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The Rio Grande National Forest Climate Change Plan Revision Workshop: Designing a Science-Management Collaborative Process to Address 2012 Planning Rule Climate Change Concerns at the Forest Plan Scale

Molly R. Roske, Linda A. Joyce, Linda M. Nagel, Lara K. Peterson, Courtney L. Peterson, Megan Matonis

Abstract—*Scientists and managers initiated a collaborative process to assist the Rio Grande National Forest (RGNF) with bringing climate change information into its Forest Planning Process. The first objective of the collaborative, 2-day workshop was to present and discuss in a workshop format the salient climate change science for the RGNF landscape, in terms of projections, impacts, and vulnerabilities. The second objective was to facilitate a planning process that would stimulate ideas regarding aspects of current and proposed management that may need modification in light of stressors related to climate change. We used an adaptation decisionmaking framework to structure the workshop. All parties deemed the workshop a success, leading to lessons learned and minimum conditions for replicating similar efforts to effectively meet the 2012 planning rule criteria. As other forests consider undertaking similar collaborative science-management workshops to integrate climate change adaptation into their plan revisions, we recommend: (1) that the workshop take place early in the plan revision process, (2) that there be commitment from the national forest leadership and support for staff to complete a comprehensive look at management actions for climate change adaptation, and (3) that there be clear agreement on expectations of workshop participants—for scientists in their role of providing scientific information and for managers in their role of incorporating that information into the planning process.*

Keywords: climate change, National Forest Plan Revision, workshop, science-manager collaboration

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INTRODUCTION

The U.S. Department of Agriculture (USDA) Forest Service (hereafter "Forest Service") is taking a proactive approach to incorporating climate change considerations into the management of its National Forest System (NFS) lands through its 2012 planning rule regulations, indicating an agency-wide commitment to climate change adaptation. The 2012 rule lays out a three-part planning process for systematic consideration of climate change effects and vulnerabilities in ecosystem management. The assessment, plan development, and monitoring phases are intended to enable the "Forest Service to adapt to changing conditions, including climate change, and improve management based on new information and monitoring" (36 CFR 219.5). The Forest Service Manual (FSM) 1920 and Forest Service Handbook (FSH) 1909.12 contain directives that provide policy, instructions, and definitions to assist in complying with the 2012 rule, also explicitly naming "improv[ing] resilience of National Forests and Grasslands to climate change and other stressors" as a key objective of planning (FSM 1920, Sec. 1921.02). The 2012 rule also calls for coordination between NFS regions and Forest Service research stations.

The Forest Service Manual and Handbook provide guidance on the implementation of the 2012 rule; however, the process by which individual national forests incorporate climate change into their planning process is not prescriptive. As Forest Service staff gain a deeper understanding about the new rule, there is a need to develop mechanisms and procedures to accommodate unique, local situations. At the time this study began, only one national forest had released a revised plan and a draft record of decision under the 2012 rule (Francis Marion National Forest in South Carolina); however, other national forest units have since reached this milestone. Numerous national forests are now proceeding through the planning process in ways unique to their local settings (e.g., ecological, social, administrative, economic). Climate change effects will vary across national forests, yet lessons learned, particularly about processes for incorporating the science of climate and adaptation into planning, have not been shared widely to date.

Innovative processes are needed at the level of the national forest to synthesize climate change and ecological information (e.g., Timberlake et al. 2018), and to test and improve methods for effectively and efficiently demonstrating compliance with the climate change-related mandates of the 2012 rule. Individual national forests often turn to the Forest Service research station in their geographic area for climate change projections and information on the effects of climate change and resource vulnerability. Science-management collaboration supports the interchange among scientists and national forest staff of scientific knowledge and experiential knowledge; both types of knowledge are needed to support the responsible official in determining what constitutes best available science (36 CFR 219.3). Greater exchange through science-management collaboration is needed to effectively and efficiently identify the current knowledge of climate change vulnerabilities at the local forest level.

In spring 2016, the NFS Rocky Mountain Regional Office (Region 2, also referred to as R2 in this document) and the NFS Rio Grande National Forest (RGNF) line officers reached out to the Forest Service Rocky Mountain Research Station (RMRS) for assistance in incorporating climate change considerations into the RGNF planning process. Located in southwest Colorado, RGNF is the first national forest unit in Region 2 to embark on plan revision under the 2012 rule. This request prompted the development of a science-management partnership among R2, RGNF, RMRS, Colorado State University (CSU), and the Colorado Climate Center.

