Fire Science in the Department of Defense

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Wildland Fire Management Science and Technology Coordination Workshop

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SERDP DOD • EPA • DOE | ESTCP

Wildland Fire on DoD Lands

- Fire is a necessary ecological process for many DoD ecosystems but altered in others (i.e., by invasive plants)
- Fire suppression has degraded fire-adapted ecosystems
- Military Services spend millions of dollars annually on claims, asset loss, and suppression activities due to wildfire
- Significant training time is lost due to wildfires, yet training activities themselves are a significant ignition source
- Prescribed burning—primarily in those systems in which the historical regime is low intensity ground fire—decreases wildfire occurrence, improves military training conditions, and provides ecosystem service benefits
- DoD fire science is focused on maintaining the ability to use fire as a management tool

DoD Forestry

General Forest Type	Acres (K; nearest 10K)
Southern Yellow Pine	2,490
Northern & Eastern Hardwoods	1,070
Northern Conifers	10
Western Conifers	330
Western Hardwoods	1,310
Total	5,210

SE Forestry	Acres (K; nearest 10K)
Manageable Longleaf Pine	600
Annual Acres Burned	400

We need to maintain the use of fire as a management tool.

Wildland Fire in a Disaster Reduction Context

"*America's wildfire season lasts two months longer than it did 40 years ago and burns up twice as much land as it did in those earlier days because of the hotter, drier conditions produced by climate change*" US Forest Service Chief Thomas Tidwell told Congress on 4 June 2013.

- Wildfire activity, intensity, size, and impact is increasing across the nation.
- Army as an example:
  - Installation Management Command (IMCOM) manages 13M acres of unimproved lands for military training and testing.
  - IMCOM responds to an estimated 2 to 3K wildfires annually.
  - 85% of IMCOM emergency wildfire response is a result of military training activities.
  - Wildfires present excessive costs to the Army through lost training time, asset loss, damage claims, negative publicity, and suppression actions.
  - Lack of prescribed burning at IMCOM garrisons is resulting in heavy fuel loads, which negatively impacts military training and increases risk for catastrophic fire.

THE RISK IS REAL

Yakima TC 1996
63K Acres Burned
$500K in Claims

Ft Carson 2008
56.7K Acres Burned
$4.6M in Costs
Loss of Life (1) Pilot

Ft Carson 2011
44.7K Acres Burned
$1.9M in Costs

Ft Carson / PCMS
374K Total Acres
$6.5M since 2008
148 Wildland Fires/Yr

Ft Wainwright 2013
87K Acres Burned
$23.5M in BLM
Reimbursement

Hawaii 2005
$333K in
Claims

Ft Huachuca 2014
266 Acres Burned
$3M in Suppression

Ft Sill 2011
$5.7M in Claims
13 Homes Burned
Residents
evacuated
100 Fires/Yr Avg.

