# Appendix D: Adaptation Technical Guidance

Scorecard Element 7 asks whether information about adaptation is being implemented within management and planning to ensure sustainability of key resources, ecosystem elements, and human communities. The scientific basis for adaptation has developed rapidly in recent years (IPCC 2007, Millar et al. 2007, Joyce et al. 2008, Seppälä et al. 2009, Halofsky et al. in press), providing Regions and national forests with sufficient documentation to develop adaptation strategies and tactics (e.g., Peterson et al. *in press*). Focused science-management partnerships provide a means for developing adaptation approaches that are closely linked with vulnerability assessments.

An adaptation strategy for a given Unit should describe a clear path toward practically integrating climate change adaptation into Unit-level decisions. The strategy is not meant to replace planning processes, but instead to describe how climate change information will be acquired and integrated into existing planning and management processes at the Unit level. Most Units will not immediately have the necessary information to develop a comprehensive strategy, and the strategy development should be considered iterative. An initial strategy could include a description of how the Unit intends to address each of the components listed below. It could include an initial list of partners, a general time line for major milestones, and descriptions of successful products and outcomes for each component. The adaptation strategy should describe how it will be integrated into Unit-level decision making.

Below are some steps you can take for incorporating adaptation into your current management activities and plans:

1. **Connect adaptation activities to vulnerability assessments:** Vulnerability assessment will generally occur before the development of adaptation strategies and tactics. This improves the efficiency of adaptation by focusing on those resources and locations that are most sensitive to a changing climate. Linking adaptation to vulnerability assessments can be done for resource disciplines (e.g., vegetation, hydrology), ecosystems (e.g., alpine, mixed conifer forest), or geographic locations (e.g., administrative Units, ecological subregions). The spatial and temporal scales of system structure, function, and processes need to be considered with respect to how a potential effect of climate change (vulnerability) can be matched with a specific adaptation tactic. In addition, landscapes beyond Unit boundaries should be included in adaptation approaches that address resource issues that are inherently cross-boundary in nature (e.g., ungulate migration, fire).

2. **Review synthesized information on adaptation strategies:** Documentation of adaptation strategies is the normal process of generating options for management and the scientific basis for those options. This provides credibility for including climate change as a component of sustainable resource management and reduces the potential for appeals and legal challenges. The scientific literature in this area is rapidly expanding, but the citations below provide a good starting point. It is ultimately the responsibility of Unit-level staff to identify the strategies that

are most relevant for their location and management objectives. It can be helpful to link adaptation strategies with other general strategies for managing resources (e.g., animal populations, road networks) to ensure compatibility and consistency. Adaptation strategies can be initially compiled by others, such as Regional staff, and subsequently referenced and refined by Unit-level staff.

3. **Review planned projects:** As you develop new projects or re-evaluate ongoing projects, you should also integrate climate change adaptation within your management and planning. At the most basic level, a Unit can simply make a list and for each project ask "How can potentially adverse effects of climate change be reduced through specific management actions?" This does not imply that all these actions must be taken, only that they be considered. Decision support tools are available for doing this type of review.

4. **Develop adaptation tactics:** Adaptation tactics are a set of potential on-the-ground actions that fall under specific general adaptation strategies. Adaptation tactics are generally consistent with principles of sustainable resource management, and it may be possible to simply modify existing activities that are ongoing or planned (e.g., remove more surface fuels than has been done in previous fuel treatments). It is helpful to link each tactic with a specific outcome in terms of general system function (e.g., tree growth) or a more quantifiable ecosystem service (e.g., water supply) at relevant spatial and temporal scales. Adaptation tactics should have a scientific basis and be adequately documented to reduce appeals and legal challenges.

5. **Evaluate feasibility and probability of success**: For any given ecosystem or location, a wide range of adaptation strategies and tactics can be considered. However, the *feasibility* – economic costs, staff time, regulations, and logistics – must be considered prior to implementation. Also, the *probability of success* for a specific adaptation tactic, based on scientific principles and previous applications, will often be the ultimate criterion for implementation. In considering feasibility and probability of success, the priority of specific projects must be balanced against the urgency of enhancing the adaptive capacity of various systems. Seemingly hopeless causes and situations requiring heroic and expensive actions are poor candidates for adaptation. Situations with highly uncertain outcomes or methods are not appropriate for single actions, but might be appropriate for experimentation with multiple actions.

6. **Identify monitoring options:** Monitoring plans for evaluating the effectiveness of adaptation approaches should be developed concurrently with the initial implementation of adaptation strategies and tactics. While this may be viewed as an expensive burden, it is the only way to confirm if specific approaches are working and if they are not, to allow enough time to make revisions. For some systems, relatively infrequent monitoring may be sufficient for evaluating effectiveness. In addition, monitoring of adaptation effectiveness can be combined with existing monitoring programs to improve efficiency.

## Glossary of Terms *(from IPCC 2007)*

**Adaptive capacity**– The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

**Adaptation tactic** – A specific action described in management and planning documents that supports adaptation strategies and is implemented on the ground (e.g. reducing stem density and surface fuels in a dry mixed conifer forest, increasing culvert size on roads along a stream that is expected to have higher flood volumes).

**Climate change adaptation** – An adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Adaptation is often referred to as preparedness, and is based on scientifically supported strategic and tactical activities that support sustainable resource management. Adaptation addresses specific aspects of the sensitivity of resources to an altered climate.

**Resilience** -- The degree to which systems (e.g., a forest ecosystem) can recover from one or more disturbances without a major (and perhaps irreversible) shift in composition or function. Example of managing for resilience: periodic reduction in stem densities and surface fuels to reduce fire severity in dry forest.

**Resistance --** The ability of an organism, population, community, or ecosystem to withstand perturbations without significant loss of structure or function. From a management perspective, resistance includes both 1) the concept of taking advantage of and boosting the inherent (biological) degree to which species are able to resist change, and 2) manipulation of the physical environment to counteract and resist physical and biological change. Example of managing for resistance: placement of fire breaks on the perimeter of climatically sensitive wildlife habitat to reduce fire spread.

**Sensitivity** –The degree to which a system is affected, either adversely or beneficially, by climatic variability or change. The effect may be direct (e.g., a change in tree growth in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damage caused by an increase in the frequency of river flooding).

**Uncertainty** – An expression of the degree to which a value (e.g., the future state of the climate system) is unknown. Uncertainty can result from lack of information or from disagreement about what is known or even knowable. It may have many types of sources, from quantifiable errors in the data to ambiguously defined concepts or terminology, or uncertain projections of human behavior. Uncertainty can be represented by quantitative measures (e.g., a range of values calculated by various models) or by qualitative statements (e.g., reflecting the judgment of a team of experts).

**Vulnerability** – The degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climatic variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climatic change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.

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