Smoke Management Principles

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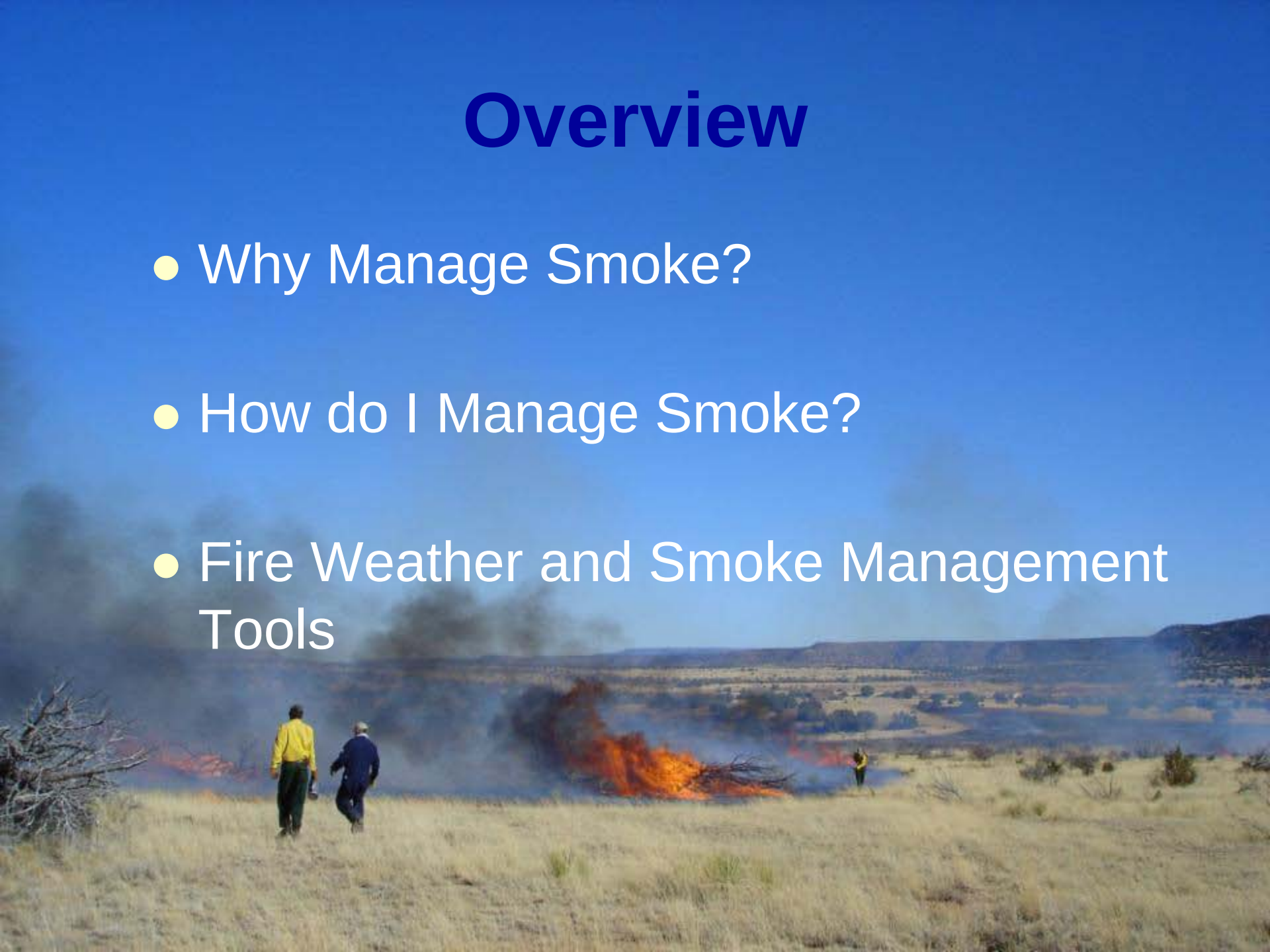
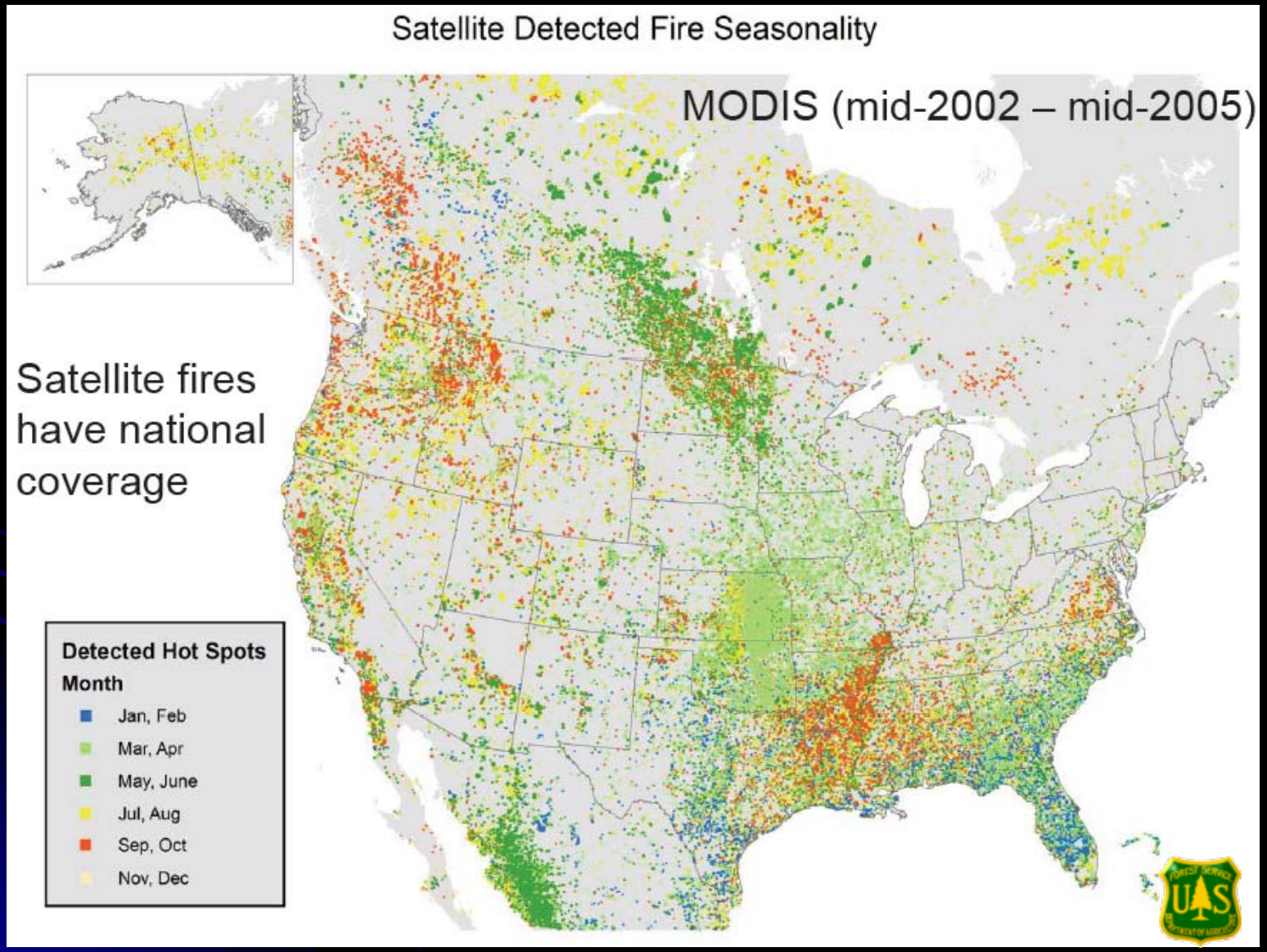
Photo courtesy Lorraine Vogt