Ft Huachuca 2011
30K Acres Burned
Residents
Evacuated

Ft Hood
200 Wildfire
Responses/Yr

Camp Grayling
2010
1.2K Acres Burned
$128K in Claims

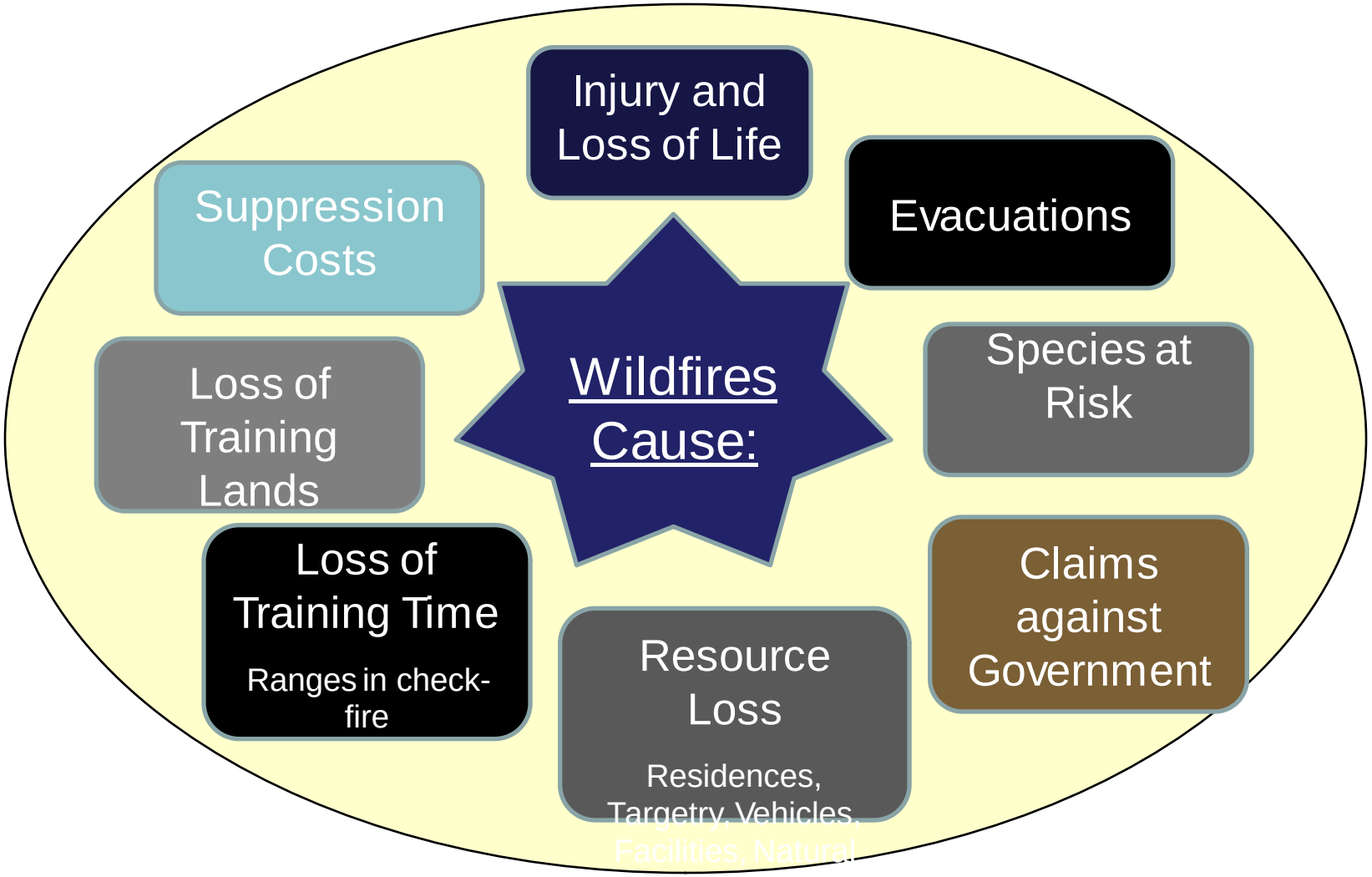
Ft Polk 2011
$900K in
Claims

Ft AP Hill 2011
4.8K Acres Burned
targetry lost (>
$450K)
70 Fires/Yr Avg.

Ft Bragg 2011
16.9K Acres Burned
in Wildfires
250 Fires/Yr Avg.

Ft Stewart 2007
2.2K Acres Burned
$600K in
Suppression
70 Fires/Yr Avg.

