



# FACTORS INFLUENCING NATIONAL FORESTS' USE OF CLIMATE CHANGE VULNERABILITY ASSESSMENTS

## FINDINGS FROM A PILOT STUDY

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**T**he USDA Forest Service conducts climate change vulnerability assessments (CCVA) to inform planning and management for climate change impacts. CCVA have been completed for several Forest Service administrative regions, and individual forests have also assessed climate change vulnerabilities for their landscapes and ecosystems, often in support of forest plan revision. National forests have used CCVA to inform forest planning and management in a range of ways, some more comprehensive than others. We designed a pilot survey instrument aimed at exploring social and organizational factors that may influence the degree to which national forests adopt practices or undertake activities related to climate change adaptation.

### RESEARCH APPROACH

Over the last two years we have been working with the Forest Service Office of Sustainability and Climate to investigate this question. We piloted a quantitative survey for understanding the potential for CCVA usage at the national forest level. Our objectives were to:

1. Create an index measuring the degree to which their national forests have implemented considerations of climate change into forest level practices, planning, and management activities, and
2. Identify factors within the forest leadership culture that may be associated with more robust responses to climate change at the forest level.

### Survey respondents

We recruited management and planning leadership from a total of 24 national forest units in Forest Service Regions 1 and 6 (Figure 1). We assembled a recruitment list of 184 potential respondents with help from climate coordinators at the regional- and forest- level offices. For each forest, we received the name of the climate coordinator from

the regional climate change coordinator, and then asked each forest-level coordinator for the names and contact information for people at the forest level whose work was potentially relevant implementing CCVA recommendations.

### Survey instrument

Our online survey instrument included 46 questions, with 18 questions aimed at understanding the degree of a national forest's adoption of practices and management activities that consider climate change (combined into an index representing our dependent variable) and 28 questions aimed at understanding factors that we hypothesized might influence climate change related management considerations at the unit level. The factors we asked about included personal beliefs related to their cultural worldview and opinions about climate change as well as their perception of their forest's leadership culture and the influence of external stakeholders on their forest's management activities. We additionally asked about respondents' age, gender, career history, education, current job position.

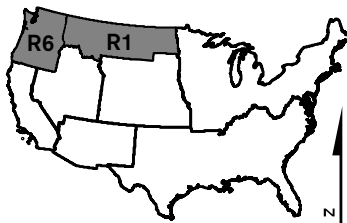
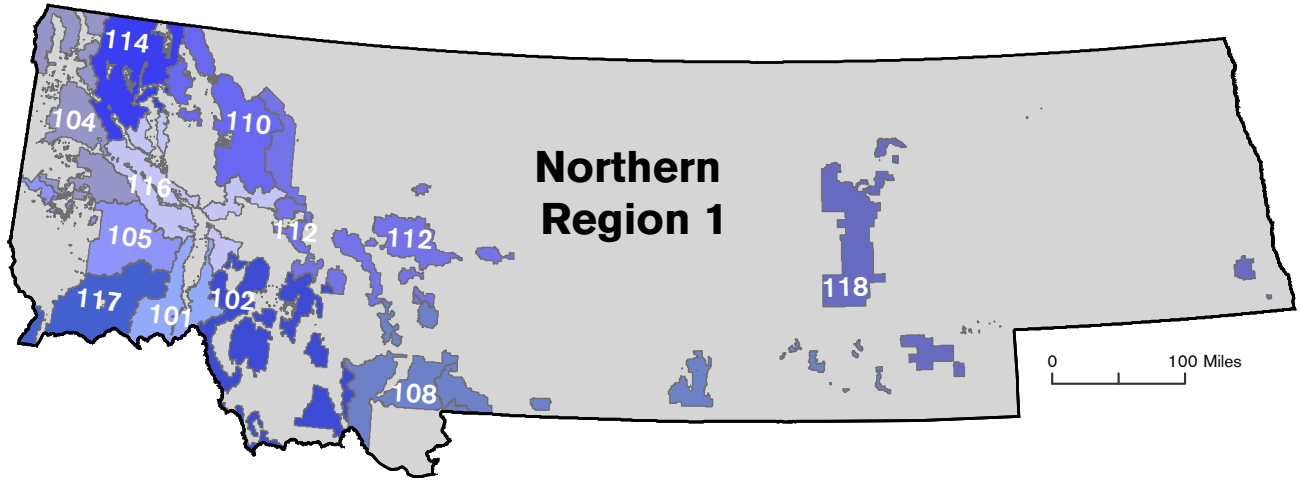