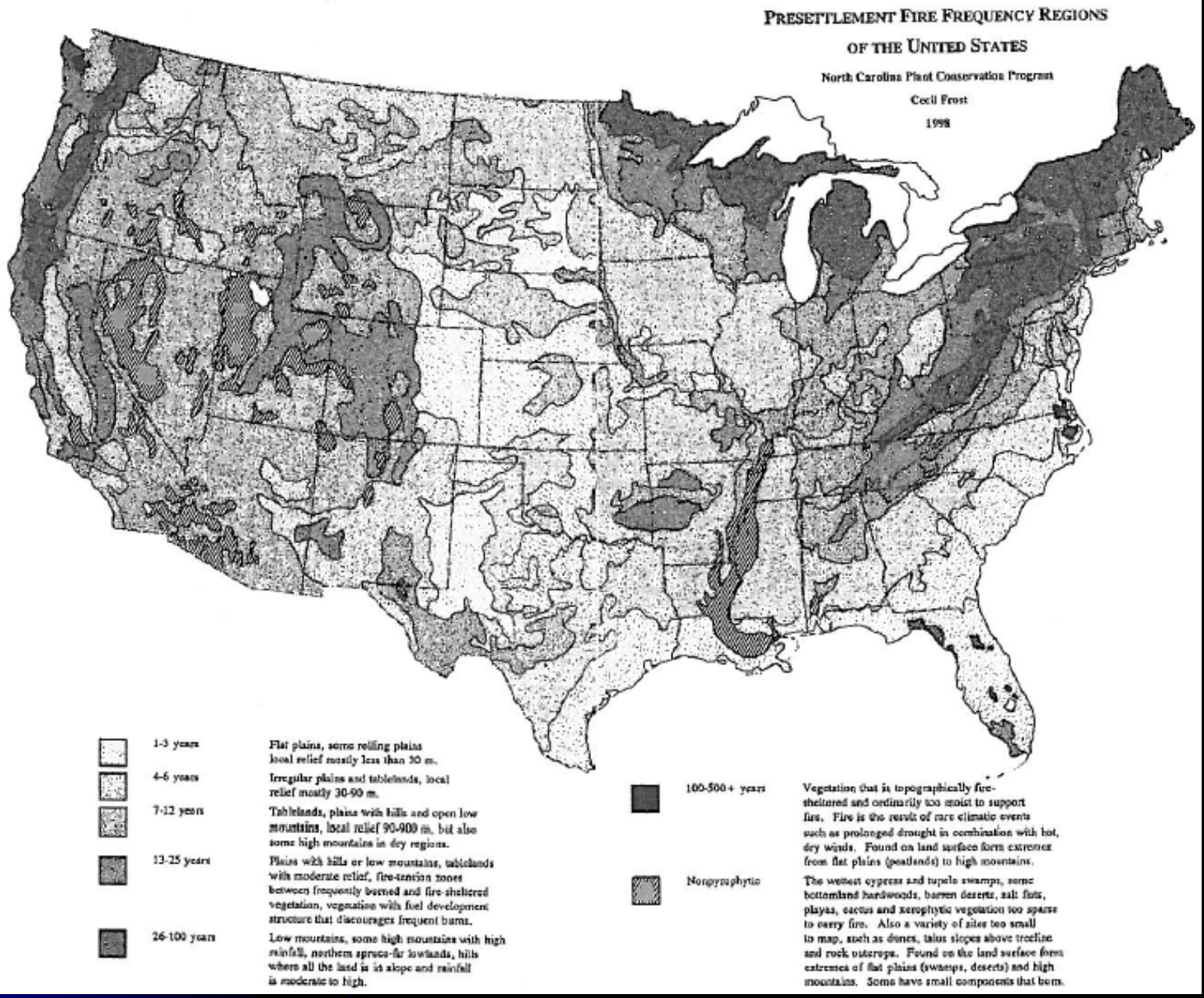
Overview

- Why Manage Smoke?
- How do I Manage Smoke?
- Fire Weather and Smoke Management Tools



