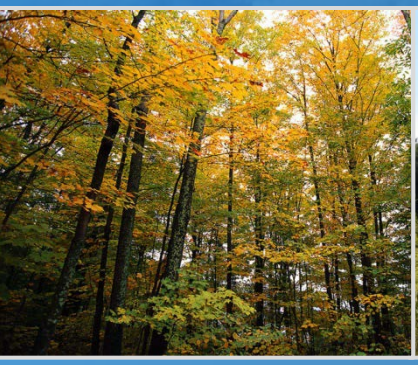
Responding to a Changing Climate and its Effects on Forests and Grasslands

Climate Change Education for Forest Service Employees

Instructional Package – April 2014

Summary of Revisions

- Additional information sources for adaptation and mitigation to support the AgLearn quiz
- Updated URLs for the Sustainable Operations information resources
- How to find the AgLearn course and quiz "Responding to a Changing Climate and its Effects on Forests and Grasslands"

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INTRODUCTION

Many of the benefits that are provided by forests and grasslands are threatened by a changing climate and its impacts on ecosystems within the units. Many of the urgent forest and grassland management challenges we currently face, such as wildfires, changing water regimes, and expanding forest insect infestations are driven in part by a changing climate. Thus, the mission of the Forest Service is profoundly affected by the changing climate:

> *To sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations.*

The Forest Service is engaged in a number of actions to respond to the challenges posed by climate change. The *National Roadmap for Responding to Climate Change* provides guidance to the Forest Service to help ensure that National Forests and Grasslands, as well as other lands, are conserved, restored, and made more resilient to climate change. The Roadmap identifies four key dimensions for action: agency capacity, engagement, adaptation, and mitigation and sustainable consumption. The progress in each of these dimensions on National Forest System (NFS) lands is assessed through the Climate Change Performance Scorecard (Scorecard). Additionally, the Chief has developed an executive position, the Climate Change Advisor, and there is a small staff assisting the Advisor to assist the agency in addressing climate change and implementing the Scorecard.

The first of the ten Scorecard Performance Elements (Element #1) focuses on employee education. The Forest Service needs employees who are knowledgeable about climate change and ecosystems and skilled in the use of climate-sensitive planning and management practices in order to respond appropriately to current and future climatic conditions and the associated effects. Dedicated climate change education and training efforts will build capacity in the Forest Service and integrate climate change into Forest Service programs and projects, with the vision that, over time, climate change considerations will be fully integrated into the agency's operations and resource management activities.

As part of Scorecard Element #1, all National Forest System units are asked to provide employee education on three core concepts: (1) climate change science; (2) effects of climate change on ecosystems and resources; and (3) Forest Service response. This instructional package is designed to fulfill the education needs outlined in Scorecard Element #1 pertaining to all-employee training. The all-employee education materials provided in this packet provides the foundation for more in-depth training, such as specific training for resource specialists, as well as a launching point for continued learning and discussion as climate change becomes integrated into the agency's programs.

Learning Objectives:

This instructional package provides a wide-ranging set of resources to help NFS units provide basic climate change education to all employees as outlined in Scorecard Element #1, with the intent that all employees will:

- Have a basic understanding of climate and climate change.
- Understand the potential effects of climate change on forest and grassland resources.
- Know what the Forest Service is doing to respond to climate change.
- Be aware of actions they can take while on the job to reduce the agency's environmental footprint.

ABOUT THE INSTRUCTIONAL PACKAGE

This instructional package provides the necessary information for developing a basic, all-employee training that can be conducted on National Forests and Grasslands or at any Forest Service office. The Climate Change Advisor's Office prepared this training package to enable units to 'get to yes' on Scorecard Performance Element #1.

This instructional package was developed with three guiding principles:

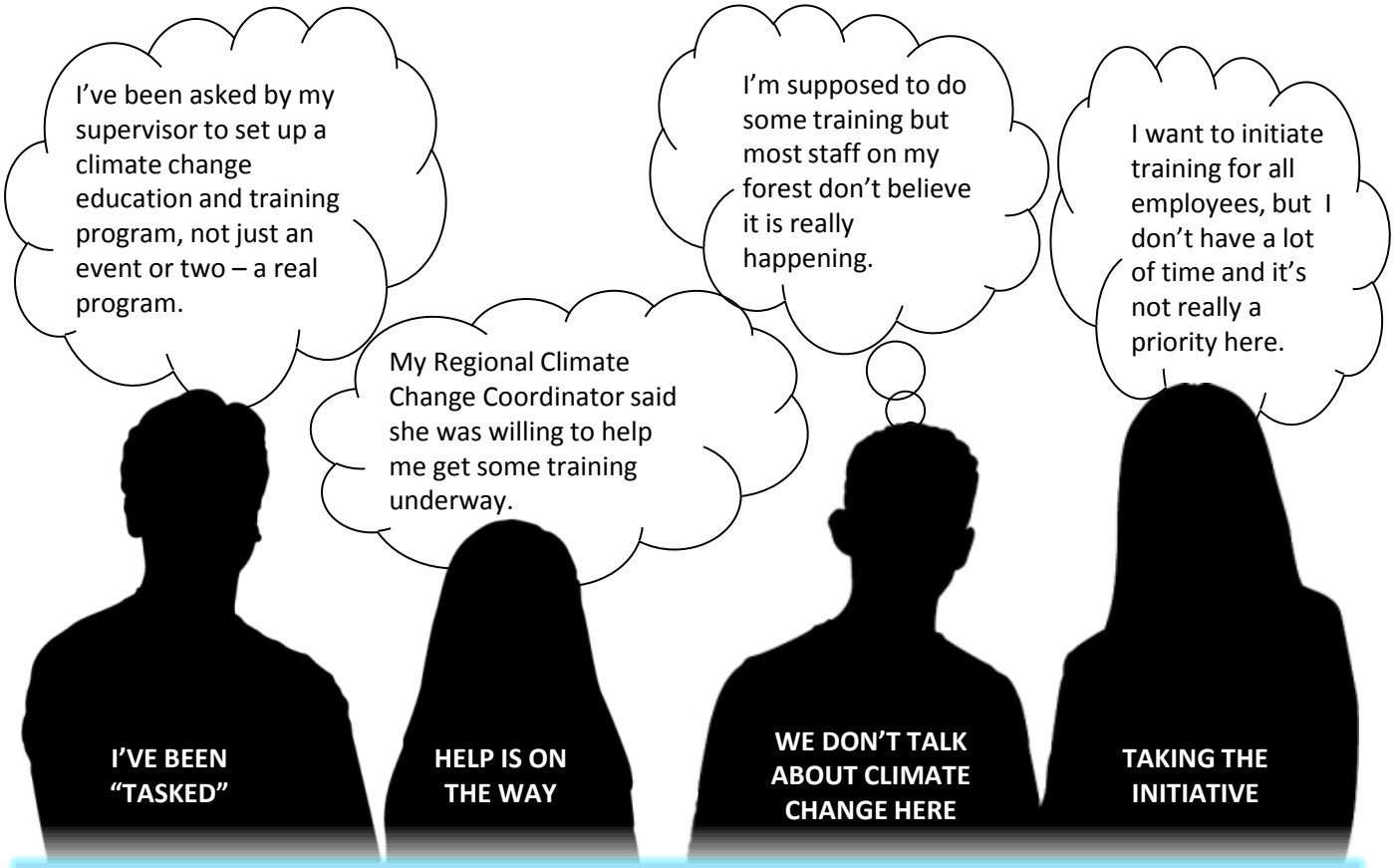
- We've used the best existing information, including readings and videos, from credible sources and provided links to the most relevant resources.
- We've created new materials and educational processes as needed.
- We've developed this with the Unit Climate Change Coordinator in mind; the Coordinator's role is to coordinate and is not expected to be a subject matter expert.

This package is intended to enable all units to quickly implement climate change core concept training by using one or more methods that are appropriate for the unit. The "Key Concepts" for this training are highlighted in the next section, with additional, amplifying information provided elsewhere in this package. We have also suggested a variety of formats and templates for providing this training along with links to materials, videos, and resources to help each unit successfully provide education and training for their employees on each of the key concepts. This package is designed to minimize the impact of this training on all unit and individual work plans while meeting the desired goal of a climate change-educated workforce.

Additional materials will be continue to be developed by the Climate Change Advisor's Office and disseminated to Regional and Unit Climate Change Coordinators via portals at the Climate Change Advisor's Office intranet site, for incorporation into on-going unit and regional climate change education and training programs.

YOU WANT ME TO COORDINATE A TRAINING SESSION?

Do any of these scenarios sound familiar or fit your situation? If so, don't despair. This instructional package will help you get started. **Just start with the steps below.**



1) Call your Regional Climate Change Coordinator.

They are there to be a resource for you. Ask if they have recommended resources or examples for you to use, if there are any upcoming regional training opportunities, and specific suggestions to ensure success.

2) Assemble resources.

In addition to your Regional Climate Change Coordinator, this package is full of resources for climate change education that you can use to educate yourself and others. We've located the best resources out there and developed easy-to-use training templates.

3) Approach it as a learning opportunity for everyone.

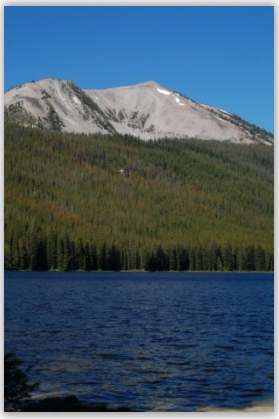
There is a wide range of scientific knowledge and individual perspectives regarding climate change, so it can be a challenging topic. There are many ways to approach it, but creating an atmosphere for open discussion and conversation about the science will go a long way toward responding to a changing climate.

4) Be a champion!

Being a Climate Change Coordinator doesn't mean that you have to be an expert on all climate change topics. That's what experts are for! Your role is to help coordinate activities and help integrate climate change into the everyday work of your Forest or Grassland. So take a deep breath and dive in! You won't sink! You won't even flounder!

AN APPROACH TO ALL-EMPLOYEE EDUCATION

Using the Best Available Science



About 30% of National Forests and Grasslands have conducted climate change education activities that fulfill the education expectations of the Climate Change Performance Scorecard.

Climate change has been widely studied and reported, and there is consensus within the scientific community that the global climate is changing and that these changes are affecting the planet in a myriad of ways. Climate change is a complex issue, sometimes bringing forward emotional reactions and personal beliefs and opinions. The Forest Service utilizes sound scientific findings to plan for and manage resources making it critical that all employees understand the science of climate change, its effects on ecosystems and resources, and how the Forest Service is responding to changing conditions.

