and vegetation management in these forests.

The RMRS–R4 Science Partner Program epitomizes data-supported decisionmaking and future policy development, while also increasing analytical capacity and evidence-based land management. The program has greatly improved communication between National Forest Systems in Region 4 and RMRS, which in turn improves the identification of program areas or projects that could benefit from scientific research and involvement. NFS management backed by rigorous science is powerful in combination.

Holistically, we are evaluating this new Science Partner model for the co-production of science with management. We have learned that our model has created powerful, positive feedback loops including:

- Managers and scientists develop high quality relationships that lead to expansive networks across the Region and Station.
- Pilot, site-specific projects can be scaled-up to regional and multiregional applications.
- Significant outside funds and resources can be leveraged with upfront small investments.
- In-person interactions and competitive project microgrants have resulted in deeply rooted relationships, innovative approaches, and positive outcomes.

Sharing what has been learned with others across the agency and beyond has been a foundational goal of the Science Partner Program. Some of the mechanisms employed are conference and workshop presentations (National Silviculture Conference, Regional Leadership, WO presentations, etc.), developing a web presence (https://www.fs.usda.gov/rmrs/region-4-science-partner-program) for the program, and creating an engaging series of short videos (https://www.youtube.com/playlist?list=PLNsZX2SBTlVmJUigal3RovCyjV-iZl-Cp) about the Science Partner Program. Web pages were viewed over 3,000 times, YouTube videos were watched 2,500 times, and social media impressions numbered more than 9,000 as of July 2019. More critically, this model is being shared as highly beneficial with other Regions and Stations.

Partnerships resulting from the RMRS–R4 Science Partner Program are helping NFS managers improve science-informed decisionmaking and establish networks in the science community. In turn, RMRS scientists are presented with opportunities to work more deeply in application, while increasing their awareness of current NFS issues and processes. Forest Service scientists and managers working together on discrete projects and science-based, actionable outcomes is a powerful model for combining Forest Service R&D with NFS into the future. At the very core of the Science Partner program is improving relationships and customer service in direct support of sustainable management of forests and grasslands.

For others interested in developing a partnership program of this nature, we offer these key components that we believe have led to the success of this program: leadership champions; empowered program co-leads comprised of science and management organization staff; modest funds to support travel and innovative collaborations; and an informal communication and check-in framework that allows individual partner groups to realize their value to the larger program. The aforementioned framework serves to maintain program consistency when individual players change.

Additional information about the Science Partner Program can be found here, including a six-part short YouTube video series highlighting the work of the partner groups: https://www.fs.fed.us/rmrs/region-4-science-partner-program (accessed February 24, 2020).

LITERATURE CITED

Beier, P.; Hansen, L.J.; Helbrecht, L. [et al.]. 2017. **A how-to guide for co-production of actionable science.** Conservation Letters. 10(3): 288-296. https://doi.org/10.1111/conl.12300 .

Franklin, T.W.; Dysthe, J.C.; Golden, M. [et al.]. 2018. **Inferring presence of the western toad (*Anaxyrus boreas*) species complex using environmental DNA.** Global Ecology and Conservation. 15: e00438. https://doi.org/10.1016/j.gecco.2018.e00438.

Golding, J.D.; Schwartz, M.K.; McKelvey, K.S. [et al.]. 2018. **Multispecies mesocarnivore monitoring: USDA Forest Service multiregional monitoring approach.** Gen. Tech. Rep. RMRS-388. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 68 p.

Halofsky, J.E.; Peterson, D.L.; Ho, J.J. [et al.], eds. 2018a. **Climate change vulnerability and adaptation in the Intermountain Region [Part 1].** Gen. Tech. Rep. RMRS-375. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 1-197.

Halofsky, J.E.; Peterson, D.L.; Ho, J.J. [et al.], eds. 2018b. **Climate change vulnerability and adaptation in the Intermountain Region [Part 2].** Gen. Tech. Rep. RMRS-375. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 199-513.