… Fire Happens




PRESETTLEMENT FIRE FREQUENCY REGIONS
OF THE UNITED STATES
North Carolina Plant Conservation Program
Cecil Frost
1998
1-3 years
Flat plains, some rolling plains local relief mostly less than 30 m.
4-6 years
Irregular plains and tablelands, local relief mostly 30-90 m.
7-12 years
Tablelands, plains with hills and open low mountains, local relief 90-900 m, but also some high mountains in dry regions.
13-25 years
Plains with hills or low mountains, tablelands with moderate relief, fire-tension zones between frequently burned and fire-sheltered vegetation, vegetation with fuel development structure that discourages frequent burns.
26-100 years
Low mountains, some high mountains with high rainfall, northern spruce-fir lowlands, hills where all the land is at slope and rainfall is moderate to high.
100-500+ years
Vegetation that is topographically fire-sheltered and ordinarily too moist to support fire. Fire is the result of rare climatic events such as prolonged drought in combination with hot, dry winds. Found on land surface form extremes from flat plains (peatlands) to high mountains.
Nonpyrophytic
The wettest cypress and tupelo swamps, some bottomland hardwoods, barren deserts, salt flats, playas, cactus and xerophytic vegetation too sparse to carry fire. Also a variety of sites too small to map, such as dunes, talus slopes above treeline and rock outcrops. Found on the land surface form extremes of flat plains (swamps, deserts) and high mountains. Some have small components that burn.

Prescribed Burning Conservation Practice Standard

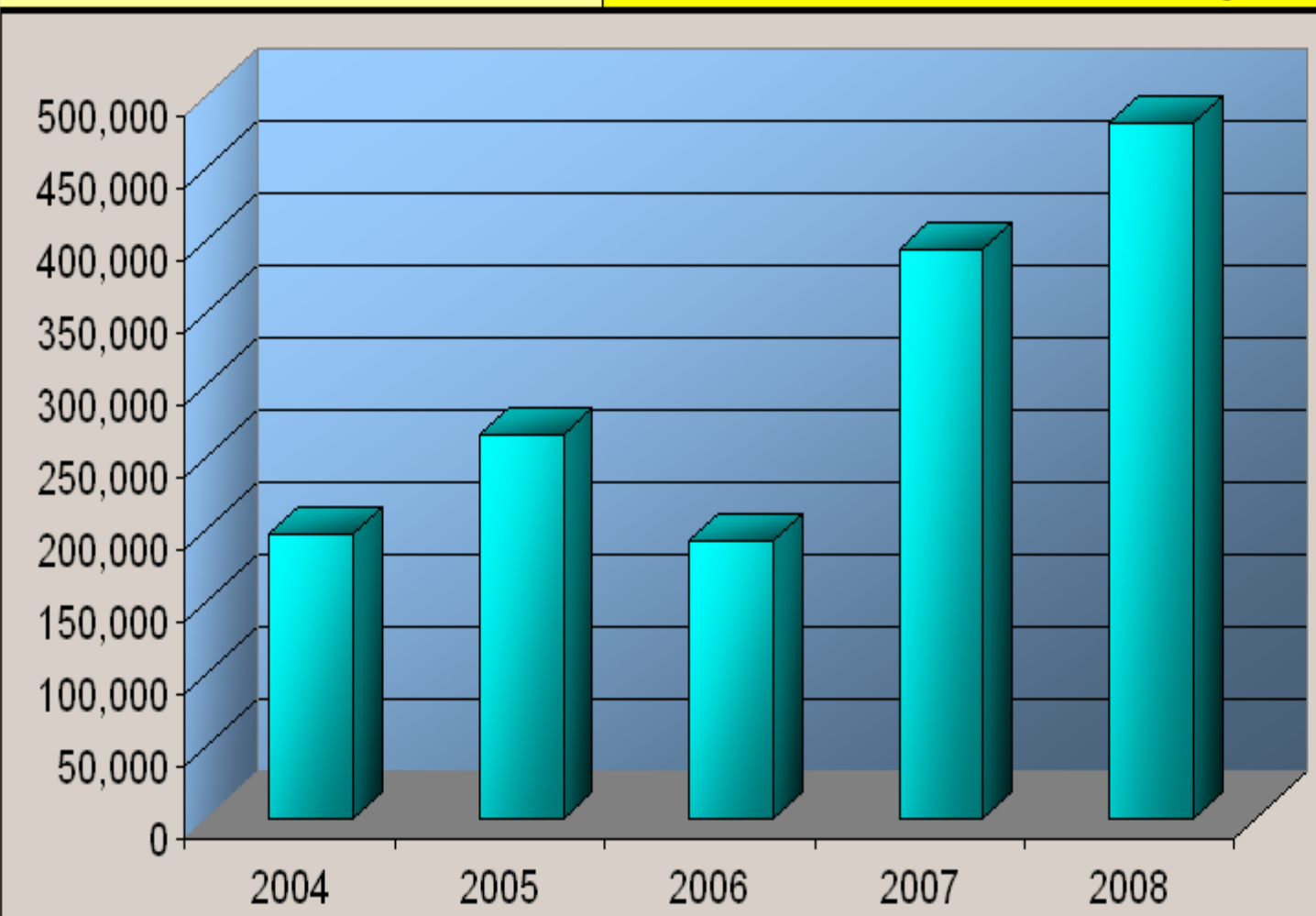
- Purpose of Prescribed Burning
  - Control undesirable vegetation.
  - Prepare sites for harvesting, planting or seeding.
  - Control plant disease.
  - Reduce wildfire hazards.
  - Improve wildlife habitat.
  - Improve plant production quantity and/or quality.
  - Remove slash and debris.
  - Enhance seed and seedling production.
  - Facilitate distribution of grazing and browsing animals.
  - Restore and maintain ecological sites