Discussion of the potential effects of a changing climate and appropriate actions to respond to those effects is necessary to achieve the mission of the Forest Service. ***The goal of this training is to provide all employees with the basic scientific concepts that are guiding Forest Service actions so that they can be successful in their work and the agency can fulfill its mission and responsibilities; it is not about changing an individual's values and beliefs.***

This instructional package is intended to convey the science so that as employees engage in discussions with coworkers and with the public, they can also convey what the science is telling us and what is being observed on the ground.

Talking Clearly about Climate Change

Climate change is a topic that brings together scientific information from a variety of disciplines, including physics, chemistry, and ecosystem sciences. As a result, there are several words and terms that will be new to many employees, but important because they are used in agency practices or documents. These same words and terms are often misused in non-scientific literature and public discussions. Thus, a glossary of commonly used words and terms is provided at the end of this instructional package in order to bring more consistency, clarity, and understanding for the purposes of education and continued discussion of climate change within the Forest Service.

More about Climate Change Communication

Here are a few resources that provide help in talking about climate change:

- Center for Climate Change Communication at George Mason University
- Climate Communication: Science and Outreach
- "Communicating the Science of Climate Change" by Richard Somerville and Susan Joy Hassol. *Physics Today*
- "The Psychology of Climate Change Communication" by the Center for Research on Environmental Decisions at Columbia University
- Yale Project on Climate Change Communication

KEY CONCEPTS FOR ALL EMPLOYEES

The Climate Change Scorecard identifies three main topics for all employees to understand: basic climate change science, climate change effects on forests and grasslands, and the Forest Service's response. These concepts, listed below, are the key educational components of the basic training modules that follow. Additional detail on the information that corresponds to each concept is provided in this section, along with recommended resources that contain more information. Concepts identified as "core" are fundamental to basic climate change for all employees and should be included in all training events; "supplemental" concepts area also valuable, but may not be included in all situations.

Key Concepts at a Glance
1. Basic climate change science
1.1. Causes of climate change, greenhouse gases, basic carbon cycle
1.2. Climate variability, weather vs. climate
1.3. Uncertainty and risk from a changing climate, scientific vs. public uncertainty
1.4. Climate models and their use and interpretation
1.5. Observed changes in climate (temperature, precipitation, extreme weather, etc.)
1.6. Projected changes in climate (temperature, precipitation, extreme weather, etc.)
2. Climate change effects on forests and grasslands
2.1. Examples of observed effects on natural resources (water, vegetation, wildlife, etc.)
2.2. Examples of projected effects on natural resources (water, vegetation, wildlife, etc.)
2.3. Observed effects in a specific geographic area or resource area
2.4. Projected effects in a specific geographic area or resource area
3. Forest Service response
3a. Forest Service approach to climate change
3a.1. Importance of climate change
3a.2. Climate Change Roadmap and Scorecard
3b. Response options
3b.1. Adaptation vs. mitigation: basic concepts, examples
3c. Actions by for Forests, Grasslands, and individuals
3c.1. Examples of activities being performed by Forests and Grasslands
3c.2. What your Forest/Grassland is doing and can do to help respond
3c.3. The role of Sustainable Operations
3c.4. What you can do as an individual

KEY CONCEPTS — DETAILED OUTLINE

1. Basic climate change science

1.1. Causes of climate change, greenhouse gases, basic carbon cycle (Core)

- The global climate is changing, and the Intergovernmental Panel on Climate Change, a coalition of hundreds of scientists, has stated that this change in unequivocal.[1] The average global temperature has increased 1.4°F over the past 50 years[1], and temperatures in the U.S. have risen 2°F during that time period.[2]
- Climate change is caused by increased greenhouse gases in the atmosphere, which come primarily from fossil fuel use and deforestation/land use change.[1]
- Increases in greenhouse gases, including carbon dioxide and methane, amplify the natural greenhouse effect. These additional greenhouse gases increased the amount of energy and heat in the atmosphere and disrupts the global climate system.[1]
  - CCRC Climate Change Primer
  - CCRC Climate FAQ
  - IPCC FAQs
  - Climate Change: Lines of Evidence booklet
  - Climate Change: Lines of Evidence videos

1.2. Climate variability, weather versus climate (Core)

- Climate and weather are different things, although they are definitely related. Climate is a long-term trend, generally occurring over 30 years or more. Weather is a short term trend, such as daily or monthly changes. Remember: Climate is what you expect; weather is what you get.
  - CCRC Climate FAQ
  - IPCC FAQs
  - Climate vs. Weather video

1.3. Uncertainty and risk from a changing climate (Core)

- There is scientific agreement that the global climate is changing and causing a wide-ranging set of effects. Additional effects are expected in the future as the global temperature increases further and other climatic changes take place.[1]
- Climate change adds uncertainty to the future, because conditions in the future will not be the same as in the past. For these reasons, it's often important to consider a *range* of potential future conditions.[3]
  - CCRC Climate FAQ
  - IPCC FAQs

1.4. Climate models and their use and interpretation (Supplemental)

- General circulation models (GCMs), which are often also called Global Climate Models, are used to simulate the global climate systems. Outputs from these models are often "downscaled" to use at finer spatial scales, such as regions and states.

- Emissions scenarios provide a range of possible future greenhouse gas emissions based on assumptions about future demographics, economics, and technology.[1] They are used as inputs to GCMs.
  - USFS Climate Projections FAQ
  - USGCRP Global Climate Change Impacts in the US Report
  - IPCC What is a GCM?
  - WMO Emissions Scenarios

1.5. Observed changes in climate (Supplemental)

- A number of effects from climate change have been observed globally and nationally, including warmer temperatures, changing precipitation patterns, sea level rise, retreating glaciers, and increases in extreme events.[1,2]
- The US average temperature has increased 2°F over the last 50 years.[2] Precipitation patterns have changed, with different trends across the country. The amount of rain falling in a single downpour has increased[2], which is partly due to the ability of warmer air to hold more moisture.
- Observed impacts vary by region.
  - USGCRP Global Climate Change Impacts in the US Report (incl. regional summaries)
  - EPA Climate Change Impacts and Adaptation
  - CCRC Climatology Videos
  - Climate Change Advisor's Office Extreme Weather Briefings

  ✓ Contact your Regional Climate Change Coordinator for their recommendations.

1.6. Projected changes in climate (Supplemental)

- The average global temperature is projected to rise another 2 to 11.5°F by 2100, depending upon future greenhouse gas emissions and the sensitivity of the climate system to those increases.[1,2]
- Many of the impacts that have been observed are expected to continue, and often intensify, in the future, including warmer temperatures, changing precipitation patterns, sea level rise, retreating glaciers, and increases in extreme events.[2]
- Projected future impacts vary by region.
  - USGCRP Global Climate Change Impacts in the US Report (includes regional summaries):
  - EPA Climate Change Impacts and Adaptation
  - CCRC Climatology Videos

  ✓ Contact your Regional Climate Change Coordinator for their recommendations.

2. Climate change effects on forests and grasslands

2.1. Examples of observed effects on natural resources (Core)

- Changes in climate affect people and ecosystems in a variety of ways.
- As one example, changes in the timing of biological events, also called phenology, have been observed worldwide. With warmer temperatures, plants are growing in a longer growing season, flowers are blooming earlier, and migrations are coming sooner.
- Some examples of effects that have been observed across the country include: tree mortality due to drought; increases in the size and severity of wildfire; increases in insect

infestation, disease, and invasive species; altered water cycles; and declines in some animal populations.[4] While these impacts are due to a combination of many factors and not solely caused by climate change, a changed climate adds stress to ecosystems and contributes to the severity of impacts.

✓ Check out the box below or contact your Regional Climate Change Coordinator for their recommendations.

2.2. Examples of potential effects on natural resources (Core)

- Many of the effects that have been observed are expected to continue, and often intensify, such as: tree mortality due to drought; increases in the size and severity of wildfire; increases in insect infestation, disease, and invasive species; altered water cycles; and declines in some animal populations.[4]

2.3. Observed effects in a specific geographic area or resource area (Supplemental)

- Observed effects vary by region and resource area.

2.4. Potential effects in a specific geographic area or resource area (Supplemental)

- Projected effects vary by region and resource area.

✓ Check out the Resources on Climate Change Effects on Forests and Grasslands below or contact your Regional Climate Change Coordinator for their recommendations.

Recommended Resources on Climate Change Effects on Forests and Grasslands

General Effects

- CCRC Climate FAQ
- EPA Climate Change Impacts and Adaptation - Ecosystems

Effects by Region

- Global Climate Change Impacts in the US Report (includes regional summaries)

Effects by Resource Area

- CCRC Topic Pages

Regional Videos and Recordings on Climate Change Effects

- Northwest: Climate and Stress Interactions in Western Forest Ecosystems (video)
- Midwest/Northeast: Interactions Between Carbon, Climate, and Forests (video)
- Great Plains: Climate Change in the Great Plains (slideshow with audio)
- Alaska: Faces of Climate Change (videos)

3. Forest Service response

3a. Forest Service approach to climate change

3a.1. Importance of climate change (Core)

- Climate change creates a wide variety of challenges for communities and ecosystems, so it is important to respond.
- The mission of the Forest Service is profoundly affected by the changing climate: "To sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations."
- Many of the benefits that are provided by forests and grasslands are threatened by a changing climate and its impacts on ecosystems within the units. Most of the urgent forest and grassland management challenges of the past 20 years, such as wildfires, changing water regimes, and expanding forest insect infestations are driven in part by a changing climate.[4]

3a.2. Climate Change Roadmap and Scorecard (Core)

- The Forest Service's response to climate change is guided by several strategic documents, including the USDA Strategic Plan Goal 2 to "ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources"
- The Forest Service has developed a *National Roadmap for Responding to Climate Change* to help all National Forests adjust to and prepare for new conditions created by changing climates (adaptation) and reduce the amount of greenhouse gases present in the atmosphere (mitigation).
- The Climate Change Performance Scorecard helps to plan and measure progress in four dimensions (organizational capacity, engagement, adaptation, and mitigation) using a series of 10 questions.
- The Chief of the Forest Service also has a Climate Change Advisor, Dr. David Cleaves. The Climate Change Advisor's Office coordinates the implementation of the Scorecard, provides assistance to units regarding relevant climate change information, and provides information to the Chief and to the USDA.
- Regions, Forests, and Grasslands all have designated climate change coordinators that serve as the primary points of contact and help to implement the Scorecard at the regional and unit levels.

  - Climate Change Advisor's Website
  - Climate Change Advisor's Office Intranet
  - *National Roadmap for Responding to Climate Change*
  - Forest Service Response Documents

  ✓ Check out the fact sheet, page 35 of this document.

