Climate Change Considerations in Land Management Plan Revisions
January 13, 2009

Introduction

Forest Service Chief Abigail R. Kimbell has characterized the agency's response to the challenges presented by climate change as "one of the most urgent tasks facing the Forest Service" and stresses that "as a science-based organization, we need to be aware of this information and to consider it any time we make a decision regarding resource management, technical assistance, business operations, or any other aspect of our mission." Leadership in mitigating climate change and adaptive management for unavoidable climate change are the modern challenges of proper land stewardship for our national forests and grasslands. This leadership needs to be demonstrated in our land management planning processes, especially at the time of plan revision.

This guidance is intended to set an appropriate level of consistency across the agency for treating climate change in land management plan revisions. It allows flexibility for units to focus on what is relevant locally to mitigate and adapt to climate change. Regional offices and Forest Service Research will also have a substantial role in assisting in the assimilation and evaluation of scientific information relevant to the forest and grassland units within the region. The principles provided here are designed to reflect current science and provide for resilient forests, grasslands, and prairies. We expect to update this guidance as policy and science evolves. At this time, the following is a list of minimum items recommended to be addressed when revising land management plans:

Principles:

- The focus of NFS land management is multiple use management with ecological, social, and economic sustainability. Climate change is a factor to be considered in the delivery of our overall mission.
- Use the best available science on climate change that is relevant to the planning unit and the issues being considered in planning.
- Where necessary to make informed decisions and provide planning direction responsive to changing climate, use climate change science and projections of change in temperature and precipitation patterns at the lowest geographic level (national, broad, mid-, base) that is scientifically defensible. Given the uncertainty involved and limits to modeling capability, this is most likely at much broader scales than appropriate for the planning unit.
- Address climate change during LMP revision in terms of "need for change" from current LMP direction so that the unit will continue contributing to social, economic, and ecological sustainability.
- Place increased value on monitoring and trend data to understand actual climate change implications to local natural resource management.

1. Discuss the role of climate change in the plan set of documents.

Climate change information should be integrated in appropriate sections throughout the plan and the plan set of documents. The comprehensive evaluation report (CER) is a

good place for the bulk of the climate change discussion, with appropriate consideration of climate change woven into the plan components and other parts of the plan documents. Climate change needs to be discussed in the CER and plan approval document, even if there are no implications for the plan revision.

Comprehensive Evaluation Report

One of the first steps in the plan revision process is an evaluation of the conditions and trends on the planning unit followed by identifying the need for change in the plan. This includes past, present and projected future climate conditions and trends. This evaluation of the conditions and trends related to the planning unit is organized in the comprehensive evaluation report. Assessments at broader scales or scientific syntheses may provide information on climate change that can be summarized in the CER. The CER can also be used as a foundation of information related to climate change that can be used for other work such as project planning.

There are two basic considerations for evaluating climate change:

- How climate change is likely to modify conditions on the planning unit?
- How management of the planning unit may influence climate change?

Most of the focus of the evaluation for plan revision will be to understand how climate change is affecting the planning unit to determine what parts of the plan need to be changed to maintain the commitment to sustainability. The evaluation should also include some discussion how management of the planning unit may influence climate change. This would usually be limited to how the planning unit contributes to or mitigates the build up of greenhouse gases in the atmosphere.

- FS Regions and FS Research Stations should collaborate to provide a common synthesis and assessment of science information relevant to climate change for land management planning. These would draw on the existing synthesis and assessments prepared by the Intergovernmental Panel on Climate Change (IPCC) and US Climate Change Science Program Science Assessment Products (CCSP SAP) as well as information from Forest Service Research to provide regionally consistent scientific information on :
    - Climate change projections relevant to your part of the country
    - A characterization of what is known and what is not known about climate change and the uncertainty about projecting future scenarios.
    - Emerging trends and the range of climate change scenarios, and

- This information would be discussed in the context of the planning unit along with a discussion of how the planning unit might adapt over time. This can include:
    - Identify risks and vulnerabilities within the planning unit
    - Discussions of ecological adaptations likely on the planning unit
    - Discussions of how management of the unit can also adapt.

- Focus on expected climate change factors that are most likely to affect plan components, especially desired conditions, and convey how (or why) they could be affected. Evaluation of climate change may lead to recognition that some current conditions may be difficult to maintain in the future. This should be recognized in the evaluation of the habitat requirements for some species.

- Identify potential risks that may lead to 'undesirable conditions' from climate change or other factors.