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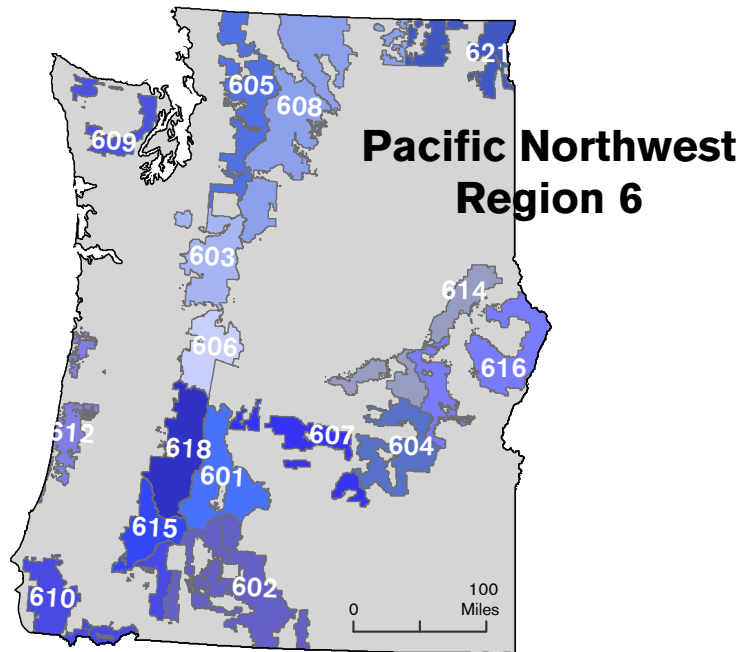


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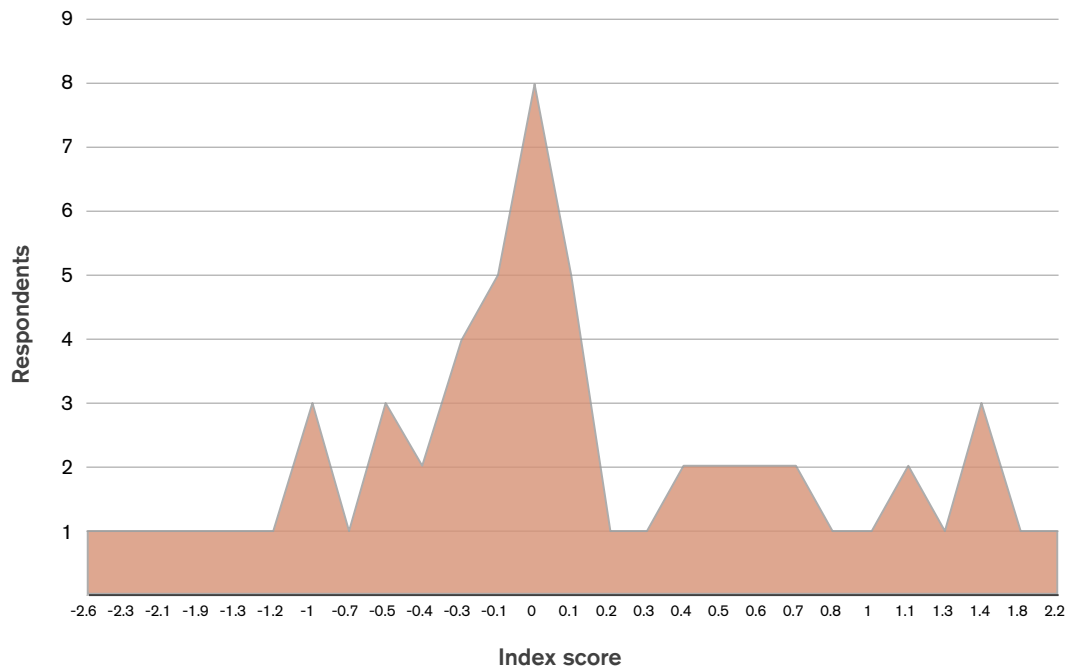
**Figure 1. Map of National Forests surveyed in Forest Service Regions 1 and 6**