3b. Response Options

3b.1. Adaptation vs. mitigation: basic concepts, examples (Core)

- Adaptation and mitigation are two different ways of responding to climate change.
- Adaptation, in the context of climate change, includes efforts that reduce the vulnerability of natural or human systems to expected climate change effects.[5]
- Adaptation strategies include the following: (1) building resistance to climate-related stressors such as drought, wildfire, insects, and disease; (2) increasing ecosystem resilience by minimizing the severity of climate change impacts, reducing the vulnerability and/or increasing the adaptive capacity of ecosystem elements, and (3) facilitating large-scale ecological transitions in response to changing environmental conditions.[5]
- Mitigation, in the context of climate change, is the intervention to reduce the amount of greenhouse gases present in the atmosphere. Mitigation is predicated on adaptation: the long-term capacity of ecosystems to capture and store carbon depends in large part on their ability to adapt to a rapidly changing climate.[5]
- Mitigation strategies include the following: (1) promoting the uptake of atmospheric carbon by forests and the storage of carbon in soils, vegetation, long-lived wood products, and recycled wood materials; (2) indirectly reducing greenhouse gas emissions (for example, through the use of carbon-neutral bioenergy to offset fossil fuel emissions and substituting wood for more fossil fuel-intensive building products), and (3) diminishing greenhouse gas emissions (for example, through the cooling effects of urban forests, which reduce the need for fossil fuels to run air conditioners) or through more prudent consumption in facilities, fleet, and other operations.
- While adaptation and mitigation work on different ends of the climate change issue, they are not mutually exclusive. Many actions, including activities to enhance the health of productivity of forests and grasslands, can have a positive benefit on both.[5]
  - CCRC Climate Change Management Options
  - Adapting to Climate Change (video/DVD short course)
  - Forest and Grassland Carbon in North America
  - Managing Forests in the Face of Climate Change (video)
  - CCRC Climate Basics: Frequently Asked Questions: Management Options: What are adaptation and mitigation in a management context?

3c. Actions by for Forests, Grasslands, and individuals

3c.1. Examples of activities being performed by Forests and Grasslands (Core)

- Forests and Grasslands across the country are engaged in a wide variety of activities that address the Scorecard's 10 elements. This includes educational activities, the development of vulnerability assessments that provide information on key resources under climate change, and actions to reduce the agency's environmental footprint.
  - Climate Change Advisor's Scorecard pages (examples provided for each element

3c.2. What your Forest/Grassland is doing and can do to help respond (Core)

- Every Forest and Grassland is expected to be able to answer "yes" to at least 7 of the 10 Scorecard questions, with at least one "yes" in each of the four main dimensions (organizational capacity, engagement, adaptation, and mitigation).
- The Scorecard has a lot of flexibility, allowing each unit to determine the best way for it to "get to yes".

✓ Remember to highlight examples of Scorecard-specific activities that have been completed or are in progress and to identify areas where additional help is needed.

3c.3. The role of sustainable operations (Core)

- Sustainable operations is a part of the Climate Change Scorecard that focuses on reducing the environmental footprint of Agency operations.
- Several laws, regulations, and Executive Orders have established requirements for reducing our environmental footprint. Additionally, to fulfill the Forest Service's obligation to present and future generations, the land stewardship mission must be strategically integrated with practices that reduce resource consumption.
- Sustainable operations activities take place on several aspects of the agency's operations, including energy, water, fleet and transportation, waste, and green purchasing.
  - Sustainable Operations Scorecard page
  - Sustainable Operations webpage
  - Sustainable Operations – Our Environmental Footprint and the Climate Change Connection (video)
  - Sustainable Operations Demonstration website (intranet)

✓ Check out the fact sheet page 37 of this document and the training for managers on page 38.

3c.4. What you can do as an individual (Core)

- Individual employees can help their Forest or Grassland to respond to climate change. Examples include participating in climate change-related activities on the forest, helping to reduce your environmental footprint at work, joining a green team, or talking with your coworkers about additional things that your unit could be doing.

✓ Remember to take advantage of additional help and expertise that may be available for your unit.

EDUCATION AND TRAINING TEMPLATES

The Climate Change Performance Scorecard asks that National Forest System provide employees with basic training on climate change science, effects on ecosystems, and agency response. This section provides four templates to serve as examples for conducting all-employee education and training. All the examples use the best available resources on climate change to provide an informative and engaging training.

At the same time, it is important to underscore that each Forest, Grassland, or Regional Office has its own set of interests, available resources, and ways of doing things. No single method is suitable for all settings and purposes, and the following options are intended to serve as a starting point to developing a training that fits a particular unit's needs and situation. We've provided the basic building blocks, which you can modify as needed to best meet the training objectives, training time available, and desired approach to accomplishing the training. Before initiating training or responding to direction to get some training underway, we suggest you consider these templates to see if one best fits your situation.

- Individual self-paced online learning
- Online resources plus group discussion
- All employee in-person training session

Getting Started

In addition to the training templates that follow, these resources may be useful as "icebreakers" to get people thinking about climate change in advance of any training activities.

Test your climate change knowledge. The quizzes available through NASA's website are a fun way to learn about climate change and test your knowledge of the facts.

Meet the Chief's Climate Change Advisor. Dr. David Cleaves is the primary advisor and spokesman on climate change for the Forest Service. He provides leadership for the implementation of the Roadmap for Responding to Climate Change. Dave's staff provides policy support, manages the Climate Change Scorecard reporting process, and provides education and training resources for Forest Service employees. In this video interview Dave describes how the Forest Service is approaching climate change. To get straight to the good stuff, skip ahead until 20 minutes into the interview.

Overview of Training Templates

The three templates are provided to assist you in getting to YES on Scorecard Element #1 and suggest additional optional materials that will assist employees in developing a better understanding of climate change and its potential effects in your location. No single method is suitable for all settings and purposes. The sequence in which they are listed is not suggestive of preferred options. Rather, they outline three potential ways to provide training on the key concepts outlined earlier in this document.

1: INDIVIDUAL SELF-PACED ONLINE LEARNING

Strengths:	Weaknesses:	Resources needed:
▪ Learners are able to visit the material on their own time and go at their own pace ▪ A mix of print and video materials provides variety and is helpful for people who prefer certain media ▪ May be most suitable when it is not possible to bring staff together in person or via video teleconference ▪ Text-only option also available	▪ Passive format and no interaction is less effective than in-person trainings ▪ No ability to ask questions or have discussion ▪ Little information is available about local or regional effects ▪ Users may complain about 'just another AgLearn course' because of this style (even though AgLearn itself is not used)	▪ Reliable internet connection that allows for viewing online videos. ▪ Clear explanation of expectations for completion to participants

2: ONLINE RESOURCES PLUS GROUP DISCUSSION

Strengths:	Weaknesses:	Resources needed:
▪ Combines the best online resources with interaction and discussion among learners ▪ Best for in-person meetings, but can be modified for use via video teleconference or phone/web meetings ▪ Can be used as an "add-on" to family, safety, or other meetings where people are already gathered	▪ Some participant questions may not be able to be answered because there is no 'expert' present	▪ Staff gathered in a central location, such as a safety or family meeting ▪ A facilitator to manage discussion and time ▪ Reliable internet connection that allows for viewing online videos (if used), or DVDs of videos ▪ Equipment to view videos (TV/DVD or projector/laptop/speakers) and a person to run the equipment ▪ Clear explanation of expectations for completion to participants

3: ALL EMPLOYEE IN-PERSON TRAINING SESSION

Strengths:	Weaknesses:	Resources needed:
▪ Local experts are brought in to provide locally-relevant information and answer questions ▪ Best method for learning ▪ Furthers science-management partnerships, which are another part of the Climate Change Scorecard ▪ Many staff will appreciate time with scientists ▪ Agenda can be modified to include additional presentations or discussion topics relevant to unit	▪ Requires most planning and coordination to bring everyone together ▪ Unit-wide meetings may require travel time in addition to the meeting	▪ Coordination of expert presenters and other logistical items, such as a location large enough for all attendees ▪ Projector/laptop set up for presenters. In a large room, microphones are also recommended. ▪ Clear explanation of expectations for completion to participants

TEMPLATE #1

Individual Self-Paced Online Learning

Online learning and reading provides an opportunity for employees to complete it at a time and place that is convenient and does not require presenters or instructors. This template provides an approach for you to coordinate a climate change training effort using online resources to support learning. It will take an employee 1-2 hours to complete. Encourage people to take additional time to look at other resources that may be of interest, such as those in the box on pages 9 and 17

A training guide has also been developed for participants to provide information and instructions to lead them through the self-paced module. View it at the Climate Change Advisor's Office intranet site.

Tips for the Coordinator/Facilitator

- Preview the materials below so that you are prepared to answer questions that may be asked by the employees.
- Encourage employees to ask questions and further research this topic so that they can become fully engaged with climate change implementation on the unit.
- Provide feedback to the Climate Change Advisor's Office on this course and suggestions for improvement.

Training Outline

Both video/interactive and text resources are available to complete the training.

1. Basic climate change science

Print/508-Compliant Option—Read the following:

Webpage: The Difference between Climate and Weather

Booklet: Climate Change– Lines of Evidence (36 pages, high-resolution, loading time may be slow)

Slideshow: What is the Greenhouse Effect?
(View the greenhouse effect and carbon cycle sections)

Video Option— View the following videos and interactive media:

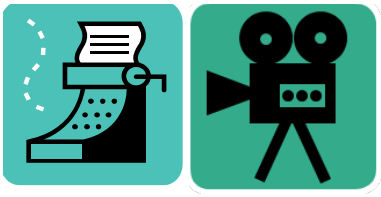
Video: Climate versus Weather (2 min.)

Slideshow: What is the Greenhouse Effect?
(View the greenhouse effect and carbon cycle sections)

Video: Climate Change–Lines of Evidence (23 min.)

2. Climate Change Effects on Forests and Grasslands

View this online module in print or video form (you will need to create a log in):

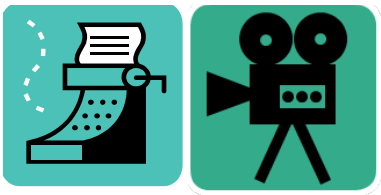


Climate Change and Regional Impacts
Click the "Begin Lesson" link. A sign in page will appear. Sign in if you have an account, or click the "Create an account" link. Fill in the registration information, and click the "Submit" button. You will be directed to the starting page for the Climate Change and Regional Impacts module. Here you can click the "Begin" link or the "Print Version" link to view the module

Additional resources are recommended on page 17!