- Identify ecosystems that are most at risk due to climate change. Focus on water availability, systems susceptible to changes in temperature, and elevated levels of atmospheric CO2 as factors affecting ecosystems. See SAP 4.3 and 4.4for information to identify vulnerable resources.

- Include a basic analysis of conditions and trends of carbon stocks and fluxes on the planning unit, and greenhouse gas emissions influenced by the management of the planning unit. More information on consistent methods to do this analysis will be provided in the future.

- Identify management responses that are feasible, realistic, and relate to the anticipated climate change effects that are pertinent to the unit and the vision in the plan. Consider long term effects, but also identify some steps that could be taken during the life of the plan.

Plan Approval Document

Discuss how the plan responds to pertinent aspects of climate change in the rationale section of the plan approval document.

2. <u>Provide analysis at the appropriate scale using the best climate change information available</u>.

- Examine monitoring data and trends that exist for the region and planning unit to understand what climate change effects are occurring.

- Rely on existing regional-scale climate projections to understand the type and magnitude of climate change effects that could occur. Use information from FS research on appropriate regional projections and scenarios and to ensure that the 'regional-scale' information is appropriate for how is it being used. (In some cases, the regional scale projections may misrepresent the local climate trends and patterns due to a failure to recognize key local influences.)

- Coordinate with regional offices, the FS research community, university scientists, and other researchers to use existing science and modeling/scenario results. Creating new climate change models and climate change scenarios specifically for plan revision is not recommended. Climate change effects are multiple, varied, and interact with other stressors such as habitat fragmentation,

insects and diseases, non-native invasive species, etc. The current climate change effects models do not incorporate all of the potential effects or their interactions that are relevant to land management planning. Most are appropriately applied at much broader spatial scales—continental, even hemispheric—but not at the planning unit or regional scale.

- Use the historical range of variability (HRV) to help understand historical ecosystem dynamics, current ecosystem conditions, and for insight into potential future ecosystem behaviors. While HRV does not typically describe the desired conditions of managed landscapes and future conditions are likely to vary from the HRV in many places, still the HRV may (a) provide information relevant to ecosystem resiliency or vulnerability to projected climate change effects and other disturbances; and (b) help to identify the most urgent ecosystem needs and effective restoration methods to increase resilience for a given ecosystem. It has been useful for understanding:
  - Fire ecology and disturbance processes
  - Watershed hydrological function
  - Distribution of plant and animal populations

  Note: HRV is expected to provide information for developing desired conditions, not be the desired conditions. HRV may not be useful for all planning situations (See 1909.12 Chapter 40).

3. **<u>Integrate climate change into the plan components based on the results of the comprehensive evaluation</u>.**
   - Use the information from the CER to focus on risks posed by climate change to the sustainability of the planning unit and to potential contributions of the planning unit to mitigate levels of greenhouse gases.

   - Integrate climate change as appropriate into descriptions of plan components, rather than develop stand-alone desired conditions or objectives for climate change.

   - To contribute to sustainability, plan components should be feasible under a variety of future scientifically credible climate scenarios.

   - The general principle of maintaining ecosystem resiliency by promoting ecological processes and diversity in vegetative composition and structure is also likely to lead to resilient landscapes affected by climate change.

   - Consider the influence of climate change in developing plan components related to threatened and endangered species, species of concern and species of interest.

   - Consider adjustments to post disturbance recovery guidelines that are more resilient to climate change (e.g. reforestation densities and species mixes following a fire).

- See information in SAP 4.4 (Chapter 3, especially 3-107-108) for Forest Planning assumptions and adaptation options to consider regarding climate change.

Plan Component Examples: Three examples are presented: 1) improving the resistance of Intermountain forests to drought and fire risk, 2) replacement of loblolly pine with longleaf pine to improve resiliency and carbon sequestration, and 3) adjustment to accommodate peak flow events that are outside of the historical levels. Most of these examples are hypothetical, but illustrate how climate change can be taken into account in developing plan components. Better examples are anticipated from future plans.

Example 1: Improving resistance of Intermountain forests

Desired conditions:

Forest stands are at stand densities and of species composition such that they will be resilient under a variety of potential future climates. Lower densities are more likely to survive future drought stress, fire, and insect and disease problems. For the different forest types and seral stages the following range of tree densities are desirable:

Desirable Tree Density Ranges (TPA) by Forest Type and Seral Stage

Forest Type	*Young Stage*	*Mid-Stage*	*Old Stage*
Ponderosa Pine	*100-300*	*70-100*	*30-70*
Douglas-f ir	*150-350*	*100-150*	*50-100*
Lodgepole Pine	*200-400*	*60-200*	*20-60*

All land areas that are classified as forest land are occupied by trees to the appropriate density for their seral stage.