Project Evolution and Rationale

Together, R2, RGNF, and RMRS identified the need for more information on climate change effects specific to RGNF ecosystems and a process for incorporating climate change considerations into plan components. At the time this need was identified, RGNF had already completed the assessment phase of the planning process, which covered topic areas such as air, soil, and water; carbon; cultural and historic resources; and drivers and stressors of ecosystem integrity (available on the Rio Grande NF's Land Management: Planning webpage). While individual assessment reports discussed climate change to varying degrees, RGNF expressed interest in completing a more comprehensive climate change vulnerability assessment for its landscape. However, researchers and planners agreed that such a vulnerability assessment was no longer feasible because RGNF was simultaneously moving into the plan development phase of the plan revision process, and time and resources were limited. Staff with RGNF, R2, and RMRS instead selected the following suite of projects to address information needs and encourage science-management integration around climate change.

1. Climate history report: The Colorado Climate Center developed a short report on the climate history of RGNF.
2. Climate projections report: The North Central Climate Science Center summarized future climate projections for RGNF and the surrounding geographic area.
3. Bibliographies by topic area: Janine Rice, consultant, compiled comprehensive bibliographies citing relevant peer-reviewed research on 13 topics identified by RGNF staff.
4. Workshop: Managers and scientists gathered for a 2-day workshop to put scientific information on climate change into context at the national forest level, and to brainstorm and refine climate-adaptive plan components. RGNF leadership and staff selected three priority topic areas for the workshop: vegetation (forest and range), insect and disease issues, and water resources (including surface water- or groundwater-dependent ecosystems). RMRS research specialists, as well as State and regional climate experts, were invited to participate in the workshop, and CSU scientists facilitated the use of an adaptive management planning framework (Janowiak et al. 2014; Swanston et al. 2016) for the workshop.
5. Appendix review: At RGNF's request, three scientists reviewed the Appendix on Natural Range of Vulnerability from the RGNF 1996 Forest Plan.
6. Specialist white papers: Two RMRS topic-area specialist researchers (Michael Battaglia, José Negrón) produced a short postworkshop report encapsulating key points from the discussions on their topics and climate change at the workshop.

RGNF staff used these project outputs in their subsequent plan development. These outputs can be found under Projects (www.fs.fed.us/rmrs/projects/rio-grande-national-forest-climate-change-plan-revision-workshop) on the RMRS website. The remainder of this Research Note will focus primarily on the workshop process and outcomes.

Two main objectives were identified for the Rio Grande National Forest Climate Change Plan Revision Workshop. First, the workshop offered an opportunity to present and discuss climate change science included in recent literature that was salient for the RGNF landscape in terms of

projections, effects of climate change, and resource vulnerabilities. We intentionally connected the conversations with the 2012 planning rule language and allowed local managers and experts to put the scientific information in the context of their on-the-ground observations. Second, the workshop stimulated ideas and discussion around the development of plan components, such as desired future conditions, management goals and objectives, guidelines for implementation, and aspects of current or planned management that may need modification in light of climate change stressors.

Broader objectives of this collaborative project were to facilitate information exchange between NFS and RMRS, and to test the use of the climate adaptation framework at the *planning* level. This climate adaptation framework has been developed for forest project-level management. We evaluated the effectiveness of this pilot project and the feasibility of replicating this process at other national forests or even at the NFS regional level.

WORKSHOP: PREPARATION, DESIGN, IMPLEMENTATION

Preparation and Workshop Design

The RGNF/RMRS/CSU workshop planning team held several calls and in-person meetings to agree on objectives and workshop outcomes, as well as to assess knowledge gaps. RGNF expressed concern that a very high planning workload for the Forest Plan Revision left insufficient time for staff to compile climate change-related literature to inform planning documents. Therefore, high-priority outputs from the workshop included information on climate change projections, effects of climate change, and vulnerabilities of RGNF ecosystems; based on workshop discussion, a report described the exploration of the RGNF's proposed action and plan components for climate change adaptation. The workshop planning team also engaged the RGNF planning staff to determine which of the draft planning documents and plan components could be the focus of the adaptation session of the workshop. The following proposed plan components were identified for discussion during Day 2 of the workshop: (1) new RGNF-wide objectives, (2) the allowable activities for each management area described in the proposed action, and (3) the desired conditions from the last (1996) Forest Plan. The Proposed Action included forest-wide objectives and allowable activities, but at the time of the workshop the RGNF planning staff had not yet developed management objectives and desired conditions for each type of management area.

The content and structure of the workshop was based on the "Adaptation Cycle," a decisionmaking framework presented in *Forest Adaptation Resources* (FAR) developed by Forest Service and other researchers at the Northern Institute of Applied Climate Science (NIACS), and others (Swanston et al. 2016). This five-step framework (fig. 1) has been modified for and successfully applied in a variety of contexts, including management demonstration projects participating in the Climate Change Response Framework (CCRF, www.forestadaptation.org) (Janowiak et al. 2014) and during site-development workshops for the Adaptive Silviculture for Climate Change research project (Nagel et al. 2017). This decisionmaking cycle is promoting a cultural shift in how resource managers and planners "think" about climate change adaptation and action. When used at the right time and in the right contexts (i.e., temporal and spatial scales), this framework can be a powerful learning experience that helps natural resource managers work through ways to incorporate climate change considerations into management decisions, and arms them with a framework for thinking about future problems. Because the framework has helped natural resource managers deal with risk and uncertainty related to climate change in management projects, we chose to test the application of this framework to forest plan revisions.

