

## Appendix E (8/1/2011): Monitoring Technical Guidance



### Types of monitoring to consider

The type of monitoring used and the appropriate spatial scale and resolution will be determined by the resources of interest and the particular questions asked. Below are three types of monitoring described in the Roadmap that are important to consider in the context of climate change:

- ✓ **Systematic monitoring** establishes monitoring locations across large areas, with monitoring stations often located in an established grid of various resolutions.
  - Example: The Forest Inventory and Analysis (FIA) program.
- ✓ **Targeted monitoring** assesses particular areas based on specific objectives, using measurements or indicators related to those objectives. It obtains quantitative or qualitative population density and trend estimates in areas where a given species or community has been identified as potentially vulnerable.
  - Example: monitoring outbreaks of insects and diseases or invasive species in areas that have been identified as vulnerable to infestation due to climate change.
- ✓ **Effectiveness monitoring** is focused on evaluating resilience and adaptation outcomes that result from on-the-ground activities. The aim is to determine the effectiveness of management actions taken to reduce stressors, enhance resilience, or conserve species.

In addition to those mentioned above, you may also want to consider the following in your adaptation activities:

- ✓ **Implementation monitoring** is designed to determine if plans, prescriptions, projects, and other resource management activities are implemented as designed and in compliance with land management plan objectives, requirements, and standards and guidelines. In relation to climate change, implementation monitoring is most valuable when it records what, where, when, how, and why adaptation activities are implemented.

Monitoring programs that were designed for other purposes can provide helpful information on trends in climate-related stressors and changes in vulnerable resources. Below are a few illustrative examples of how you can use data from current national monitoring programs to assess climate change-related questions at multiple scales, including the Unit level. **Many more examples are included in the Unified Multi-Scale Monitoring Approach: Summary Report for Agency Leadership (Monitoring Team for Climate Change, 2009).**

## Example 1: Burn Severity

The Monitoring Trends in Burn Severity (MTBS) project (<http://www.mtbs.gov/>) has mapped severity, size, and other attributes of wildland fires nationwide from 1984 to the present using Landsat data (Eidenshink et al., 2007). The MTBS project was initiated to provide better information for monitoring the effectiveness and effects of the National Fire Plan (National Fire Plan 2004) and the Healthy Forests Restoration Act. MTBS data were specifically designed to assess the environmental impacts of large wildland fires and identify the trends of burn severity on all lands across the U.S. These data have been validated using pre-fire and post-fire measurements from FIA and related field plots to estimate and quantify fire effects on vegetation, biomass, and carbon stocks. MTBS is jointly implemented by the Forest Service's Remote Sensing Applications Center (RSAC) and the USGS Earth Resources Observation and Science Center.

As an ongoing activity (systematic monitoring) these data can be summarized by Unit or Region for monitoring trends in fire disturbance by year. They can also be summarized by watersheds to provide disturbance information for watershed assessment activities (Note: RSAC has completed some of these national summaries and could provide these data to Forests and Regions as needed).

Let's say your vulnerability assessment identified that there may be an increase in burn severity and associated impacts on invasive species and/or post-fire regeneration. These data can be used to develop a targeted monitoring plan to sample some burned areas to characterize and develop estimates of the attributes of interest across all burned areas. In our example, some fires in one region could be sampled (sample design will likely be based on time since disturbance, burn severity, biophysical setting, etc.). The attributes of interest include the regeneration status of these burned areas and the presence and abundance of invasive species in the floristic community. These attributes can then be monitored through time for trend information as needed. If the analysis of the sampling data suggests a need for management action such as a reforestation activity or invasive species treatment, site specific effectiveness monitoring would be conducted by the Unit implementing the activity.

## Example 2: Forest Inventory and Analysis

The Forest Inventory and Analysis (FIA) program (<http://fia.fs.fed.us/>) provides the information needed to assess America's forests. FIA is the nation's continuous forest inventory on all land ownerships. These data are well suited for characterizing land cover change agents and estimating the associated area. FIA reports on status and trends in forest area and location; in the species, size, and health of trees; in total tree growth, mortality, and removals by harvest; in wood production and utilization rates by various products; and in forest land ownership. The FIA program includes data on soil, under story vegetation, tree crown conditions, coarse woody debris, and lichen community composition on a subsample of field plots. FIA is managed by the Research and Development organization within the USDA Forest Service in cooperation with State and Private Forestry and the National Forest System.

These data will be critical to vulnerability assessments given their design-based sample and long program history. A number of objectives related to climate change have been identified resulting in increased sampling intensity on Experimental Forests and Ranges. Some NFS Regions have also intensified the FIA sample to enhance their ability to detect change, and improve the precision of their estimates. Based on the results of the vulnerability assessments, some species ecosystems, or communities may be identified for targeted monitoring. The FIA program is uniquely positioned to implement such a strategy across ownership boundaries and provide both context and statistical inference to all forested lands. Site specific management activities for adaptation and genetic conservation would remain the implementation monitoring responsibility of the Unit implementing the activity.

## References

- Eidenshink, J., B. Schwind, K. Brewer, Z-L. Zhu, B. Quayle, and S. Howard. 2007. A project for monitoring trends in burn severity. *Fire Ecology* 3: 3–21.
- Monitoring Team for Climate Change, 2009. Unified Multi-Scale Monitoring Approach: Summary Report for Agency Leadership. Unpublished Report developed to support the Forest Service Strategic Framework For Responding to Climate Change. USDA Forest Service. 17p.
- U.S. Department of Agriculture (USDA), Natural Resource Conservation Service (NRCS). 1997. National range and pasture handbook. Washington, DC: U.S. Department of Agriculture, Natural Resources Conservation Service.