Note: You will have to register and create an account with MetEd to view this module. Once you create an account, you'll also be able to access material on a number of additional climate change topics, including climate models, extreme events, and sea level rise.

3. Forest Service Response



Watch the following video or read the transcript:
Forest Service and Climate Change (13 min.)

Read the following information at the Climate Change Resource Center under the Management Options tab:
Climate Basics: Frequently Asked Questions: Management Options: What are adaptation and mitigation in a management context?

Read the following fact sheets:
1) Forest Service Organization and Resources for Climate Change (page 35)

2) Sustainable Operations (page 37)

These are also available at Climate Change Advisor's Office intranet site.

Visit the Sustainable Operations Demonstration Website and familiarize yourself with the content.

4. Training Certification via AgLearn

An AgLearn course and quiz has been developed for those who wish to receive credit for taking the course or record it as part of their Individual Development Plan. Go to AgLearn and search AgLearn for the course, "Responding to a Changing Climate and its Effects on Forests and Grasslands." When the course description appears, select "Add to To-Do List", and then if you are ready to begin, launch the content.

Looking for more information? We have recommendations!

You may want to modify the training above to provide more material on any or all of the topics. We've included a few of our favorite videos and other materials below to highlight easy additions to the basic training. More resources are incorporated into the detailed outline that begins on page 7 and through the Climate Change Resource Center.

Basic climate change science

- Frequently Asked Questions – US Forest Service Climate Change Resource Center
- Climate Change Primer – US Forest Service Climate Change Resource Center
- Frequently Asked Questions – Intergovernmental Panel on Climate Change

Climate Change Effects on Forests and Grasslands

General Effects

- CCRC Climate FAQ
- EPA Climate Change Impacts and Adaptation - Ecosystems

Effects by Region

- USGCRP Global Climate Change Impacts in the US Report (includes regional summaries, loading time may be slow)

Effects by Resource Area

- CCRC Topic Pages

Regional Videos and Recordings on Climate Change Effects

- Northwest: Climate and Stress Interactions in Western Forest Ecosystems (video)
- Midwest/Northeast: Interactions Between Carbon, Climate, and Forests (video)
- Great Plains: Climate Change in the Great Plains (slideshow with audio)
- Alaska: Faces of Climate Change (videos)

Forest Service Response

- Office of the Climate Change Advisor (CCAO Internet or CCAO Intranet)
- National Roadmap for Responding to Climate Change and Climate Change Performance Scorecard
- Forest Service Organization and Resources for Climate Change – Available on page 35
- Sustainable Operations (SusOps Internet or SusOps Intranet) or the fact sheet on page 37

TEMPLATE #2

Online Resources Plus Group Discussion

This template combines online educational resources on climate change with an in-person discussion. It utilizes the same resources as Option 1, but is designed to take place at a group meeting. It may be used in conjunction with a safety, staff or family meeting, or as a separate event. Allow at least one hour to view the videos and presentations followed by at least 30 minutes for adequate time for questions and discussions.

Tips for the Coordinator/Facilitator

- Propose to your supervisor that this training be conducted at an already-scheduled meeting where it would be appropriate, or propose an alternative time and setting.
- Make arrangements for all needed equipment, such as computers and projectors.
- Preview the videos and review the information below so that you are prepared to answer questions that may be asked by the participants.
- Prepare some discussion questions to ask the trainees upon completion of the videos. Some suggested questions are provided below.
- If you anticipate having difficult or negative employees who may dominate or sidetrack the discussion you may want to use a facilitator or try the following:
  - Check out the resources on climate change communication on page 5.
  - Discuss approaches to handling conflict during the training with your supervisor.
  - Anticipate likely questions, and prepare responses, materials, or discussion points.
  - Ensure the line officer is briefed and ready to assist on questions, especially on Forest Service policy.
- Use a sign-in sheet so that you can keep track of who participated for Scorecard reporting.
- Please complete the end-of-training survey.

Training Outline

1. Introduction (approx. 10 minutes)

Arrange for someone to give a short introduction to this session. It can be any of a number of people, such as a member of the unit's leadership, the climate change coordinator, or the training facilitator, but the best person is someone that will be able to speak to why the Forest Service is concerned about climate change and why all employees will benefit from having a greater awareness and ability to talk about climate change. This person should help to provide important context by explaining that the training session is designed to be a starting point for further discussion and learning related to the effects of a changing climate on humans and resources, and the ways the agency is responding. It is very likely that questions will arise that cannot be answered during this training, and that is okay because it is a new issue and everyone is learning how to proceed with uncertain and changing conditions.

If people have questions that you cannot answer, you can point them to the resources on pages 9 and 17 and elsewhere in this document, as well as and the Climate Change Resource Center.

2. Videos on climate change science, effects on forests and grasslands, and Forest Service Response (20-60 minutes)

Climate Change Science

1. Video: Climate versus Weather (2 min.)
2. Slideshow: What is the Greenhouse Effect?
   (View the greenhouse effect and carbon cycle sections)
3. Video: Climate Change–Lines of Evidence (23 min.)

Climate Change Effects on Forests and Grasslands

Module/Video: Climate Change and Regional Impacts
Click the "Begin Lesson" link. A sign in page will appear. Sign in if you have an account, or click the "Create an account" link. Fill in the registration information, and click the "Submit" button. You will be directed to the starting page for the Climate Change and Regional Impacts module. Here you can click the "Begin" link or the "Print Version" link to view the module

> Note: You will have to register and create an account with MetEd to view this module. Once you create an account, you'll also be able to access material on a number of additional climate change topics, including climate models, extreme events, and sea level rise.

There are lots of great videos on regional impacts, and we recommend that you also view one of these videos. Check out the resources on page 17, the modules available through MetEd, or contact your Regional Climate Change Coordinator for their recommendations!

Forest Service Response

1. Video: Forest Service and Climate Change (13 min.)
2. Fact Sheet: Forest Service Organization and Resources for Climate Change (available on page 35)
3. Presentation – Sustainable Operations: Ask your Sustainable Operations coordinator or Green Team contact to provide an informal 15-minute presentation on what is taking place on your unit and how people can get involved if they are interested.

3. Discussion (30 or more minutes)

Take some time to discuss what you've learned and how it might apply to your unit. Some suggested questions are below, but feel free to develop others.

- Have you seen local changes that could be climate change related?
- What potential impacts are you most concerned about?
- What are some actions we might consider to respond to those impacts?

You may also want to host a fun quiz on what you learned. Use the NASA quizzes online; use the quiz as a group or set up teams and have people try to earn treats or small prizes.

Provide some closure to the meeting by arranging for the person who gave the session's introduction or someone else to provide some final thoughts and adjourn the session.

4. Training Certification via AgLearn

An AgLearn course and quiz has been developed for those who wish to receive credit for taking the course or record it as part of their Individual Development Plan. Go to AgLearn and search AgLearn for the course, "Responding to a Changing Climate and its Effects on Forests and Grasslands." When the course description appears, select "Add to To-Do List", and then if you are ready to begin, launch the content.

TEMPLATE #3

Climate Change All-Employee Meeting

Some Forests and Grasslands have hosted all-employee meetings to provide climate change training to everyone at one time. This can be particularly effective because it provides opportunities to bring in outside speakers who are experts on the topics and encourage discussion among employees. This generic template can be used to organize a four-hour (or more, if desired) training session to cover the three primary topics (climate science, impacts of climate change on forests, and Forest Service response), but it should be customized to meet specific needs and interests.

Tips for the Coordinator/Facilitator

- This training is part of a much bigger discussion. People have a variety of views and opinions related to climate change. It may seem obvious, but it is important to point out to the training participants that climate change is not something that will be "figured out" through a single meeting and to acknowledge that there will be remaining questions. Approaching the subject as something to learn about and the beginning of a discussion that will continue over time shows consideration for diverse of views and opinions and allows for a more productive discussion.
- The presenters make the difference between a great training experience and a "dud". Because climate change is a complex topic, it is critical to bring in knowledgeable speakers who are also good presenters and effective communicators, whether they be practitioners, educators, or scientists.
- When arranging and confirming presenters, provide each presenter with the list of key content (see pages 7-12) that needs to be covered and topics that you would like them to present.
- Familiarize the presenters with the audience's depth of understanding about forest and climate change. Otherwise, they may confuse or intimidate the audience with too much detail on specific scientific elements. Useful background about the audience includes:
  - Whether the audience has participated in previous climate change training.
  - Any knowledge you have as to "where the audience is" regarding climate change, based on interactions with individuals and groups of employees.
  - Composition of the audience in terms of line officers, team leaders, "front-liners", etc.
  - Clue the speakers in on what audience behaviors are signs of engagement or disengagement so that they can adjust their presentation "on the fly." Good presenters should be able to do this.
- If possible, try to arrange a time for all presenters to have a conversation in advance of the training in order to allow the presenters to know what each is presenting.
- Participants are likely to have a lot of questions, so provide adequate question and answer opportunities after each presentation, as well as time for additional questions and discussion at the end. Do not consider this to be "off task" time; it could make or break the training opportunity.
- The information presented may be very complex. Allowing extra time for breaks can help to prevent "brain burnout."
- Use a sign-in sheet so that you can keep track of who participated for Scorecard reporting.
- Please complete the end-of-training survey.

Training Outline

1. Introduction (10-15 minutes)

Arrange for someone to give a short introduction to this session. It can be any of a number of people, such as a member of the unit's leadership, the climate change coordinator, or the training facilitator, but the best person is someone that will be able to speak to why the Forest Service is concerned about climate change and why all employees will benefit from having a greater awareness and ability to talk about climate change. This person should help to provide important context by explaining that the training session is designed to be a starting point for further discussion and learning related to the effects of a changing climate on humans and resources, and the ways the agency is responding. It is very likely that questions will arise that cannot be answered during this training, and that is okay because it is a new issue and everyone is learning how to proceed with uncertain and changing conditions.

If people have questions that you cannot answer, you can point them to the resources on page 17 and elsewhere in this document, as well as and the Climate Change Resource Center.

2. Presentations (2.5 hours or more)

Invite local, regional, or even national experts to give presentations on key concepts. The three presentations below are designed to cover the core material, but additional topics can be covered. More detail on what information should be covered during the presentations is presented in the Key Content – Detailed Outline on pages 7-12.

Your Regional Climate Change Coordinator can help provide contacts of internal and external experts for your presentation, and the regional Sustainable Operations Collective contact or local green team members can help provide contacts for Sustainable Operations speakers.

Climate and Climate Change Science
30-45 minutes for presentation
10 minutes for questions

Climate Change Effects on Forests and Grasslands
30-45 minutes for presentation
10 minutes for questions

Make sure to break for at least 15 minutes!