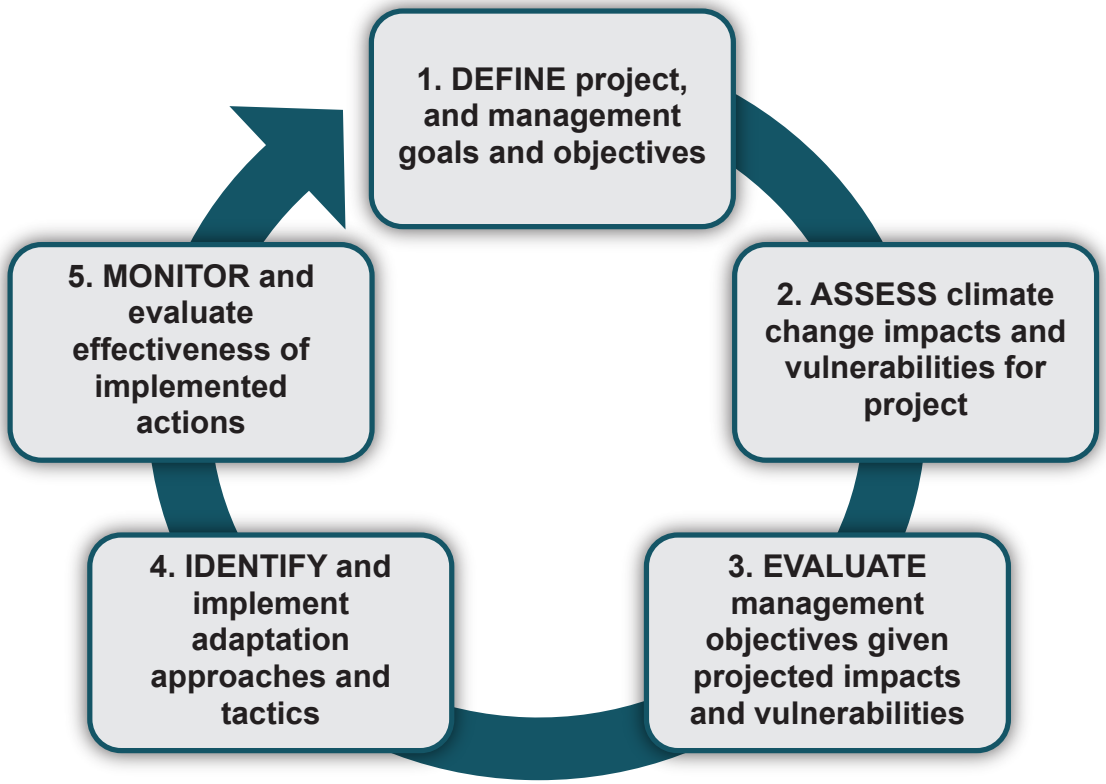

Figure 1—An illustration of the Forest Adaptation Resources adaptation process used to incorporate climate change considerations into resource management planning (Swanston et al. 2016).

Implementation

The workshop was structured to provide information on Day 1 with a discussion of climate change effects and vulnerabilities of the RGNF (step 2 in figure 1), and engage national forest staff and scientists on Day 2 in evaluating the plan components given what was known about potential impacts of climate change on RGNF (see Appendix A for the workshop agenda). We opened the workshop with brief comments from RGNF leadership to convey the workshop objectives and used a round-robin of personal introductions to acquaint and energize the group. Though non-RGNF workshop participants were expected to have familiarized themselves with the Forest Service planning process and the basics of RGNF ecology, we defined the ecological, climate, and management context of RGNF to provide everyone with enough basic information to actively engage on both days.

Presenting and synthesizing in-depth climate and vulnerability information on the key topic areas was a main objective of the workshop, so Day 1 largely consisted of talks from research and management specialists. We ended Day 1 with a short, facilitated activity to allow workshop participants to integrate and synthesize the day's information (see Appendix B). This activity stimulated participants' thinking on the top climate vulnerabilities of concern based on the specialists' presentations and additional ideas developed during discussions, as well as identifying any remaining points of confusion. These ideas were then visually recorded and displayed for further consideration throughout the workshop. This participant-generated list of vulnerabilities gave attendees a sense of the key planning and management challenges with respect to climate and represents the primary "outcome" from the first day.