Table 1.—Rocky Mountain Research Station–Region 4 science partner groups

Project Co-Leads:
Nehalem Clark, RMRS Science Delivery Specialist
Kris Rutledge, R4 Planning Specialist
Natalie Little, R4 Sustainability and Climate Coordinator

Project Advisors:
Mark Bethke, R4 Budget Director
Jan Engert, Special Assistant Station Director, RMRS

Science partner group	Members	Project overview
Accessible Climate Change Science for the Manti-La Sal National Forest (NF) Forest Plan Revision	Charlie Luce, Research Hydrologist, RMRS Natalie Little, Sustainability & Climate Coordinator, R4 Tiffany Cummins, Wildlife Biologist, Manti-La Sal	This Group worked together to make climate change data more understandable and useable to national forests (now completed). The team organized a 1-day climate workshop on the Manti-La Sal NF to inform the Forest Plan Revision process. Down-scaled climate change maps were created for the Manti-La Sal to use in their Revision process, and using this process, maps were then developed for all national forests in the lower 48 states. National Forest Climate Change Maps: Your Guide to the Future, (https://www.fs.fed.us/rm/boise/AWAE/projects/national-forest-climate-change-maps.html) employed state-of-the art science (to generate readily available maps that predict precipitation, air temperature, and snow for individual national forests. This team was an integral part of the Intermountain Adaptation Partnership (https://adaptationpartners.org/iap/index.php) and the resulting General Technical Report (Halofsky 2018a, 2018b).
Adapting Rangeland Monitoring Strategies	Matt Reeves, Research Ecologist, RMRS Jim Menlove, FIA Analyst, RMRS Chris Miller, Economist, WO Pete Gomben, Regional Appeals/ Litigation, R4	The Range Group (https://www.fs.fed.us/rmrs/projects/region-4-science-partner-program-adapting-rangeland-monitoring-strategies) has leveraged the Rangeland Production Monitoring Service (RPMS) to analyze trends in rangeland vegetation production across Region 4. The RPMS offers spatially explicit data describing rangeland production across all ownerships. This process can help Forest Plan Revisions, improve allotment management plans, and streamline the NEPA process.
Aspen Restoration on the Fishlake NF	Keith Moser, Research Forester, RMRS Danielle Malesky, Entomologist, R4 SP&F Darren Blackford, Entomologist, R4 SP&F Liz Hebertson, Plant Pathologist, R4 SP&F Robert Cruz, Monitoring Coordinator, Forest Health, R4 SP&F John Shaw, FIA Analyst, RMRS John Guyon, Plant Pathologist, R4 SP&F	Aspen regeneration and recruitment on the Pahvant region of the Fishlake NF is not currently occurring. It is believed that fire and coppicing restoration treatments would be unsuccessful if not combined with a better understanding of grazing pressure. This science partner group has joined forces to better understand the drivers of change in these aspen forests and recommended future management.
Boreal Toad eDNA Marker Development	Kevin McKelvey, Research Ecologist, RMRS Tommy Franklin, eDNA Program Coodinator Cynthia Tait, Aquatic Program Manager, R4 Michael Golden, Wildlife Biologist, Dixie NF	The Boreal Toad Science Partner Group (https://www.fs.fed.us/rmrs/projects/region-4-science-partner-program-detecting-boreal-toads-using-environmental-dnahas) developed a reliable eDNA marker for Boreal toad (*Bufo boreas)*, a Western toad species listed as a "species of greatest conservation need" in New Mexico, Colorado, Utah, and Wyoming. This innovation is easily deployed to the field and will result in significant cost savings while eliminating the need for time intensive, costly and inaccurate visual toad surveys. The peer-reviewed publication (Franklin et al. 2018) of this eDNA toad detection methodology lends tremendous credibility with regulatory agencies such as the USFWS and can be an essential piece of rare species planning and management.