Objectives:

Over the next 15 years reforest 10,000 to 15,000 acres of lands using a desired mix of species within the range of desired densities likely to thrive under a warmer and either a wetter or dryer future climate.

Over the next 15 years 9,000 to 12,000 acres of young (40-80 year old) ponderosa pine stands are thinned to basal areas of ____ to ____ square feet so that they are likely to remain healthy should the sites become warmer and dryer due to changing climate.

Guidelines

The following residual stand densities should be used for thinning stands of different forest types and seral stages. These residual densities are based on possible annual precipitation reductions of 10-20 percent and possible increases in evapotranspiration during peak periods of 5-10 percent.

Residual Density Ranges (TPA) by Forest Type and Seral Stage

Forest Type	*Young Stage*	*Mid-Stage*	*Old Stage*
Ponderosa Pine	*100-200*	*70-90*	*30-50*

Douglas-fir	*150-250*	*100-125*	*50-80*
Lodgepole Pine	*200-300*	*60-150*	*20-60*

Thinning within these stands should seek to retain the existing species composition, rather than modifying the species composition of the existing stand. This will retain diversity and provide species capable of thriving in either wetter or dryer conditions.

Example 2: Replacement of loblolly pine with longleaf pine

Desired conditions:

Longleaf pine occupies drier sites that are more susceptible to fire on approximately 65-75% of the national forest. (Longleaf pines are more resilient to drought and fire and may sequester more carbon than the current trees occupying these sites.)

Objectives:

At the end of the first decade after the approval of the plan, approximately 13,000 acres of longleaf pine exist on sites formerly occupied by loblolly pine forest.

Guidelines

In thinning operations on loblolly pine sites, all healthy longleaf pine trees that are found on the site should be retained.

Example 3: Adjustment to accommodate larger peak flow events

Desired conditions:

Bridges and other stream crossings are constructed to withstand major storm and runoff events, even beyond those associated with 100 year flood event.

Objectives:

Over the next 15 years replace the 15-20 stream crossings most vulnerable to loss or damage by increased peak flows.

Guidelines

When constructing or reconstructing stream crossings, design should accommodate flows 20% greater than a 100 year flood event.

4. Develop a monitoring program for the revised plan with an awareness of climate change.

- It is not recommended that planning units create a whole new initiative or program of work solely for monitoring climate change. However, consider appropriate adjustments to the monitoring program that will improve understanding the relationships of key plan components and climate change. For example, if collecting information on aquatic conditions pertinent to aquatic species of concern, information about water temperatures and water flows associated with climate change may be easily obtained and provide relevant

information to understanding the condition and trends of these species and their habitats.

- Rely on regional scale and other cooperative monitoring to develop basic information specifically about climate change.

- The monitoring program may assist the planning unit to periodically re-evaluate (at least every 5 years) what is really happening with respect to climate change.

5. Tie into higher scale (multi-state, regional, or state-wide) climate change strategies as appropriate to gain collaborative support and efficiencies for climate change in land management plan revisions

- Collaborate with other Federal agencies, federally recognized Indian Tribes, Alaska Native Corporations, State or local governments, or other interested or affected communities, groups, or persons to address climate change across the landscape.

Examples and Sources of Information

A major source of information is the U.S. Climate Change Science Program and its associated synthesis and assessments products. These include SAP 4.3 (The Effects of Climate Change on Agriculture, Land Resources, Water Resources and Biodiversity in the United States) and SAP 4.4 (Preliminary Review of Adaptation Options for Climate Sensitive Ecosystems and Resources). These reports can be found at: http://www.climatescience.gov/

The International Panel on Climate Change (IPCC) is a scientific intergovernmental body set up by the World Meteorological Organization (WMO) and by the United Nations Environment Programme (UNEP). The IPCC was established to provide the decision-makers and others interested in climate change with an objective source of information about climate change. The IPCC prepares periodic assessments of climate change in the form of three major assessments, as well as technical summaries and summaries for policy makers. The IPCC also prepares Special Reports and Technical Papers on specific issues related to climate change. The web page for the IPCC is http://www.ipcc.ch

Climate change information and examples relating to land management planning will continue to be updated on the TIPS website at: http://www.fs.fed.us/TIPS, click on FS user. Some other links we want to highlight are provided below:

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Forest Service Research & Development web page .The links on the upper right lead to briefing papers on a variety of topics. The links on the lower right lead to main pages for the various research stations, all of which have additional information related to climate change research. http://www.fs.fed.us/research/fsgc/climate-change.shtml