Forest Service Responses
20-45 minutes for presentation
10 minutes for questions

Note: It may be desirable to split this into two separate presentations – one on land management responses (including adaptation and mitigation) and another on sustainable operations activities and action planning that is taking place at your unit.

Make sure to break for at least 15 minutes!

3. Discussion (1.25 hours or more)

Having experts and employees in the same place is a great opportunity to engage in discussion. We've provided the outline for a discussion session below, but feel free to draw upon the discussion used in Template 2 (Online Resources plus Group Discussion) or develop something else to meet your unit's needs and interests.

1. **Large Group Discussion (10 minutes or more)**
   Following all presentations, allow an opportunity for additional questions from the participants.
2. **Breakout Groups (30 minutes or more)**
   Break into groups (randomly, by district, or some way other than by resource area) and discuss the following questions. Presenters can join a group or float amongst groups. You may want to include time from groups to report out to the entire group.
   - Have you seen local changes that could be climate change related?
   - What potential impacts are you most concerned about?
   - What are some actions we might consider to respond to those impacts?
3. **Breakout Groups (30 minutes or more)**
   Break into groups by resource area and discuss the following questions. Presenters can join a group or float amongst groups. You may want to include time from groups to report out to the entire group.
   - Have you seen local changes that could be climate change related?
   - What potential impacts are you most concerned about?
   - What are some actions we might consider to respond to those impacts?
4. **Report Out and Adjourn (10 minutes or more)**
   You may want to include time from groups to report out to the entire group. Provide some closure to the meeting by reminding people of how to complete the AgLearn component of the training and arrange for the person who gave the session's introduction or someone else to provide some final thoughts and adjourn the session.

4. Training Certification via AgLearn

An AgLearn course and quiz has been developed for those who wish to receive credit for taking the course or record it as part of their Individual Development Plan. Go to AgLearn and search AgLearn for the course, "Responding to a Changing Climate and its Effects on Forests and Grasslands." When the course description appears, select "Add to To-Do List", and then if you are ready to begin, launch the content.

EVALUATING THE TRAINING PROGRAM

What is evaluation?

There are many definitions of *evaluation* that emphasize different aspects of the practice of evaluation. The following definition is based on the premise that evaluation is conducted for one or more stakeholders that have clearly identified needs and uses for information:

> *Evaluation is the systematic collection of information about the activities, characteristics, and outcomes of programs which is used to make judgments, improve program effectiveness, and/or inform future decisions.*[6]

The key words in that definition are:

- ***Systematic*** – An organized and thoughtful approach to collecting information that is valid and useful.
- ***Used*** – The information will be used by someone to make program improvements and/or document program impacts.

Why evaluate?

There is one basic reason to do an evaluation: Various stakeholders (people who have a "stake" in the program) may have different needs and plans for using evaluation data. In the case of the Forest Service Climate Change Education and Training Program, stakeholders may include yourself, your Forest Supervisor, your District Ranger, the training participants, and Climate Change Advisor's Office, the Chief, or others. If no one wants information or does not want to use evaluation information, there is no reason to conduct an evaluation. This, however, is rarely the case. Someone usually wants to know something.

Types of Evaluations

The type of evaluation that you conduct depends on what you and others want to know about the results of the program.

There are two kinds of evaluation:

- ***Summative*** – This evaluation approach is used to "sum up" evaluation data and then report it to someone who is interested in knowing something about the program. If you or others want information about the participants' attitudes, beliefs, and knowledge toward the topic – either before, or after, or how it changed, you can collect this information using various approaches. Or you or someone might be interested in program outputs (number of trainees, number of training events)
- ***Formative*** – This evaluation approach is used to make changes in programs. For example, if you wanted to know how well your presenters were received and if they "connected with the audience" in order to know who to invite/not invite next time, your evaluation would gather information from the participants about their experience with the presenters. That information could be collected using a questionnaire, or by observing the audience-presenter interaction. You could use this information to make decisions to improve the program.

Evaluating the All-Employee Training

The great aim of education is not knowledge but action.

Herbert Spencer, English philosopher

Both summative and formative evaluation are encouraged as part of the for the all-employee training.

Summative Evaluation based on Participation

Definition

"Participation" is defined as: an employee has registered in AgLearn and successfully completed the post-training quiz.

Use

The number of participants who have successfully completed the post-training quizzes will provide information about how extensively the training has been conducted and if/how the training needs to be re-emphasized.

Procedure

All employees, regardless of the training template in which they participated (self-based, family meeting "add-on", all-employee training, or other) will need to register in AgLearn and a final quiz. An employee can register in AgLearn and take the quizzes before the training, and if passing scores are achieved, the employee is considered to have participated in the training.

Formative Evaluation from Post-Training Reports

Definition

A post-training report will provide information about the format of the training that was used, quality of presenters and presentations, venue, and Climate Change Coordinator's observations about effectiveness.

Use

This information will be used by the Climate Change Advisor's Office to better understand the nature of the training that is being accomplished and determine what additional support that can be provided to Climate Change Coordinators.

Procedure

Soon after completing the training event, please complete the end-of-training survey. The survey is a combination of multiple choice/short, fill-in-the-blank questions as well as open-ended questions which ask for information about the training session, what worked, what didn't work so well, and what additional support could be provided by the Climate Change Advisor's Office.

FEEDBACK, SHARING, AND FUTURE TRAINING

Across the agency, Forest Service employees have numerous position titles and responsibilities. Thus, there are unique education and training needs for different groups of employees. The Climate Change Advisor's Office will continue to coordinate, facilitate, develop and conduct training events as needed. Additional education and training materials and opportunities will be developed for a variety of groups within the Forest Service, such as line officers, program managers, interdisciplinary team members, and Climate Change Coordinators. The intent is that activities related to climate change education and on other elements of the Performance Scorecard will, over time, allow for climate change considerations to be fully integrated into agency operations.

Feedback on information gaps, website needs, or material development will be helpful to the Climate Change Advisor's Office. Please send all requests and suggestions on any aspect of climate change education and training to Eric Norland (enorland@nifa.usda.gov) or Kailey Marcinkowski (kfmarcinkowski@fs.fed.us) for consideration and response.

APPENDIX 1: GLOSSARY

Commonly-Used Words and Terms Related to Climate Change

Discussions of climate change often necessitate the use of specific terminology to communicate complex ideas. Many different words are included in this section, using direct definitions from published sources. It is important to note, however, that there may be additional definitions or interpretations for these words that are not included in this compilation.

Adaptation In the context of climate change, adaptation includes efforts that reduce the vulnerability of natural or human systems to expected climate change effects. Adaptation strategies include the following: (1) building resistance to climate-related stressors such as drought, wildfire, insects, and disease; (2) increasing ecosystem resilience by minimizing the severity of climate change impacts, reducing the vulnerability and/or increasing the adaptive capacity of ecosystem elements; and (3) facilitating large-scale ecological transitions in response to changing environmental conditions[5]

Adaptive capacity The ability of a species or ecosystem to accommodate or cope with climate change impacts with minimal disruption.[7,8]

Adaptive management A dynamic approach to forest management in which the effects of treatments and decisions are continually monitored and used, along with research results, to modify management on a continuing basis to ensure that objectives are being met.[7]

Afforestation The process of establishing trees on land that has lacked forest cover for a very long time or has never been forested.[9,10]

Albedo The fraction of ***solar radiation*** reflected by a surface or object, often expressed as a percentage. Snow-covered surfaces have a high albedo, the surface albedo of soils ranges from high to low, and vegetation-covered surfaces and oceans have a low albedo. The Earth's planetary albedo varies mainly through varying cloudiness, snow, ice, leaf area and land cover changes.[9]

Anthropogenic Resulting from or produced by human beings.[9]

Assisted migration Intentional movement of propagules or juvenile and adult individuals into areas assumed to be their future habitats[11]

Atmosphere The gaseous envelope surrounding the Earth. The dry atmosphere consists almost entirely of nitrogen (78.1% volume mixing ratio) and oxygen (20.9% volume mixing ratio), together with a number of trace gases, such as argon (0.93% volume mixing ratio), helium and radiatively active ***greenhouse gases*** such as ***carbon dioxide*** (0.035% volume mixing ratio) and ozone. In addition, the atmosphere contains the greenhouse gas water vapor, whose amounts are highly variable but typically around 1% volume mixing ratio. The atmosphere also contains clouds and aerosols.[9]

Biomass

1) The mass of living organic matter (plant and animal) in an ecosystem.[10]
2) Organic matter (living and dead) available on a renewable basis for use as a fuel; biomass includes trees and plants (both terrestrial and aquatic,), agricultural crops and wastes, wood and wood wastes, forest and mill residues, animal wastes, livestock operation residues, and some municipal and industrial wastes.[10]

Carbon (C) An abundant nonmetallic element that occurs in many inorganic and in all organic compounds[12]

Carbon cycle The term used to describe the flow of carbon (in various forms such as carbon dioxide, organic matter, and carbonates) through the atmosphere, ocean, terrestrial biosphere, and lithosphere[10]

Carbon dioxide (CO_2) A naturally occurring gas, also a by-product of burning fossil fuels from fossil carbon deposits, such as oil, gas and coal, of burning ***biomass*** and of land use changes and other industrial processes. It is the principal ***anthropogenic greenhouse gas*** that affects the Earth's radiative balance. It is the reference gas against which other greenhouse gases are measured and therefore has a ***Global Warming Potential*** of 1.[9]

Carbon sequestration The process of increasing the carbon content of a carbon reservoir other than the atmosphere; often used to narrowly refer to increasing the carbon content of carbon pools in biosphere[10]; The capture of carbon dioxide for long-term storage to either mitigate or defer the accumulation of carbon dioxide in the atmosphere.[7]

Catastrophic event In the context of forest management, an event caused by natural forces that results in near or total mortality of a species, community, or unit of forest.[7]

Climate Climate in a narrow sense is usually defined as the average weather. More specifically, climate is the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. The relevant quantities are most often surface variables such as temperature, precipitation and wind. Climate in a wider sense is the state, including a statistical description, of the ***climate system***.[9]

Climate change A change in the state of the ***climate*** that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external factors, or to persistent ***anthropogenic*** changes in the composition of the ***atmosphere*** or in ***land use***.