On Day 2, we facilitated a process for RGNF managers and resource experts to develop climate-adaptive plan elements. Here we also followed modified steps in the NIACS framework (fig. 1). We divided participants into small "breakout" groups based on their area of expertise to encourage dialogue. Two groups focused on forests and vegetation management and two groups focused on water and riparian management. We provided groups with prompting questions or tasks via "worksheets" to encourage conversation during three different breakout sessions:

1. *Challenges and opportunities*: Small groups examined the plan components, particularly the allowable activities, for potential challenges to overcome or opportunities to capitalize on to meet management objectives under climate change. The full list of challenges and opportunities identified by these breakout groups was compiled and served as an important output from Day 2. These challenges and opportunities remained displayed on the walls of the workshop venue room in order to serve as inputs for the next breakout session task.

2. *Feasibility of current management*: This breakout session focused on aspects of management where the challenges or opportunities were greatest (as identified during the first breakout session), and any plan components related to that management issue. Small groups produced a rating of feasibility of achieving that aspect of management given projected climate and associated impacts. They noted any advantages, drawbacks, or other considerations affecting feasibility, and they decided whether they would recommend the plan component(s) as currently stated or propose modifications. The worksheet also contained an optional column to write down thoughts about useful modifications to these plan components in order to separate the exercise of *evaluating* current management from the exercise of *generating ideas* for how to improve it. Breakout session 2 ended with a report-out to the larger group regarding the feasibility of the plan components that each group chose to discuss, and the overall recommendation of whether to proceed as-is or to propose modifications.

3. *Modifying Proposed Action*: Groups developed climate-adaptive plan elements (e.g., management area designations or definitions, desired conditions, specific tactics, allowable activities) by modifying the existing elements or proposing new ones that are rooted in widely accepted climate adaptation theory and options currently in the scientific literature (i.e., resistance, resilience, response or transition) (DeRose and Long 2015; Janowiak et al. 2014; Joyce et al. 2009; Millar et al. 2007; Nagel et al. 2017). The overarching goal was to design plan elements that increase the likelihood of achieving management objectives in the long term under climate change. Breakout groups used the *Forest Adaptation Resources* "Menu of Adaptation Strategies and Approaches" (Swanston et al. 2016) to connect their suggested modifications to specific climate adaptation strategies and management approaches. We encouraged participants to note the full range of climate-adaptive options that RGNF could build into the forest plan rather than have them develop specific, tangible tactics. This breakout session resulted in a draft list of proposed modifications and new plan components that can be leveraged by forest planning staff for crafting a climate-adaptive revised forest plan.

The final portion of the workshop focused on monitoring plans to measure the success of proposed new or modified plan components. RGNF staff reviewed past and anticipated future monitoring activities, and the workshop team facilitated group discussions about defining climate change adaptation "success." Part of the process of developing efficient monitoring programs is to identify partnerships that could (or already do) assist in collecting monitoring data, and thus it was highly advantageous to have the full participation of several RMRS and university collaborators in this step of the workshop. We had initially planned a fourth breakout session about monitoring, but there was insufficient time remaining in the workshop, so the session became a large-group discussion on monitoring instead.

The workshop concluded with a review of the work achieved and products generated during the workshop. We established next steps and timelines for additional workshop outcomes for RGNF.

WORKSHOP: LESSONS LEARNED

Workshop Successes

RGNF leaders stated that the Plan Revision Climate Change Workshop assisted with their forest plan revision in a number of tangible ways. While the workshop achieved the stated objectives and produced desired outputs, it also opened a forest-wide dialogue and examination of current and proposed management. The workshop had the full commitment and participation of RGNF leadership from the start and was successful in drawing participation of the RGNF staff from nearly all resource areas. During a postworkshop conference call, all RGNF staff members affirmed that the workshop was a valuable process and they would recommend that other national forests devote time and energy to similar workshops early in their planning horizon.

A great deal of cross-disciplinary knowledge sharing happened in this workshop, both experiential knowledge of the RGNF staff and scientific information on climate change from scientists. The science presentations, whether in-person or done remotely via a web platform, were well received overall and encouraged productive discussion. The RGNF staff took advantage of the opportunity to ask specific questions of the researchers and shared their local experiences and observations. Scientists and managers worked to generate potential climate adaptation ideas together and learn from each other within the small-group sessions. As an example, the riparian group was led by a Forest Service scientist and the breakout conversations included a rich discussion of regulatory constraints within which RGNF water resource managers must operate when looking for climate-adaptive management ideas. Breakout sessions 2 (evaluating feasibility of plan components) and 3 (adjusting plan components for climate change) seemed most fruitful for the small groups, who produced creative and effective modifications to specific forest plan elements for climate change adaptation.

This workshop developed relationships between managers on the RGNF and scientists from RMRS and CSU. Many of the RGNF staff had never met scientists from RMRS or CSU before, and many of the scientists had never been on the Rio Grande National Forest prior to the workshop. The process of designing the workshop established trust among the organizers, and participants built trust and social capital through the breakout group sessions. These relationships can help spur future collaboration among managers and scientists with the Forest Service and other partners.