| Code | Forest Name                            | Code | Forest Name                          |
|------|--|------|--------------------------------------|
| 101  | Bitterroot National Forest             | 605  | Mt. Baker-Snoqualmie National Forest |
| 102  | Beaverhead-Deerlodge National Forest   | 606  | Mt. Hood National Forest             |
| 108  | Custer Gallatin National Forest        | 607  | Ochoco National Forest               |
| 110  | Flathead National Forest               | 608  | Okanogan-Wenatchee National Forest   |
| 112  | Helena-Lewis and Clark National Forest | 609  | Olympic National Forest              |
| 114  | Kootenai National Forest               | 610  | Rogue-River Siskiyou National Forest |
| 116  | Lolo National Forest                   | 621  | Colville National Forest             |
| 117  | Nez Perce-Clearwater National Forest   | 612  | Siuslaw National Forest              |
| 601  | Deschutes National Forest              | 614  | Umatilla National Forest             |
| 602  | Fremont-Winema National Forest         | 615  | Umpqua National Forest               |
| 603  | Gifford Pinchot National Forest        | 616  | Wallowa-Whitman National Forest      |
| 604  | Malheur National Forest                | 618  | Willamette National Forest           |



**Figure 2. Climate Change Adaptation Index**



To accomplish statistical analysis of climate change adaptation activities, we created a composite index from 13 self-assessment survey questions. The index represents the degree to which a respondent's National Forest management unit is conducting climate change adaptation activities. This area graph depicts the distribution of our composite climate change adaptation index by value (x-axis) and number of respondents associated with each value (y-axis). Negative values indicate less agreement on whether respondents' national forests were conducting climate change adaptation activities while positive values indicate more agreement that their forests were conducting climate change adaptation activities.

## KEY FINDINGS

### Climate change adaptation activities

Respondents predominantly agreed that their forests were engaged in activities related to climate change adaptations. Over three quarters reported consideration of climate change within NEPA planning processes. Most agreed that CCVA were used to prioritize management actions. Our climate change adaptation index (Figure 2.) revealed that climate change adaptation considerations were most important to unit-level operations, monitoring efforts, activities being conducted with external partnerships, and forest management priorities. Conversely, assessments of carbon stocks and carbon sequestration analyses were not as important for forests' climate change adaptation activities.

### External stakeholder influence

Individuals who perceived that their national forest units undertook management activities related to climate change also reported that external stakeholders were influencing and investing in climate change adaptation activities on their forests. This finding is consistent with recent studies documenting the increasing importance of state, local, and private partnerships and collaborations for getting work done on national forests.<sup>1</sup>

### Transformational leadership style

Previous studies have found that leaders who lead by example, encourage forward thinking, creativity in problem solving, and provide good mentorship can have transformational results on organizational culture. Our analysis found statistically significant associations between transformational style of leadership and the climate change adaptation index. This correlation indicates that a forest's leadership style can influence its climate change adaptation activities and that transformational leadership style increases the likelihood that forests will undertake more robust climate change activities.

### Forest organizational culture

Previous studies have found associations between the importance of climate change-based actions and individual cultural attributes such as cultural openness, global pro-sociality, and respect for cultural diversity - collectively called a "cosmopolitan orientation" in scholarly literatures. Our results may support these findings: individuals who expressed beliefs consistent with a cosmopolitan orientation were also more likely to indicate that their forests were undertaking more robust climate change adaptation activities. This may indicate that forests with more robust adoption of climate change-oriented activities are

also those where cosmopolitan orientations are common among the leadership. However, given the sample size of our pilot project we cannot confirm this finding. On the other hand, we found no relationship between personal beliefs about climate change and perceptions about their national forest's climate change adaptation activities, so personal beliefs may not be influencing individual's perceptions of their forest's activities.

## IMPLICATIONS FOR POLICY AND PRACTICE

**The degree to which national forests engage with external stakeholders influences forests' climate change adaptation activities.** Engagement with external stakeholders likely allows forests to leverage private, state, and other public resources, enhancing national forest capacity and motivation for undertaking climate change-related management actions. Thus, positive feedbacks between national forests and external stakeholders may expand forest-level adaptations to climate change.

**Forest leadership that encourages forward thinking and creative problem solving may encourage engagement with climate change vulnerability assessments and recommended adaptation actions.** Considering that solutions to climate change vulnerabilities will likely require de-centralized and localized innovations, promotion of transformational leadership at multiple scales may enhance the performance of forest in their efforts to adapt to climate change.



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<sup>1</sup> Abrams, J. 2019. *The emergence of network governance in US National Forest Administration: Causal factors and propositions for future research.* *Forest Policy Econ* 106:101977.

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