THE RISK IS REAL

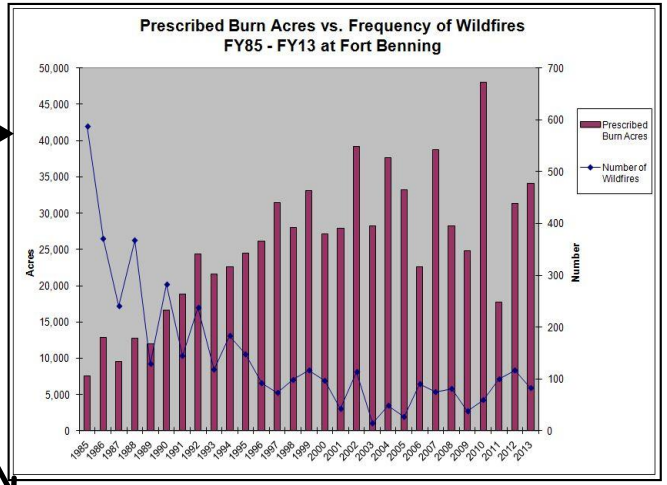


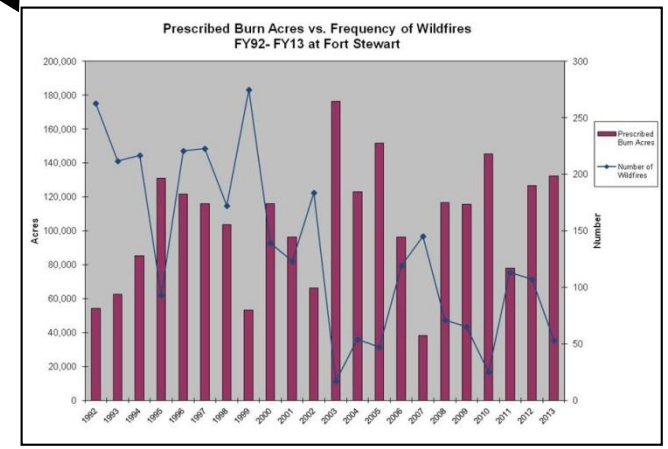
RECOMMENDATION (6 of 7)

Prescribed Burning – Recommend aggressive prescribed burning to achieve the following benefits:

- Reduces fuel loads
- Reduces wildfire occurrence
- Improves training conditions
- Provides healthy ecosystem
- Reduces ticks/chiggers
- Reduces poisonous plants
- Reduces snags
- Promotes native species
- Improves wildlife habitat

Where prescribed burns are not an option, mechanical or other fuel reduction actions should be implemented.





Strategic Environmental Research and Development Program (SERDP)

- Established by FY 1991 Defense Authorization Act
  - DoD, DOE, and EPA partnership
- SERDP is a requirements driven program that:
  - Responds directly to user requirements generated by the Services
  - Identifies high-priority, DoD environmental science and technology needs or investment opportunities that address these requirements
- Annual solicitations via Statements of Need, typically late October

http://www.serdp-estcp.org/

Environmental Security Technology Certification Program (ESTCP)

- Established in 1995
- Demonstrate innovative and cost-effective environmental methodologies and technologies
  - Capitalize on past investments
  - Transition methods and technology out of the lab and field
  - Validate operational cost and performance
- Promote implementation
  - Identify DoD user community
  - Satisfy users by direct application at a DoD facility/site
  - Gain regulatory acceptance
  - May lead to technology transfer outside of DoD
- Annual solicitations via topic areas, typically early January

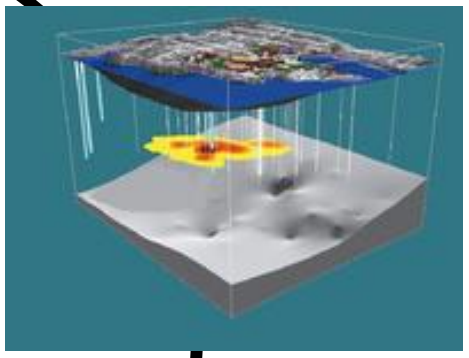
http://www.serdp-estcp.org/

Program Area Management Structure

Energy & Water

Weapons Systems & Platforms

Environmental Restoration



Resource Conservation & Climate Change

Munitions Response

Resource Conservation and Climate Change Overview

- **Natural Resources**
  - Ecological Forestry
  - Arid Lands Ecology and Management
  - Cold Regions Ecology and Management
  - Pacific Island Ecology and Management
  - Coastal and Estuarine Ecology and Management
  - Living Marine Resources Ecology and Management
  - Species Ecology and Management
  - Watershed Processes and Management
- **Climate Change**
  - Vulnerability and Impact Assessment
  - Adaptation Science
  - Land Use and Carbon Management
- **Air Quality**
  - Fugitive Dust
  - Fire Emissions