Climate projection A projection of the response of the climate system to emission scenarios of greenhouse gases based upon simulations by climate models. Climate projections are distinguished from climate predictions in order to emphasize that climate projections depend upon the scenario used, which is based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized and are therefore subject to substantial uncertainty.[9]

Climate scenario A plausible and often simplified representation of the future ***climate***, based on an internally consistent set of climatological relationships that has been constructed for explicit use in investigating the potential consequences of ***anthropogenic climate change***, often serving as input to impact analyses. ***Climate projections*** often serve as the raw material for constructing climate scenarios, but climate scenarios usually require additional information such as about the observed current climate. A climate change scenario is the difference between a climate scenario and the current climate.[9]

Climate system The climate system is the highly complex system consisting of five major components: the atmosphere, the hydrosphere, the cryosphere, the land surface and the biosphere, and the interactions between them. The climate system evolves in time under the influence of its own internal dynamics and because of other influences such as volcanic eruptions, solar variations and human-caused factors such as the changing composition of the atmosphere and ***land use change***.[9]

Climate variability Variations in the mean and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the ***climate*** on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the ***climate system*** (internal variability), or to external variations in natural or ***anthropogenic*** factors (external variability). See also ***Climate change***.[9]

Disturbance Stresses and destructive agents such as: invasive species, diseases, and fire; changes in climate and serious weather events such as hurricanes and ice storms; pollution of the air, water, and soil; real estate development of forest lands; and timber harvest. Some of these are caused by humans, in part or entirely, while others are not.[7]

Downscaling A suite of methods for producing finer-resolution climate or climate change information from relatively coarse-resolution global climate models that involves examining the relationship between past climate data and other climate model outputs.[13,14]

Drought In general terms, drought is a 'prolonged absence or marked deficiency of precipitation', a 'deficiency that results in water shortage for some activity or for some group', or a 'period of abnormally dry weather sufficiently prolonged for the lack of precipitation to cause a serious hydrological imbalance'. Drought has been defined in a number of ways. Agricultural drought relates to moisture deficits in the topmost 1 meter or so of soil (the root zone) that affect crops, meteorological drought is mainly a prolonged deficit of precipitation, and hydrologic drought is related to below-normal stream flow, lake and groundwater levels. A megadrought is a long-drawn out and pervasive drought, lasting much longer than normal, usually a decade or more.[9]

Ecological function The sum of physical conditions (e.g., depth of water, soil type) and ecological processes (e.g., nutrient cycling) that make up an ecosystem and, ultimately, habitats on which species depend. A loss of ecological function is the removal or disruption of an ecological process that produces a certain physical condition or the loss or damage to a physical condition.[7]

Ecological processes Processes fundamental to the functioning of a healthy and sustainable ecosystem, usually involving the transfer of energy and substances from one medium or trophic level to another (e.g., water flows and movement, nutrient cycling, sediment movement, and predator-prey relationships).[7]

Ecosystem A system of living organisms interacting with each other and their physical environment. The boundaries of what could be called an ecosystem are somewhat arbitrary, depending on the focus of interest or study. Thus, the extent of an ecosystem may range from very small spatial scales to, ultimately, the entire Earth. [7,9]

El Niño-Southern Oscillation (ENSO) The term El Niño was initially used to describe a warm-water current that periodically flows along the coast of Ecuador and Peru, disrupting the local fishery. It has since become identified with a basin-wide warming of the tropical Pacific Ocean east of the dateline. This oceanic event is associated with a fluctuation of a global-scale tropical and subtropical surface pressure pattern called the Southern Oscillation. This coupled ***atmosphere***-ocean phenomenon, with preferred time scales of two to about seven years, is collectively known as the El Niño-Southern Oscillation (ENSO). It is often measured by the surface pressure anomaly difference between Darwin and Tahiti and the sea surface temperatures in the central and eastern equatorial Pacific. During an ENSO event, the prevailing trade winds weaken, reducing upwelling and altering ocean currents such that the sea surface temperatures warm, further weakening the trade winds. This event has a great impact on the wind, sea surface temperature and precipitation patterns in the tropical Pacific. It has climatic effects throughout the Pacific region and in many other parts of the world, through global teleconnections. The cold phase of ENSO is called La Niña.[9]

Emission scenario A plausible representation of the future development of emissions of greenhouse gases and radiatively-active aerosols, built from assumptions about demographic, technological, or environmental developments.[1,10,14]

Ecological/Environmental footprint A measure of human demand on the Earth's ecosystems

Evapotranspiration The sum of evaporation and plant transpiration from the Earth's land surface to the atmosphere.[7,9]

Extreme weather event An event that is rare at a particular place and time of year. By definition, the characteristics of what is called extreme weather may vary from place to place in an absolute sense. Single extreme events cannot be simply and directly attributed to ***anthropogenic climate change***, as there is always a finite chance the event in question might have occurred naturally. When a pattern of extreme weather persists for some time, such as a season, it may be classed as an extreme climate event, especially if it yields an average or total that is itself extreme (e.g., ***drought*** or heavy rainfall over a season).[9]

Fossil fuels Fuels such as coal, petroleum, and natural gas derived from the chemical and physical transformation (fossilization) of the remains of plants and animals that lived during the Carboniferous Period that occurred 360 to 286 million years ago[10]

General Circulation Model (GCM) See ***Climate model***.

Global climate model See ***Climate model***.

Global warming potential A factor describing the radiative forcing impact (e.g., warming of the atmosphere) of one unit mass of a given greenhouse gas relative to the warming caused by a similar mass of carbon dioxide. For example, methane has a GWP of 23[10]

Greenhouse effect The rise in temperature that the Earth experiences because certain gases in the atmosphere (water vapor, carbon dioxide, nitrous oxide, and methane, for example) absorb and emit energy from the sun.[14]

Greenhouse gas Gases that trap infrared heat, warming the air near the surface and in the lower levels of the atmosphere.[10] Water vapor (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), and ozone (O_3) are the primary greenhouse gases in Earth's atmosphere.[7] This property causes the ***greenhouse effect.*** Water vapor (H_2O), ***carbon dioxide*** (CO_2), nitrous oxide (N_2O), methane (CH_4) and ozone (O_3) are the primary greenhouse gases in the Earth's atmosphere. There are also a number of entirely human-made greenhouse gases in the atmosphere, such as the halocarbons and other chlorine- and bromine-containing substances dealt with under the Montreal Protocol.

Impact The direct and indirect consequences of climate change on systems, particularly those that would occur without adaptation.[7]

Land use/Land use change Land use refers to the total of arrangements, activities and inputs that occur on a given piece of land (a set of human actions). The term land use is also used in the sense of the social and economic purposes for which land is managed (e.g., grazing, timber extraction and conservation). Land use change refers to a change in the use or management of land by humans, which may lead to a change in land cover. Land cover and land use change may impact surface ***albedo***, ***evapotranspiration***, ***sources*** and ***sinks*** of ***greenhouse gases***, or other properties of the ***climate system*** and may thus have a ***radiative forcing*** and/or other impacts on ***climate***, locally or globally. See also the IPCC Report on Land Use, Land-Use Change, and Forestry (IPCC, 2000).[9]

Methane (CH_4) An odorless, colorless, flammable gas that is the major constituent of natural gas, which is used as a fuel and is an important source of hydrogen and a wide variety of organic compounds.[12]

Migration The movement of genes, individuals, or species from one population or geographic location to another. Tree migration is largely influenced by dispersal ability, landscape connectivity, and climatological and other factors.[7]

Mitigation In the context of climate change, mitigation is the intervention to reduce the emissions or enhance the storage of greenhouse gases. Mitigation is predicated on adaptation: the long-term capacity of ecosystems to capture and store carbon depends in large part on their ability to adapt to a rapidly changing climate.[5] Mitigation strategies include the following:

- promoting the uptake of atmospheric carbon by forests and the storage of carbon in soils, vegetation, long-lived wood products, and recycled wood materials
- indirectly reducing greenhouse gas emissions (for example, through the use of carbon-neutral bioenergy to offset fossil fuel emissions and substituting wood for more fossil fuel-intensive building products)
- diminishing greenhouse gas emissions (for example, through the cooling effects of urban forests, which reduce the need for fossil fuels to run air conditioners) or through more prudent consumption in facilities, fleet, and other operations.[5]

Monitoring The collection of information over time, generally on a sample basis by measuring change in an indicator or variable, to determine the effects of resource management treatments in the long term.[7]

Ozone (O_3) A gaseous atmospheric constituent. In the troposphere (the lowest part of the atmosphere), it is created both naturally and by photochemical reactions involving gases resulting from human activities (smog). Tropospheric ozone acts as a ***greenhouse gas***. In the stratosphere (above the troposphere), it is created by the interaction between solar ultraviolet radiation and molecular oxygen (O_2).

Phenology The study of the timing of natural events such as the date that migrating birds return, the first flower dates for plants, and the date on which a lake freezes in the autumn or opens in the spring.[14]

Pool Any natural region or zone, or any artificial holding area, containing an accumulation of carbon or carbon-bearing compounds or having the potential to accumulate such substances[10]

Precipitation Any or all forms of liquid or solid water particles that fall from the atmosphere and reach the Earth's surface, including drizzle, rain, snow, snow pellets, snow grains, ice crystals, ice pellets, and hail.[7]

Productivity The rate at which biomass is produced per unit area by any class of organisms, or the rate of energy utilization by organisms.[7]

Projection A potential future evolution of a quantity or set of quantities, often computed with the aid of a model. Projections are distinguished from predictions in order to emphasize that projections involve assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized, and are therefore subject to substantial ***uncertainty***.[9] See also ***Climate projection***

Radiative Emission or propagation of energy in the form of waves or particles[12]

Radiative forcing The change in net power of electromagnetic radiation (irradiance) between different layers of the atmosphere. Typically, radiative forcing is quantified in units of watts per square meter. A positive forcing (more incoming energy) tends to warm the system, while a negative forcing (more outgoing energy) tends to cool it. Sources of radiative forcing include changes in solar radiation and in concentrations of radiatively active gases and aerosols.[15]

Realignment An adaptation option for ecosystems that have been significantly disturbed and are far outside historical ranges of variation, where restoration to historical pre-disturbance conditions may not be preferred and management seeks to bring processes of the disturbed landscape into the range of current or expected future environments.[11]

Refugia Locations and habitats that support populations of organisms that are limited to small fragments of their previous geographic range.[7,11]

Resilience

1) The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change.[1,14]
2) An adaptation option intended to accommodate some degree of change, but allow for a return to prior conditions after a disturbance, either naturally or through management.[7,11]

Resistance An adaptation option intended to improve the defenses of an ecosystem against anticipated changes or directly defend the forest against disturbance in order to maintain relatively unchanged conditions.[7,11]

Response

1) The behavior of an entity under the influence of environmental changes.[2]
2) An adaptation option intended to accommodate change and enable ecosystems to adaptively respond to changing and new conditions.[11]

Restoration

1) The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.[16]
2) The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. Ecological restoration focuses on reestablishing the composition, structure, pattern, and ecological processes necessary to facilitate terrestrial and aquatic ecosystems sustainability, resilience, and health under current and future conditions[17]

Risk The chance of something happening that will have an impact on objectives, often specified in terms of an event or circumstance and the consequences that may flow from it. Measured in terms of the consequences of an event and their likelihoods, risk may have a positive or negative impact.[7]

Scenario A plausible and often simplified description of how the future may develop, based on a coherent and internally consistent set of assumptions about driving forces and key relationships. Scenarios may be derived from ***projections***, but are often based on additional information from other sources, sometimes combined with a narrative storyline.[9] See also ***Climate scenario***; ***Emission scenario***.