Areas for Growth and Recommendations for Future Efforts

This workshop was a pilot project, and we identified several aspects that implementers could improve for similar workshops in the future. Our goals were ambitious for a 2-day workshop, especially given the newness of the planning process to NFS staff and RMRS scientists. Here we present several recommendations for future efforts to integrate climate change considerations into forest plan revisions:

1. The workshop needs to be held early in the forest's planning process to best achieve dual goals of providing current scientific information on climate change vulnerabilities and incorporating climate change considerations into the proposed action and other planning documents.

Under a tight plan-revision timeline, RGNF was beginning to develop plan components as workshop details were being finalized. This overlap of activities put pressure on RGNF staff to stay productive on plan development while also engaging with RMRS on the climate change aspects. Holding this workshop near the beginning of RGNF's plan revision process, such as during the pre-assessment phase, could have better integrated discussions on resource management and relevant climate change literature. An earlier and more holistic discussion could have sparked ideas from RGNF staff members themselves on plan revision changes that incorporate climate change considerations. We were dealing with plan components in an awkward stage of development that contributed to the challenge of determining the "right" questions to ask of the breakout groups. Some plan components were not yet drafted (e.g., management area objectives, revised and updated desired conditions), resulting in insufficient detail for participants to think critically and constructively about those plan components.

2. It is important to identify individuals who can bridge the gap between project- (or management-) level and plan-level thinking.

One early concern in the workshop planning process was whether the adaptation framework put forth by NIACS (fig. 1) was appropriate for the planning level since it is customarily used at the project level. We adjusted questions in each step of the adaptation framework to fit the planning context. Even when we rearticulated questions for the worksheet prompts, however, they still were not clear, useful, and accessible for all participants given their respective styles of decisionmaking. Resource managers, who may be far more accustomed to thinking about planning at the spatial and temporal scale of a project, tended to repeatedly cite examples from specific projects and struggled to provide critique or commentary at the level of a framing document like the forest plan. Likewise, some planning-level staff struggled to understand how the framing at the forest plan level may or may not harmonize with or accommodate the concerns and demands of resource specialists. We anecdotally observed that certain individuals showed greater dexterity in understanding both the project and planning planes and translating between them, and they were instrumental in helping their colleagues move through the breakout tasks. Anyone facilitating a similar process needs to personally cultivate that skill, as well as learn to recognize and encourage it in workshop participants.

3. The climate adaptation framework should be introduced before using it as a planning tool, and additional forest plan examples are needed to enhance familiarity with the tool.

Learning the adaptation framework approach was a challenging step for many workshop participants. In addition, certain aspects of the breakout sessions that built on the framework felt

"frustrating" to participants. This frustration was very likely the result of a lack of clarity around plan components and the inherently complex and pervasive nature of climate change impacts. In addition, we struggled to translate the tool as primarily utilized at the project level to the forest planning scale. We did not have models for how to execute this task since many existing demonstrations of climate adaptation are at the project level, but leave the overarching planning level unaddressed. Improvements to the breakout prompts and questions and more examples specific to the forest plan level could have helped bring clarity to the small-group work. However, more familiarity with the climate adaptation framework was needed for these sessions. We recommend holding a training to expose NFS staff, regional office staff, and NF climate change coordinators to the *Forest Adaptation Resources* (Swanston et al. 2016) process before executing a climate change workshop.

4. Evaluate the information needed, timelines in the planning process, and the availability of expertise to effectively and efficiently provide the scientific information needed to address the climate change requirements in the planning process on a specific forest.

Time is a precious commodity for NFS staff, Forest Service research scientists, and university partners. The challenge is to provide relevant scientific understanding about climate change vulnerabilities and to have a dialogue about adaptation options in a manner that is both effective and efficient for the science-management collaboration. We tried to scope the information needs prior to the workshop to help focus discussion topics. However, even with this scoping, discussions at the workshop ranged broadly at times, with managers taking advantage of the expertise in the workshop, and scientists delving into the additional research needs of the forest.

Scheduling the workshop dates and coordinating the attendance of topic specialists proved challenging. Workshop dates were juggled with other demands on the RGNF staff. The riparian ecologist could attend only "remotely" via a web platform, and another subject matter expert was unable to attend the workshop and made a separate visit to the RGNF a month later. During the workshop, even though we encouraged speakers to allow time for questions and answers, we lacked adequate time for lengthy discussion in the question-and-answer periods following each speaker. All RGNF staff members affirmed during the postworkshop conference call that the workshop was productive and worthwhile, but 2 days was insufficient to develop fleshed-out climate-adaptive plan components. The workshop and follow-up tasks took considerable effort but required far less time and resources than a full vulnerability assessment.

For this pilot, the timeline was such that a 2-day workshop was the most effective method to share information and engage with the RGNF on developing adaptation options. The understanding and application of climate information might better occur if a process were developed that facilitated learning over time, capitalizing on the three phases of the planning process. A workshop early in the assessment process might more effectively address the risk of climate change effects and initiate the discussion about climate change adaptation options. Then during the plan component phase, a half- or full-day work session might allow scientists and managers to critique the proposed adaptation options in light of climate change vulnerabilities. And another work session during the monitoring phase could connect the implications of climate change and adaptation options to suggested metrics. One of the early phases could include exposure to a climate adaptation framework so NFS staff can use the tool to guide their discussions throughout the forest planning process.