Generating Investment Topics (SON)*

- SERDP Technical Committees (STC)
- Workshops
- Special Studies
- SERDP Scientific Advisory Board
- DoD Environmental Committees and Working Groups
- Science and Engineering Conferences

***Or how SERDP identifies environmental science and technology research opportunities to address DoD environmental requirements**

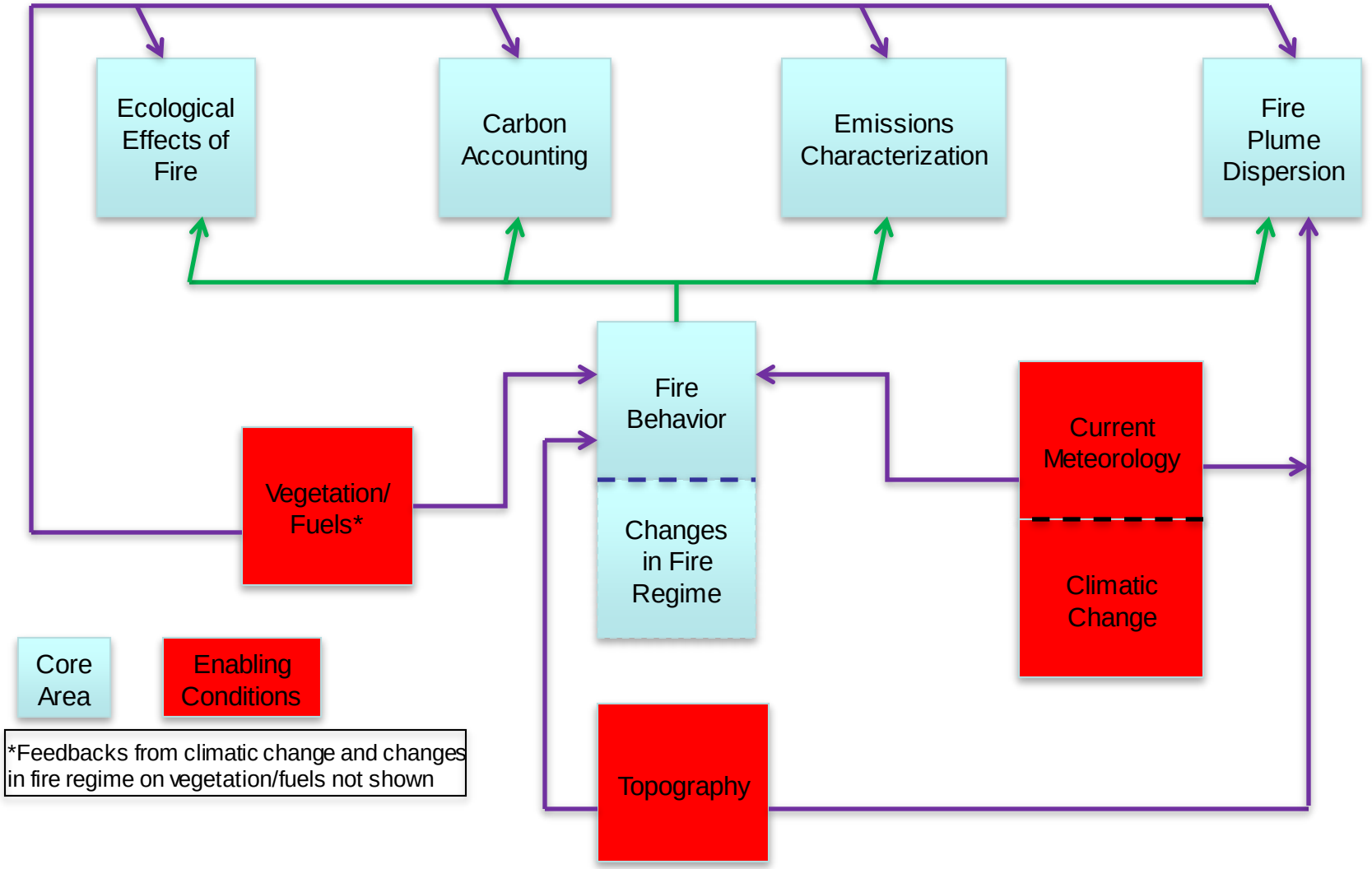
DoD Natural Resource Management Challenges and Science Needs Associated with Fire