Seed zone A designated area, usually with definite topographic bounds based on climatological, biological, and geographical criteria, containing trees with relatively uniform genetic (racial) composition as determined by progeny-testing various seed sources.[7]

Sequestration The capture of carbon dioxide for long-term storage to either mitigate or defer the accumulation of carbon dioxide in the atmosphere.[7]

Sink In general, any process, activity, or mechanism which removes a greenhouse gas or a precursor of a greenhouse gas or aerosol from the atmosphere; in this report, a sink is any regime or pool in which the amount of carbon is increasing (i.e., is being accumulated or stored)[10]

Solar radiation Electromagnetic radiation emitted by the Sun. It is also referred to as shortwave radiation. Solar radiation has a distinctive range of wavelengths (spectrum) determined by the temperature of the Sun, peaking in visible wavelengths.[9]

Source In general, any process, activity, or mechanism which releases a greenhouse gas or a precursor of a greenhouse gas or aerosol into the atmosphere; in this report, a source is any regime or pool in which the amount of carbon is decreasing (*i.e.,* is being released or emitted)[10]

Source In the context of climate change, any process, activity or mechanism that releases a ***greenhouse gas*** or a precursor of a greenhouse gas into the ***atmosphere.***[9]

Stressor An agent, condition, change in condition, or other stimulus that causes stress to an organism.[7]

Sustainable forest management The stewardship and use of forests in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality, and potential to fulfill, now and in the future, ecological, economic, and social functions at local, national, and global levels, and that does not cause damage to other ecosystems.[7]

Triage In the context of forest management, a systematic process to sort management situations into categories according to urgency, sensitivity, and capacity of available resources to achieve desired goals. Cases are rapidly assessed and divided into major categories that determine treatment priority.[7,11]

Uncertainty An expression of the degree to which a value (such as 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 described using quantitative measures or by qualitative statements.[9]

Vulnerability The degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.[1,14]

Vulnerability assessment The process of identifying, quantifying, or prioritizing the vulnerabilities in a system.[7]

Weather The state of the atmosphere at a given time and place, with respect to variables such as temperature, moisture, wind velocity, and barometric pressure.[12]

APPENDIX 2: REFERENCES

1. Intergovernmental Panel on Climate Change (IPCC). 2007. **Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II, and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K. and Reisinger, A. (eds.)]**. Geneva, Switzerland: Intergovernmental Panel on Climate Change. 104. Available at www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm.
2. Karl, T.R.; Melillo, J.M.; Peterson, T.C. 2009. **Global climate change impacts in the United States: A state of knowledge report from the U.S. Global Change Research Program.** New York, NY: Cambridge University Press: 189 p. Available at http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf.
3. Somerville, R.C.J.; Hassol, S.J. 2011. **Communicating the science of climate change**. Physics Today. 64(10): 48-53. Available at www.climatecommunication.org/news/physics-today-article/
4. US Forest Service Office of the Climate Change Advisor to the Chief. In Press. **Climate Change in National Forests and Grasslands: Impacts and Forest Service Responses**.
5. US Forest Service. 2011. **National Roadmap for Responding to Climate Change**. US Department of Agriculture, Forest Service. Available at www.fs.fed.us/climatechange/pdf/Roadmapfinal.pdf.
6. Patton, M.Q. 1997. **Utilization-Focused Evaluation.** Thousand Oaks, CA.: Sage Publications.
7. Swanston, C.W.; Janowiak, M.J. 2012. **Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers**. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. Available at www.treesearch.fs.fed.us/pubs/40543.
8. Glick, P.; Stein, B.A.; Edelson, N.A. 2011. **Scanning the conservation horizon: a guide to climate change vulnerability assessment.** Washington, D.C.: National Wildlife Federation: 176 p. Available at www.californiawildlifefoundation.org/articles/ScanningtheConservationHorizon.pdf.
9. Baede, A.P.M. (ed.). 2007. **Annex I: Glossary**. In: S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.), ed. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press. Available at www.ipcc.ch/publications_and_data/ar4/wg1/en/annexessannex-i.html.
10. King, A.W.; Dilling, L.; Zimmerman, G.P.; Fairman, D.M.; Houghton, R.A.; Marland, G.; Rose, A.Z.; Wilbanks, T.J. 2007. **The First State of the Carbon Cycle Report (SOCCR): The North American Carbon Budget and Implications for the Global Carbon Cycle**. Asheville, NC: National Oceanic and Atmospheric Administration, National Climatic Data Center. 242 pp. Available at www.climatescience.gov/Library/sap/sap2-2/final-report/default.htm.
11. Millar, C.I.; Stephenson, N.L.; Stephens, S.L. 2007. **Climate change and forests of the future: Managing in the face of uncertainty**. Ecological Applications. 17(8): 2145-2151. Available at www.treesearch.fs.fed.us/pubs/31774.
12. **The American Heritage Dictionary of the English Language**. 2012. Available at www.ahdictionary.com.
13. Daniels, A.E.; Morrison, J.F.; Joyce, L.A.; Crookston, N.L.; McNulty, S.G. 2012. **Climate projections FAQ**. Fort Collins, CO. 32 p. Available at www.treesearch.fs.fed.us/pubs/40614.
14. Swanston, C.; Janowiak, M.; Iverson, L.; Parker, L.; Mladenoff, D.J.; Brandt, L.; Butler, P.; St. Pierre, M.; Prasad, A.; Matthews, S.; Peters, M.; Higgins, D.; Dorland, A. 2011. **Ecosystem Vulnerability Assessment and Synthesis: A Report from the Climate Change Response Framework Project in Northern Wisconsin**. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 142 p. Available at www.nrs.fs.fed.us/pubs/38255.
15. Wikimedia Foundation Inc. 2012. **Radiative Forcing**. In. Wikipedia. Available at http://en.wikipedia.org/wiki/Radiative_forcing.
16. Day, K.; Berg, J.; Brown, H.; Crow, T.; Morrison, J.; Nowacki, G.; Puckett, D.; Sallee, R.; Schenck, T.; Wood, B. 2006. **Ecosystem Restoration: A Framework for Restoring and Maintaining the National Forests and Grasslands**. Available at www.fs.fed.us/restoration/documents/RestFramework_final_010606.pdf.
17. US Forest Service. 2012. **National Forest System Land Management Planning**. In: Forest Service, U.S. Department of Agriculture, ed. 36 CFR Part 219 Available at www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5362536.pdf.

APPENDIX 3: SUGGESTED HANDOUTS FOR TRAINING EVENTS

If you are coordinating a training session, you may want to provide some or all of the following documents as handouts.

1. The "Forest Service Organization and Resources for Climate Change" briefing is used as a key resource in the "Forest Service Response" portion of trainings. It is recommended that you provide a paper copy for in-person training activities.
2. Flyer for the Forest Service's Climate Change Resource Center. Many of the best climate change education materials are available through this website.
3. Flyer on Sustainable Operations information. A substantial amount of work has been done on Sustainable Operations and many resources exist. This handout highlights the best places to start looking for more information. Additionally, you can find more information through the Sustainable Operations webpage.

Forest Service Organization and Resources for Climate Change

Climate change and its effects on forests pervade all of the work of the Forest Service. In order to effectively address climate change issues at the organizational level there are several important offices and networks that guide the implementation and support of several Forest Service resources.

Organizing for Climate Change

Office of the Climate Change Advisor – The Climate Change Advisor is the primary spokesperson for the Forest Service on climate change and leads the implementation of the nationwide strategy for integrating climate change response into policies, processes, and partnerships. The Climate Change Advisor's intranet website contains the Roadmap (see below), Scorecard implementation and tracking (see below), and a collection of briefing papers that describe Forest Service efforts in tackling climate change.
Website: http://fsweb.wo.fs.fed.us/chief/climatechange/

Climate Change Field Team – The field team is comprised of a Climate Change Coordinator from each Regional Office, Station, and Area. The field team is the primary interface between the Washington Office and the field. The field team meets monthly by conference call and annually or biannually in person to discuss issues and solve problems facing Forests and Rangelands as they develop and implement plans to address climate change.
Website: http://fsweb.wo.fs.fed.us/chief/climatechange/

Unit Climate Change Coordinators – Almost all Forests and Grasslands have appointed a Climate Change Coordinator (CCC). On most units, this is a collateral duty. The coordinator serves as a single point of contact and may be responsible for accomplishing various tasks, including employee training, assisting with adaptation planning, and working with unit leadership to set goals for climate change-related activities.

