



US Forest Service R&D PNW Research Station

Project Title: A Toolkit for Adapting to Climate Change on Western National Forests: Incorporating Climate into Resource Management and Planning

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Project Description: In June 2008 scientists from the Pacific Northwest, Pacific Southwest, and Rocky Mountain Research Stations were awarded funds from the Forest Service Global Change Research Program to develop and evaluate a set of decision-support tools and reference materials that will incorporate climate-change considerations into decision making on western National Forests, as well as be broadly relevant to other managers, policy makers, and scientists. We are developing adaptation management resource materials in multiple formats; conducting replicate climate change adaptation case studies on three national forests and affiliated national parks; extending case-study results for broader applications across diverse landscapes and ownerships; and intensively developing the U.S. Forest Service Climate Change Resource Center (CCRC) website.

The three case studies, being conducted at Olympic, Inyo, and Shoshone National Forests, are science-management partnerships working toward climate change adaptation on National Forests. PNW has been conducting the case study at Olympic National Forest (collaboratively with the University of Washington Climate Impacts Group and Olympic National Park). For the Olympic Case Study, we are working to develop climate change adaptation strategies and plans of action for four main areas: hydrology and roads, vegetation, wildlife, and fish. At least two scientist-manager workshops have been conducted in each of these focus areas over the past year. Workshops were preceded by a vulnerability assessment in each of the four focus areas, and results of both the vulnerability assessments and workshops will be incorporated into a final report on climate change impacts and adaptation plans for the Olympic Peninsula (Forest and Park), published in the form of a Forest Service General Technical Report in the winter/spring of 2010.

PNW has also developed simulations of future climate and vegetation for all three case-study regions. The simulations include 9 dynamic ecosystem scenarios, at 800-m resolution, for vegetation change, carbon balance, hydrology, and disturbance for the Olympic, Inyo, and Shoshone National Forests. Videoconferences brought together scientists and resource managers from each of the National Forests to discuss climate change scenarios and their uncertainty.

Project Deliverables:

Presentations

- Numerous presentations on the Olympic National Forest case study (phase 1) for scientific and management audiences.
- Numerous presentations on climate change adaptation to national forests, U.S. Fish and Wildlife Service, U.S. Geological Survey, Environmental Protection Agency, scientific conferences, and resource manager workshops.

Website

- Climate Change Resource Center website: <http://www.fs.fed.us/ccrc>

Publications

Halofsky, J, M. Furniss, L. Joyce, B. Kerns, C. Millar, R. Neilson, D. Peterson. Adapting natural resource management to climate change: useful concepts and tactical approaches. *Journal of Forestry*. In review.

Peterson, D.L., C.I. Millar, J.S. Littell, K.A. O'Halloran. U.S. National Forests adapt to climate change through science-management partnerships. *Climatic Change*. In review.

Blate, G.M., L.A. Joyce, S. Julius, J.S. Littell, S.G. McNulty, C.I. Millar, S.C. Moser, R.P. Neilson, K. O'Halloran, D.L. Peterson and J. West. 2009. Adapting to climate change in United States national forests. *Unasylva* 60:57-62.

Joyce, L.A., G.M. Blate, J.S. Littell, S.G. McNulty, C.I. Millar, S.C., Moser, R.P. Neilson, K. O'Halloran, and D.L. Peterson. 2008. National Forests. Pages 3-1 to 3-127 in *Preliminary Review of Adaptation Options for Climate-Sensitive Ecosystems and Resources*. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research (S.H. Julius and J.M. West [eds.], J.S. Baron, B. Griffith, L.A. Joyce, P. Kareiva, B.D. Keller, M.A. Palmer, C.H. Peterson, and J.M. Scott [authors]). U.S. Environmental Protection Agency, Washington, DC.

Joyce, L.A., G.M. Blate, J.S. Littell, S.G. McNulty, C.I. Millar, S.C. Moser, R.P. Neilson, and D.L. Peterson. 2009. Managing for multiple resources under climate change. *Environmental Management* DOI 10.1007/s00267-009-9324-6.

McKenzie, D., D.L. Peterson, and J. Littell. 2009. Global warming and stress complexes in forests of western North America. Pages 317-337 in A. Bytnerowicz, M.J. Arbaugh, A.R. Riebau, and C. Andersen (eds.), *Wildland Fires and Air Pollution*. Elsevier Publishers, The Hague, Netherlands.

Peterson, D.L., C.D. Allen, J.S. Baron, D.B. Fagre, D. McKenzie, N.L. Stephenson, A.G. Fountain, J.A. Hicke, G.P. Malanson, C.L. Tague, and P.J. van Mantgem. Response of Western mountain ecosystems to climatic variability and change: a collaborative research approach. In J. Bellant and E. Beever (eds.), *Ecological Consequences of Climate Change: Mechanisms, Conservation, and Management*. Taylor and Francis Publishing, New York, NY. In press.

Peterson, D.L., J. Halofsky, and M.C. Johnson. Managing and adapting to changing fire regimes in a warmer climate. In D. McKenzie, C. Miller, and D. Falk (eds.), *The Landscape Ecology of Fire*. Springer Verlag, New York. In press.

Peterson, D.L., and D. McKenzie. Understanding and adapting to new stress complexes in forest ecosystems. In W. Rodgers (ed.), *Climate Change Reader*. In press.

Project Outcomes

Managers of forest land in the western U.S., as well as other managers, policy makers, and scientists, will have a set of decision-support tools and reference materials that will incorporate climate-change considerations into decision making.