Science partner group	Members	Project overview
Characterizing Groundwater Depend Ecosystems to Prioritize Conservation Efforts	Kate Dwire, Research Ecologist, RMRS Mark Muir, Soil Scientist, R4 Cynthia Tait, Aquatic program Manager, R4 Jeff Bruggink, Soil Scientist, R4 John Proctor, Botanist, R4	This project (https://www.fs.fed.us/rmrs/projects/region-4-science-partner-program-characterizing-and-conserving-groundwater-dependent) is an interdisciplinary working group focused on collecting, documenting, exchanging, and archiving information about R4 groundwater-dependent ecosystems (GDEs), particularly springs and wetlands. The Colorado Natural Program utilizes aerial photographs and remote sensing techniques to digitally map GDE wetlands in support of forest plan revision. These maps will serve as the basis for site selection and sampling design of inventories focused on GDE wetlands, including prioritization of site sampling of fens.
Cheatgrass Control on Bridger Teton NF	Dave Cottle, Range Management Specialist, BTNF Brice Hanberry, Research Ecologist, RMRS Jeffery Ott, Aquatic Researcher, RMRS	RMRS scientists have teamed up with managers and researchers at the Bridger-Teton NF and Colorado State University to compare herbicide treatments to reduce cheatgrass seedlings, allowing restoration of native sagebrush grassland plant communities. The study (https://www.fs.fed.us/rmrs/projects/region-4-science-partner-programs-cheatgrass-seedling-reduction-restoration-native) will inform future cheatgrass treatment in western Wyoming and beyond.
Dixie NF Fire History/Fire Science	Brian Van Winkle, Fire Ecologist, Dixie-Fishlake NFs Sharon Hood, Fire Ecologist, RMRS Mike Battaglia, Research Forester, RMRS	This project seeks to understand the effects of prescribed burning and how it can be implemented over broad spatial scales and aims to implement the "right kind of fire" and promote a fire resilient forest mosaic across the landscape. In 2019, the Fishlake NF will host the first of the western research prescribed burns as part of the Prescribed Fire Science Consortium. The goal is to facilitate collaborative research on building a mechanistic understanding of fire through annual burn experiments.
Economic & Social Science for Salmon Challis NF Forest Plan Revision	Gina Knudson, Collaboration Specialist, and Nate Anderson, Research Forester, RMRS Joshua Milligan, Revision IDT	The goal of this partnership (https://www.fs.fed.us/rmrs/projects/region-4-science-partner-program-socioeconomic-assessment-and-forest-plan-revision-salmon) is to augment the Forest's socio-economic expertise during the Forest Plan revision process. Two community workshops to dialogue about the condition of the forest products industry were held in Idaho and southwestern Montana. Best available information on forest industry trends and market projections for the Northern Rockies will be synthesized.
Improving Understanding of Pinyon-Juniper and Ponderosa Ecotone Dynamics	W. Keith Moser, Research Forester, RMRS Steve Overby, Soil Scientist, RMRS Duncan Leao, Forester, Humboldt-Toiyabe NF	This group is studing the effects of fire and its interaction with other abiotic and biotic factors on the lower extreme of ponderosa pine, the pinyon/juniper ecotone, and the upper extreme of P-J ecosystems. Forests of the southwestern United States are becoming increasingly stressed due to changing biotic and abiotic factors. Recent drought-induced infestations in Arizona, Nevada, and New Mexico have killed as much as 90 percent of the dominant pinyon species.
Landscape-Scale Forest Restoration on Boise Basin	Theresa Jain, Research Forester, RMRS Kate Dwire, Research Ecologist, RMRS Michael Feiger, Wildlife Biologist, Idaho RD, Boise NF John Wallace, Forester, Idaho RD, Boise NF Nate Anderson, Research Forester, RMRS Travis Warziniack, Research Ecologist, RMRS	RMRS researchers are partnering with managers on the Boise National Forest and scientists at the University of Idaho to develop, implement, and evaluate place-based adaptive management strategies with the goal of improving the resilience of Northern Rockies ponderosa pine stands to fire and other disturbances. The Boise Basin project (https://www.fs.fed.us/rmrs/projects/region-4-science-partner-program-landscape-restoration-boise-basin-experimental-forest) provides a unique opportunity to implement and evaluate a wide range of ponderosa pine management approaches using a management-science partnership framework, implement treatments at a landscape scale, and gain insights into improvements in project planning and decision-making.