Forest Service Climate Change Resources

National Roadmap for Responding to Climate Change – The Roadmap supports the "Strategic Framework of Responding to Climate Change" by providing a guide to help the agency move from current climate change activities to longer term investments in the future of the nation's forests. It describes four major dimensions for responding to climate change: agency capacity; partnerships and conservation education; adaptation; and mitigation
Website: www.fs.fed.us/climatechange/advisor/roadmap.html

Climate Change Scorecard – The scorecard is a way for the Forest Service – National Forest System to track its progress in addressing and planning for climate change. It consists of ten elements with YES or NO answers. The goal is for all units to answer YES to seven of the elements by 2015.
Website: http://fsweb.wo.fs.fed.us/chief/climatechange/Scorecard_briefing_all.pdf

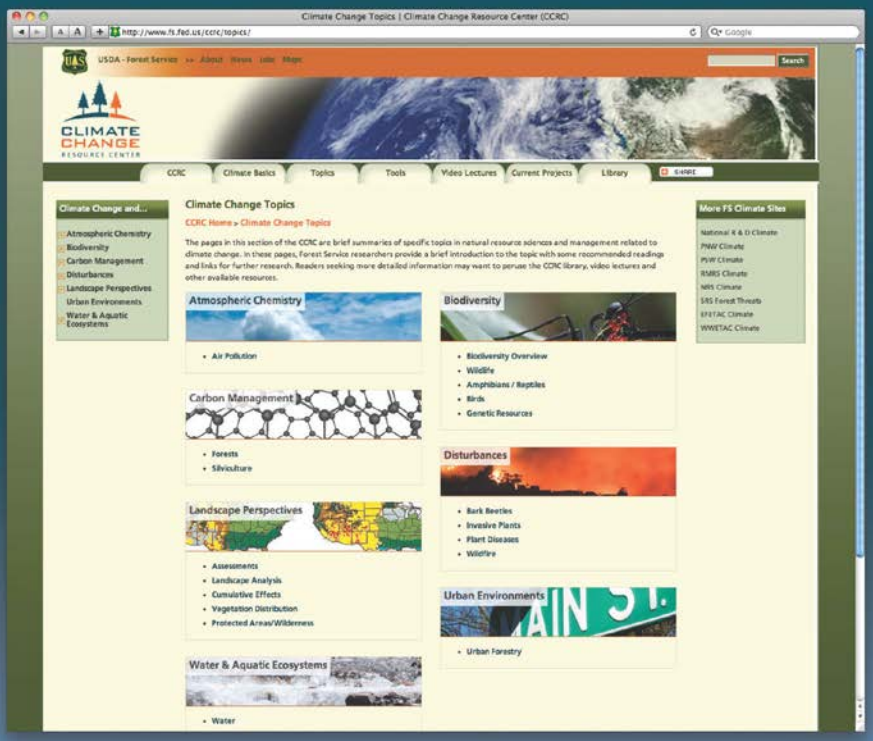
Sustainable Operations - As stewards of the environment, the Forest Service is committed to efficiently using energy and reducing consumption of resources in our daily operations. To reduce our environmental footprint, coordinated actions are required to accomplish agency wide reductions in fuel and energy consumption; increased use of renewable power sources, increased green purchasing; increased recycling, and improved monitoring of contractor compliance with sustainability-related requirements.
Website: www.fs.fed.us/sustainableoperations/

Climate Change Resource Center – The CCRC is a reference Web site for resource managers and decision makers who need information and tools to address climate change in planning and project implementation. The site contains video presentations, papers, FAQ's and a library on a wide range of topics related to climate change, forests, and grasslands.
Website: www.fs.fed.us/ccrc/

CLIMATE CHANGE
RESOURCE CENTER

Information & Tools for Land Managers

www.fs.fed.us/ccrc



CLIMATE CHANGE RESOURCE CENTER *online*

The mission of the Climate Change Resource Center (CCRC) is provide land managers with easy access to credible, science-based, and relevant information and tools concerning climate change and ecosystem management options.

Up-to-date, essential information on topics such as:

- Atmospheric Chemistry
- Biodiversity
- Carbon Management
- Climate Basics
- Disturbances
- Landscape Scale Perspective
- Urban Environments

Access climate change tools, research, documents, links, case studies, lectures & more.

Video Presentations

View key science lectures on-demand via our Portable Electronic Presentations (PEPs). Schedule anytime and bring the expert directly into your office for a brief learning experience on technical material related to climate change.

Show PEPs in meetings, training courses, or over the lunch hour.

Presentation topics include:

- Adapting to Climate Change: A Short Course for Land Managers
- Climate Change Impacts on Olympic Peninsula Salmon
- Rethinking Forest Management in the West
- What's Next? Planning for Climate Change

Annotated Bibliography

Browse the scientific literature on climate change. Abstracts are included and all are linked to the source of the paper.

Includes 1,800 citations on climate change and its effects.

The Bibliography addresses:

- How does Earth's climate system work?
- How does climate change over time and what drives those changes?
- What are the effects?
- What can be done to mitigate those effects or adapt to projected climate changes?

www.fs.fed.us/ccrc | **Information & Tools for Land Managers**

Sustainable Operations
Creating Habits Today, Conserving Resources for Tomorrow

Key Messages and Resources

Key Messages

- SusOps are core to the Forest Service's mission to **sustain the health, diversity and productivity** of the Nation's forest and grasslands to meet the needs of present and future generations.
- SusOps means **understanding how our actions impact the world** around us and making daily decisions to **reduce our consumption** of natural resources. It's about how we do business and putting our conservation ethic into everyday practice by maximizing environmental, financial, and human resources.
- As land stewards, **we are committed** to reducing the Forest Service's environmental footprint. Together we can sustain our natural resources and public lands for this and future generations.
- SusOps are a part of the Scorecard that focuses on **reducing the environmental footprint of Agency operations** (Element 10) and are integral to the USFS Strategic Framework for Responding to Climate Change.
- The Forest Service plays a key role in both climate change adaptation and mitigation of greenhouse gas emissions from its land management activities and business operations.
- With the increasing emphasis on Agency climate change goals and opportunities for cost pool reduction, the **integration of sustainable consumption principles** into our daily operations is imperative.

Resources

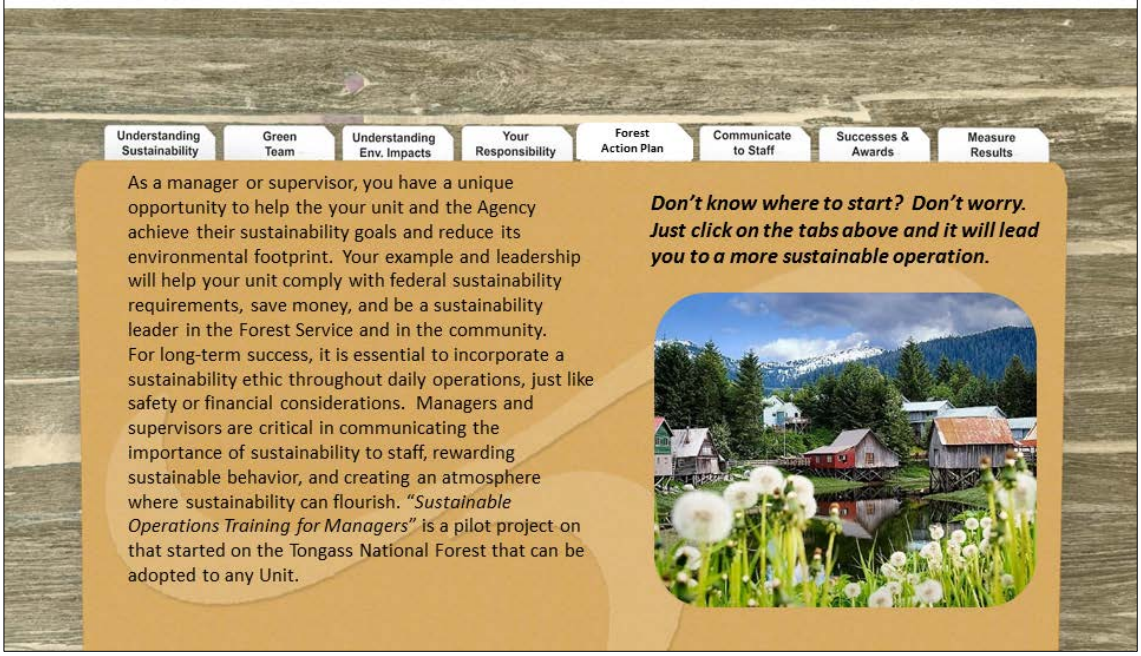
- Numerous resources are available on the Sustainable Operations Collective internal website to help implement SusOps into practice on-the-ground: http://dvspdevtest/sites/sus-ops/Pages/Default.aspx
- The "Top 10 Actions to Achieve Cost & Environmental Footprint Reductions in FY12" is helping Units collectively reduce costs up to $33 million through activities such as eco-driving and cleaning up utility bill accounts.
- Multiple SusOps videos exist to help spark conversation at All Employee Meetings, Orientations, etc:
  - Chief's "Sustainable Operations in the Forest Service: You Have a Role!" – 3 min.
  - Rocky Mountain Region's "Be Sustainable – What's Your Excuse" – 6 min.
  - Deer River Ranger District's "Extreme Makeover: Ranger District Edition" – 33 min.
  - Interagency "Sustainability within the Greater Yellowstone Ecosystem" – 14 min.
- SusOps Peer Learning webinar presentations share resources and Forest-level case studies specific to all Footprint Areas; webinar recordings, slides, and supplemental materials are available at: www.fs.fed.us/sustainableoperations/climate-change.shtml#peerlearning
- Opportunities for Sustainable Operations Training are listed here: www.fs.fed.us/sustainableoperations/documents/sustainable-operations-training.pdf
- Leadership in Sustainable Operations (LISO) provides an online platform for employees to post or view Sustainable Operations projects throughout the Sustainable Operations Collective through a combination of self-reporting and success stories. LISO Actions include Element 10 Action Items, plus many more. Enter your Unit into LISO here: http://liso.dv.r5.fs.fed.us:8080/liso/index.do
- The Green Team Map will help you locate the Green Teams in your area to promote cross-pollination and coordination: (http://dvspdevtest/sites/sus-ops/Pages/Green-Teams-Map.aspx)
- A customizable New & Seasonal Employee Orientation to SusOps Template is available to tailor for your Unit: www.fs.fed.us/sustainableoperations/documents/new-seasonal-employee-orientation-template.docx

APPENDIX 4: SUSTAINABLE OPERATIONS FOR MANAGERS TRAINING

Education and engaging employees in Sustainable Operations is a focus area moving forward. All staffs must be involved in environmental footprint reduction activities to attain the best results. While many staff members throughout all organizational levels are involved in sustainability initiatives, Units must find ways to engage employees who are short on time and may feel that their job descriptions do not fit with environmental footprint reduction activities. To strengthen their ability to reach all staff, the Tongass National Forest (Tongass) Green Team developed the "Sustainable Operations for Managers Training" that is included in the National Climate Change Instructional Package. This training has been modified for a national audience and is now available for all managers. The training provides managers and supervisors with information on how to make their operations more sustainable and on how to engage employees in sustainability initiatives. For additional information, contact Michele Parker, Tongass Environmental Engineer, at (907) 518-1079 or mmparker@fs.fed.us.

Sustainable Operations Training for Managers

Follow the path to successful and sustainable leadership



As a manager or supervisor, you have a unique opportunity to help the your unit and the Agency achieve their sustainability goals and reduce its environmental footprint. Your example and leadership will help your unit comply with federal sustainability requirements, save money, and be a sustainability leader in the Forest Service and in the community. For long-term success, it is essential to incorporate a sustainability ethic throughout daily operations, just like safety or financial considerations. Managers and supervisors are critical in communicating the importance of sustainability to staff, rewarding sustainable behavior, and creating an atmosphere where sustainability can flourish. "*Sustainable Operations Training for Managers*" is a pilot project on that started on the Tongass National Forest that can be adopted to any Unit.

Don't know where to start? Don't worry. Just click on the tabs above and it will lead you to a more sustainable operation.