POTENTIAL PATHS FORWARD

Because the 2012 rule is still relatively new, the way forward for forest planning under these requirements remains somewhat nebulous for national forests undertaking the plan revision process, which requires attention to climate change. The aim of this workshop was in part to help address that need for clarity and further information on the unknowns through enhancing information exchange among the land management and research branches within the Forest Service, and with other allies and partners. This workshop should therefore be judged by its contribution to good and effective science-management partnerships, by creating new or strengthening existing working relationships between managers and scientists. *Good* partnerships might be evidenced by two-way learning and sharing, and *effective* ones by the ability to collaboratively produce and use outputs for meaningful ends. This workshop framework was able to achieve these criteria, so we consider it to be both a good and effective mechanism to enhance such partnerships, and we encourage further consideration of this workshop as a model for climate adaptation at the planning level.

There are enormous indirect benefits of holding a workshop where the scientific presentations and manager experiential knowledge are focused on a specific geography. Conferences, symposia, webinars, and other science-delivery mechanisms are efficient for passing on research findings, but they are not well suited for complex discussions about climate change adaptation. In this setting, scientists were seeing how one another's work related to management of a specific national forest, and learning reciprocally from managers' on-the-ground experiences, resulting in a better understanding of management information needs. In addition, it is improbable that such a diverse swath of a national forest's staff would commit to a series of disjoint, separate presentations. One-off presentations would certainly lack the value of this full-immersion workshop, where participants can disengage from other work distractions, devote critical thinking to the topic of climate change, consider a suite of scientific content all at once, and together create solutions with a broad and diverse group of colleagues.

The Plan Revision Climate Change Workshop helped RGNF effectively incorporate climate change considerations into plan components and set the stage for future science-management partnerships. Nonetheless, implementing this process requires careful scrutiny of the information needs of the individual forest. Situational and managerial unknowns presented certain challenges for planning and managing expectations for this workshop. If other national forests are considering replicating the approach used on the RGNF, we suggest that the following minimum conditions be met in order for this process to be successful:

1. That this process take place *early* in plan revision to ensure that sufficient time remains in the planning timeline to address climate change comprehensively, and that enough of conveners' and attendees' time (hours or days) can be dedicated to the workshop. In our experience, 2 days was not long enough for a thorough treatment of plan components and resource-management topics, though there are surely efficiencies to be gained from our lessons learned in this pilot project.
2. That there be adequate commitment by national forest leaders to encourage a truly comprehensive look at climate change adaptation and to support their planning staff in this examination. The RGNF workshop had tremendous backing from the RGNF leadership, and this support was a key element in our workshop's success.

3. That there be clear agreement on appropriate expectations of the invited workshop guests (research station scientists, university collaborators, regional office staff, and others), recognizing from the outset that researchers can provide best available science to help inform management decisions, but cannot make those decisions for the forest. Upfront clarity on the role of these partners alleviates the risk of mismanaged expectations, helps allay concerns the management staff may have, and places emphasis on the collaborative nature of the production of climate-adaptive alternatives jointly by scientists and managers.

4. That opportunities for engagement with the national forest be considered prior to the workshop. The RMRS organizers traveled to the RGNF months before the workshop to discuss workshop structure and to visit a part of the forest. This trip led to a pre-workshop field trip that several of the research scientists attended, giving them an opportunity to see aspects of the RGNF. Both opportunities allowed time for discussion and for bringing on-the-ground experience into those discussions.

The RGNF workshop and the broader collaboration between the national forest and RMRS were intended as a pilot project. A potentially more effective direction for further consideration is how this workshop could translate to the regional (or research station) level, such as planning assistance or templates, science availability and delivery, and outreach. Upscaling from a site-specific workshop to a larger landscape or administration context presents some challenges, but there is a growing body of peer-reviewed and gray literature illustrating how Forest Service regions and Federal lands in general have addressed these issues. For example, the Adaptation Partners experiences in the western United States, which involved thorough climate vulnerability assessments by biogeographic region and workshops that provided some management direction, often involved multiple agencies and spanned local to regional or subregional scales (e.g., Halofsky and Peterson 2016; Halofsky et al. 2011, 2018). These experiences and resources could be leveraged in future efforts undertaken by regions and individual national forests.