Science partner group	Members	Project overview
Mesocarnivore Modelling at Multiple Scales	Kevin McKelvey, Research Ecologist, RMRS Rema Sadak, Wildlife Ecologist, R4 Randall Griebel, Wildlife Biologist, Bridger-Teton NF Jessie Golding, Wildlife Ecologist, RMRS	RMRS scientists are partnering with the Bridger-Teton National Forest (BTNF) and other national forests to create a detailed model of rare mesocarnivores across multiple regions. This project will survey rare mesocarnivores (Canada lynx, fishers, and wolverines) within the Greater Yellowstone Ecosystem. https://www.fs.usda.gov/rmrs/projects/region-4-science-partner-program-developing-meso-carnivore-models-across-multiple-regions.
Pollinator Habitat Restoration Proof of Concept on the Curlew National Grassland	Francis Kilkenny, Research Biologist, RMRS Rose Lehman, Forest Botanist, Caribou-Targhee NFs John Proctor, Regional Botanist, R4	RMRS scientists have teamed up with the Caribou-Targhee National Forest Soil Scientist, Botanist, and Hydrologist to remove Russian olive from riparian habitat in Curlew National Grassland, convert it to biochar, apply to the removal site, plant and monitor native grass and forb species, and determine soil physical and chemical changes from biochar additions. The initial steps of the project (https://www.fs.fed.us/rmrs/projects/region-4-science-partner-program-pollination-restoration-curlew-national-grassland) timeline were accomplished, including the harvesting and chipping of Russian olive and converting it to biochar.
Ponderosa Density and Aggregation	Keith Moser, Research Forester, RMRS Eric Taylor, Silviculturist, Dixie NF Russell T. Graham, Research Forester, RMRS Theresa Jain, Research Forester, RMRS Buddie Carroll, Forester and Silviculturist, Dixie NF	The goal of this collaborative study is to examine the influence of overstory basal area, tree spacing, and site characteristics on overall dwarf mistletoe rating and tree response while exploring combinations of vegetative structural chance that would satisfy Forest Service guidelines for northern goshawk. This group will examine the causes of the presence of Jeffrey pine and related species and projected long-term future trends on the Escalante Ranger District of the Dixie NF.
Post-Fire Reseeding Guidelines for Salmon-Challis NF	Christine Droske, Forest Fuels Specialist, Salmon-Challis NFs Francis Kilkenny, Research Biologist, RMRS	Due to threat of cheatgrass and other native plant invasions following fire, there is a need to develop appropriate post-fire re-seeding guidelines that will yield resilient landscapes in the long term. This partner group will develop guidelines using Salmon-Challis environmental conditions as the basis, which could then be scaled up to large geographies.
Putting FIA Data to Work for Fuels Planning on the Salmon-Challis NF	Kristen Pelz, Forester, I&M, RMRS Christine Droske, Forest Fuels Specialist, Salmon-Challis NFs Joshua Milligan, Plan Revision Team Leader, SCNF Cassandra (Sandy) Kollenberg, GIS Specialists, SCNF	The goal of this partnership between the RMRS Human Dimensions program and the Salmon-Challis National Forest (SCNF), located in east-central Idaho, is to augment the Forest's expertise during the forest plan revision process (https://www.fs.fed.us/rmrs/projects/region-4-science-partner-program-socioeconomic-assessment-and-forest-plan-revision-salmon; https://www.fs.fed.us/rmrs/science-program-areas/human-dimensions; and https://www.fs.usda.gov/scnf). The planning team has identified a need to host community workshops to learn about the state of the forest products industry in Idaho and southwestern Montana. There is also a need to summarize the best available information on forest industry trends and market projections for the Northern Rockies. A near-term goal of this collaboration is to plan and execute the socioeconomic-focused community workshops. The partners are in the planning phase, orchestrating what is the most critical information to provide to stakeholders, resource managers, and scientists, as well as determining who to best present the workshops.

The content of this paper reflects the views of the authors, who are responsible for the facts and accuracy of the information presented herein.

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