- Challenges
  - Manage fire-prone ecosystems—with a focus on open-canopied systems—to support DoD mission and stewardship requirements
  - Maintain use of prescribed fire as an integral part of the silvicultural toolbox, especially in the context of ecological forestry
  - Account for air quality, smoke management, and carbon accounting requirements in the use of fire
- Emerging Research/Demonstration Needs
  - Carbon accounting and trade-offs with other ecosystem services in fire-adapted ecosystems
  - Fire behavior and its relationship to ecosystem and smoke management issues
  - Fire behavior and other fire-related model validations

SERDP/ESTCP Investments to Date in Fire Science

- Air Quality Aspects of Prescribed Burning
  - Evaluate the air quality aspects of prescribed burning in the different ecological systems managed by the DoD.
  - Execution: FY08-FY14; four projects
- Southwest Ecological Systems on Department of Defense Lands: Altered Fire Regimes and Non-Native Invasive Plants
  - Develop the science and tools to support managing and recovering ecosystems in the Southwest that currently are impacted by altered fire regimes and non-native invasive plants.
  - Execution: FY10-FY15; three projects
- Ecological Forestry and Carbon Management
  - Understand the interactions between ecological forestry-based silvicultural prescriptions and carbon management in the context of maintaining other desired ecosystem services, such as military mission support, as well as native biodiversity.
  - Execution: FY11-FY15, four projects
- Fire Behavior Model Validation
  - Execution: FY13-FY16; one project (FIRETEC)

Moving Forward: SERDP/ESTCP Core Fire Science Research Areas and Conceptual Model



SERDP/ESTCP Core Fire Science Research Areas

- Fire Behavior
  - Fire spread patterns
  - Interactions with fine-scale meteorology and topography
  - Plume dynamics
- Ecological Effects of Fire (in coordination with Army Corps)
  - Fire regimes
  - Interaction with silvicultural treatments (restoration vs. maintenance)
- Carbon Accounting
  - Ecosystem carbon allocations
  - Life cycle changes, including fire
  - Trade-offs with other ecosystem services
- Emissions Characterization
  - Fuel type, loadings, flaming versus smoldering, and consumption
- Fire Plume Dispersion
  - Local and regional effects (prescribed vs. unplanned fires)

Next Steps

- Finalize SERDP/ESTCP Fire Science Strategy
  - SERDP/ESTCP does not want to duplicate the efforts of others
  - When feasible, seeks opportunities to leverage resources
  - DoD has a primary interest in the SE, especially in regard to the recovery of the longleaf pine ecosystem
  - Comments received on draft from the Army, Air Force, JFSP, and USFS; finalize summer 2014
- Vet strategy with JFSP (and others?) to transition to an investment strategy/implementation plan
- Implement strategy through SERDP SONs and ESTCP topics, monitor outcomes, and make adjustments
- Transfer knowledge gained to end users

Next Steps—continued

- Main areas of interest to DoD:
  - Develop science-based emission factors that place the air quality effects of prescribed burning into context to maintain the use of fire as a management tool
  - Define carbon stocks for open canopy systems managed by DoD and manage carbon in manner that maintains other desired ecosystem services
  - Better understand fire behavior and its drivers to facilitate its application to meet management objectives
  - Advance ecological forestry as standard practice for DoD forests
  - Achieve appropriate standardization and validations of tools and models related to the above to facilitate technology transfer to end users and consistent applications

Summary (S&T Producer Template)