CONCLUSIONS

All parties to this collaborative RGNF/R2/RMRS/CSU project have deemed the workshop a success. The feedback comments on the workshop were very positive, whether measured by anonymous evaluation forms or by debriefing discussions with the planning and leadership team on the forest. The outputs from this workshop process and subsequent work are providing valuable information and documentation to assist RGNF in its plan revision process, but may also be useful in evaluating what role collaborations or workshops like this, or both, might have in the future for Region 2, other Forest Service regions, or other Federal lands. This was the first workshop of its kind in this region—and indeed, perhaps the first workshop anywhere—that aimed specifically to address climate change adaptation in Forest Service forest plan revision processes under the new planning rule. It was also a new application of a tested climate-adaptive decisionmaking framework that equipped the RGNF participants with a step-by-step toolkit to think about and incorporate climate change considerations into their future management on the forest.

Still, significant challenges remain, in part because it was difficult in this experience to separate and deal with planning-related challenges (those stemming from learning how to plan under the new rule) apart from the real and growing climate change-related challenges. Replication of this workshop at national forests embarking on plan revision would lead to valuable exchanges and

possibly the most robust systemic approach to dealing with climate change adaptation planning on NFS lands. But other factors, such as time, funding, and institutional capacity, may make such an approach infeasible or undesirable. An alternative may be to scale this process up to some form of regional-level assistance or template, although any anticipated gains from this method should be considered carefully against the benefits of on-site replication as demonstrated by this workshop on the Rio Grande National Forest.

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APPENDIX A—WORKSHOP AGENDA

October 19–20, 2016
Rio Grande Water Conservancy District Office, Alamosa, Colorado

DAY 1

8:30–9:00am – Welcome and Introductions

1. Welcome and purpose for workshop – *Dan Dallas, Forest Supervisor, RGNF and Linda Joyce, Quantitative Ecologist, RMRS*
2. Introductions – name, role, personal share (prompt: favorite forest or wild place)
3. Workshop overview, expectations – *Molly Roske, Research Associate, Forest & Rangeland Stewardship, CSU*

Defining our context:

9:00–9:45am – Historical and current climate in the Rio Grande NF area – *Peter Goble, Colorado Climate Center*

Overview of temperature and precipitation, including summer monsoonal patterns, precipitation frequency/intensity patterns, frost free season; extreme events as information is available; enhanced climate complexities of topography

9:45–10:30am – Current Plan and Summary of past and anticipated (future) Rio Grande NF management – *Rio Grande NF staff*

1. Forest-wide goals and objectives – *Judi Perez, Program Manager – Range, Soils, Water, RGNF*
2. Typical ecology, silviculture, and management considerations
    a. Vegetation Management – *Kirby Self, Vegetation Program Manager, RGNF*
    b. Range Management – *Judi Perez, Kelly Garcia, Range Management Specialist, RGNF*
    c. Fire Management – *Sid Hall, Forest Fuels Specialist, RGNF, and Chad Lewis, RGNF*
    d. Wildlife Management – *Randy Ghormley, Wildlife Program Leader, RGNF*

10:30–10:45am – Break

Assessing projections and vulnerabilities:

10:45–11:15am – Projected future climate – *Linda Joyce*

Temperature and precipitation: observed trends and future projections

11:15–12:15pm – Forest Carbon Disturbance Assessments: Results for the Rio Grande NF – *(via Adobe Connect)*

1. Context for Forest Carbon Monitoring in the Forest Service – *Karen Dante, Climate Change Adaptation and Policy Specialist, Forest Service*
2. The Forest Carbon Management Framework (ForCaMF) – *Sean Healey, Research Ecologist, RMRS*
3. The Integrated Terrestrial Ecosystem Carbon Model (InTEC) – *Richard Birdsey, Senior Scientist, Woods Hole Research Center, Volunteer, Forest Service*

12:15–1:15pm – Lunch (off-site)

1:15–2:00pm – Impacts and vulnerabilities for forest ecosystem types – *Michael Battaglia, Research Forester, RMRS*

1. General, across all Rio Grande NF forest types
2. Emphasis: Mixed-conifer forest type, and Spruce-fir forest type

2:00–2:45pm – Impacts and vulnerabilities for water-dependent ecosystems – *David Merritt, Riparian Ecologist, National Stream and Aquatic Ecology Center, WO Watershed, Fish, Wildlife, Air, and Rare Plants staff (via Adobe Connect)*

1. Impacts of precipitation and flow projections; interactions with vegetation changes
2. Emphasis: Riparian areas, wetlands, and groundwater-depended systems (fens/bogs)

2:45–3:00pm – Break

3:00–3:45pm – Insects, pathogens (disturbance) – *José Negrón, Research Entomologist, RMRS*

Overview – climate change impacts for relevant insect populations and pathogens

Interactions with fire, other disturbances

3:45–4:30pm – Vulnerability interactions and ranking – *Facilitators: Molly Roske, Linda Joyce, and Lara Peterson, Science Delivery & Exchange, RMRS*

Facilitator-led group activity to identify, synthesize, and discuss the most common vulnerabilities / impacts of greatest concern, and interactions/synergies between the workshop focus topic areas, for the Rio Grande NF