- **Background**
  - SERDP/ESTCP are the primary DoD programs that conduct fire-related research and demonstration; fire science comes under the Resource Conservation and Climate Change program area
  - Both programs are located within the Science and Technology Directorate within the Office of the Deputy Under Secretary for Installations and Environment
  - Coordinate with fire-focused programs within the Air Force and Army Corps
  - Use various mechanisms to determine new investment areas
- **Portfolio**
  - Fire-related issues are spread across the program area, but primary focus is understanding and maintain use of prescribed fire as a management tool
  - Don't directly address NSTC's grand challenges for Disaster Reduction but likely address in many indirect ways

Summary (S&T Producer Template)

- Science Accessibility, Application, and Integration
  - ESTCP is a primary technology transfer mechanism
  - Transition to end users remains a difficult challenge
- Coordination and Application
  - In the midst of completing action on a Fire Science Strategy to guide future investment (summer 2014)
  - Have developed informal collaborations with the Joint Fire Science Program and the US Forest Service research organizations; internally coordinate with Corps labs
  - Given the limited resource environment, need to pursue new collaborative relationships and leveraging opportunities

Backup

Joint Web Site

- SERDP & ESTCP Information at One Location
  - Easy access to all information
    - Funding opportunities
    - Investigator resources
    - Research results
  - Highlights program areas and initiatives
  - Platform for technology transfer: Tools and Training

serdp-estcp.org

What is Demonstration?

- Formal translation of scientific understanding or technology development into the metrics of performance and implementation cost under real world conditions.
- Enables end-users (e.g., resource managers) and decision-makers to understand the potential consequences of implementing a new methodology or technology—in comparison to an existing methodology or technology when such exists.
- Provides practical "evidence" that our assumptions about how things work are valid and that our associated responses are feasible.
- Attempt to collect data at scale or at least information that is scalable to the real world situation.
- Avoids trial and error approaches without assessment—reduces uncertainty and risk.

Air Quality Aspects of Prescribed Burning:
A Few SERDP Project Outcomes

- Emission factors for representative DoD vegetation types; gas phase and particulate/aerosol
- Laboratory versus field measurement comparison
- Airborne versus ground-based measurement comparisons
- Flaming versus smoldering comparisons
- Fire-maintained versus fire-suppressed stand comparison
- Fuel loading and fuel consumption data
- Contributions to our understanding of fire's contribution to GHG and carbon particulate emissions
- Emission factor database (both project data and mined data)
- Validation of Daysmoke model and coupling to a regional air quality model using an adaptive grid (some data collected in conjunction with Rx-CADRE at Eglin AFB; portions of which JFSP funded)
- Effect of management treatments on emissions

Ecological Forestry Policy Context

- New Policy: DoDI 4715.03, dated February 14, 2011, Natural Resources Conservation Program, Procedures (Enclosure 3), Section 4 Land Management:
  - "DoD Components shall assess installation lands for forestry and agricultural outlease suitability. Any such uses shall support the military mission, be addressed in and compatible with the INRMP, and be consistent with long-term ecosystem-based management goals that place ecological sustainability objectives above revenue optimization goals."
  - "Forest products may be commercially harvested to generate electricity, heat, steam, or for other uses only if such harvest is consistent with military mission support, the principles of ecologically sustainable management, and the Sikes Act, and if the Military Service's forestry account is paid fair market value."

Army Corps Fire Research

Multi-scale Ecological Assessment of Altered Fire Regimes

(FY11-14)

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Engineer Research and Development Center (ERDC)
Construction Engineering Research Laboratory (CERL)

BUILDING STRONG®

Project Objectives

- ***Physiological-based Assessment of Vegetation Response to Altered Fire Regimes***
  - **Objective:** Provide physiological-based projections of vegetation response to altered fire regimes in the longleaf pine-wiregrass ecosystem.
- ***Demographic-based Assessment of Vegetation Response to Altered Fire Regime***
  - **Objective:** Develop demographic-based projections of vegetation response to altered fire regimes within the longleaf pine-wiregrass ecosystem.
- ***Community-based Assessment and Cross-Scale Synthesis***
  - **Objective**: Provide a community-based assessment and cross-scale synthesis of vegetation response to altered fire regimes within the longleaf pine-wiregrass ecosystem.