DAY 2

Evaluating Proposed Action given climate change impacts

8:30–8:45am – Reviewing yesterday's work – *Facilitator: Lara Peterson*

Impacts and vulnerabilities of concern for Rio Grande NF Forest Plan

8:45–9:15am – 2012 Planning Rule implications and climate change – *Judi Perez, Stephanie Rebain, R2 Planning Staff*

1. Desired conditionsNeed for change
2. Proposed Action, in brief (Management areas & allowable activities)

9:15–10:15am – Breakout activity 1: Challenges & Opportunities – *Facilitator: Molly Roske*

Identify challenges to, and opportunities for, meeting management area objectives and desired conditions under climate change

10:15–10:30am – Break

10:30–11:30am – Breakout activity 2: Feasibility – *Facilitator: Molly Roske*

Evaluate feasibility of current desired conditions and management area objectives and tactics, given challenges and opportunities identified in Breakout Activity 1

Developing climate-adaptive Forest Plan guideposts: modifying Proposed Action

11:30–12:15pm – Breakout group activity 3: Modifying Proposed Action – *Facilitator: Lara Peterson*

Discuss modification of Management Area designations or definitions, Desired Conditions and/or tactics in the Proposed Action with low feasibility rating

*Group-work before lunch; Report-out and synthesis will happen after lunch

12:15–1:00pm – Lunch (on-site)

1:00–1:30pm – Report-out from Breakout group activity 3: Modifying Proposed Action – *Facilitator: Lara Peterson*

*Group-work before lunch; Report-out and synthesis after lunch

Monitoring success of Proposed Action

1:30–1:50pm – Rio Grande NF Adaptive Management and Monitoring Program domains, activities, and goals – *Randy Ghormley and Judi Perez*

1. Past monitoring on the Rio Grande NF (Randy)
2. Future Monitoring under the 2012 Planning Rule (Judi)

1:50–3:00pm – Breakout group activity 4: Monitoring – *Facilitator: Linda Joyce*

Defining and measuring success of Proposed Action (Management Area objectives) through the Monitoring Program and other partnerships

[Note: this section of the agenda was skipped for lack of time, due to earlier sections running long.]

3:00–3:15pm – Break

Synthesis, Wrap Up, Next Steps

3:15–3:50pm – Review and integration: facilitated large-group discussion – *Linda Joyce, with input from Planning staff Erin Minks and Stephanie Rebain*

1. Review of work achieved and products generated; additional forthcoming products
2. Integration of workshop outcomes into Plan Revision components and process
3. Application to other topics/resource areas

3:50–4:30pm – Closing comments and wrap-up – Linda Joyce, Dan Dallas and/or Tom Malacek

1. Next steps: overview of post-workshop activities
    a. RMRS / CSU deliverables from workshop follow-up
    b. Timeline and check-in points
    c. Acknowledgements, thanks and farewells

4:30pm – Workshop conclusion

APPENDIX B—SUPPLEMENTAL RESOURCES

These resources are available on the RMRS website at: www.fs.fed.us/rmrs/projects/rio-grande-national-forest-climate-change-plan-revision-workshop

Workshop Outputs

- Climate Change Vulnerabilities of Concern
- Challenges and Opportunities
- Proposed Plan Components and Modifications

Workshop Handouts

- List of Enclosed Handouts
- Plan Component 1: Forest-wide Goals and Objectives
- Plan Component 2: Desired Conditions (excerpted from the Rio Grande 1996 Forest Plan)

Breakout Worksheets

- Worksheet 1: Challenges and Opportunities
- Worksheet 2: Evaluating Proposed Action elements
- Worksheet 3: Adjusting Proposed Action elements for climate change
- FAR Menu of Adaptation Strategies & Approaches (accompanies Worksheet 3)
- Worksheet 4: Monitoring Items for Adaptive Management

Specialist Reports

- Rio Grande National Forest Historic Climate Assessment
- Impacts and Vulnerabilities for Forest Ecosystem Types of the Rio Grande National Forest
- Climate Change and Selected Forest Insect and Pathogens in the Rio Grande National Forest

Bibliographies

The list displays bibliography studies by topic and number of studies.

Vulnerability assessments and reports - - - - 11
Water - 49
Groundwater - 16
Vegetation: Alpine - - - - - - - - - - - - - - - - - 19
Vegetation: Spruce-fir - - - - - - - - - - - - - - - 27
Vegetation: Pinyon-juniper- - - - - - - - - - - - 32
Vegetation: Sagebrush - - - - - - - - - - - - - - - 18
Vegetation: Oak - - - - - - - - - - - - - - - - - - - 5
Vegetation: Riparian - - - - - - - - - - - - - - - - 28
Disturbance: Fire - - - - - - - - - - - - - - - - - - 68
Disturbance: Insects and disease - - - - - - - - 52
Disturbance: Invasive plants - - - - - - - - - - - 50
Socio-economic conditions - - - - - - - - - - - 46

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