NRCS Prescribed Burning Training

- 1-week Courses Tailored to:
  - The region/ecosystem
  - The goals of the NRCS State office
- Include:
  - Prescribed Burning Policy
  - Fire Ecology
  - Fire Behavior
  - Ignition Techniques
  - Fire Weather
  - Smoke Management
  - Burn Plans
  - Planning and Executing a Prescribed Burn

Prescribed Burning Assistance in NRCS

Select Practice	Prescribed Burning (338) (ac)



Fiscal year	Applied Amount
2004	197,576
2005	266,115
2006	192,894
2007	393,779
2008	480,515
Total	1,530,879

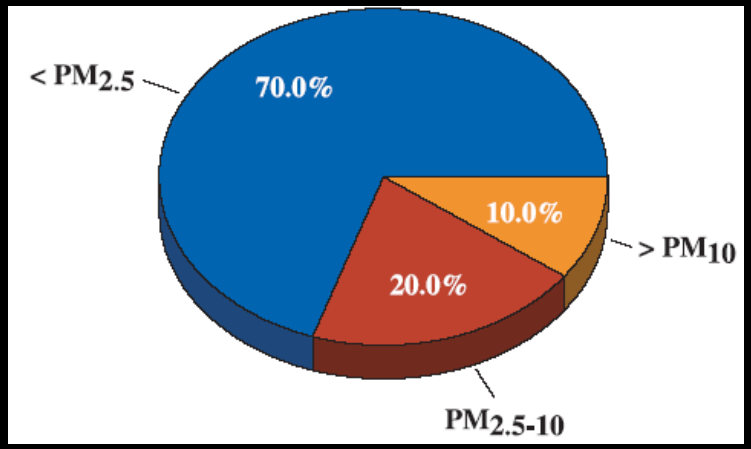
Top 10 states for this practice from 2004 to 2008	
Kansas	368,096
Texas	211,026
Oklahoma	209,272
Alabama	142,424
Georgia	124,201
South Carolina	71,685
Mississippi	71,621
Florida	47,342
Nebraska	40,899
Iowa	30,045
Entire Nation	1,530,879

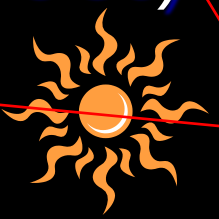
Why manage smoke?

- Health Impacts
- Public Safety and Nuisance
- Visibility – Regional Haze Rule
- We are a Conservation Agency – Air Quality is a resource concern

Emissions from Fire

- Complete Combustion
  - Carbon Dioxide (CO_2)
  - Water (H_2O)
- Incomplete Combustion
  - Carbon Monoxide (CO)
  - Particulate Matter (PM)
  - Volatile Organic Compounds (VOCs)
  - Oxides of Nitrogen (NOx)
  - Sulfur Dioxide (SO_2)
  - Methane (CH_4)





Ozone (O_3)

How Do I Manage Smoke?

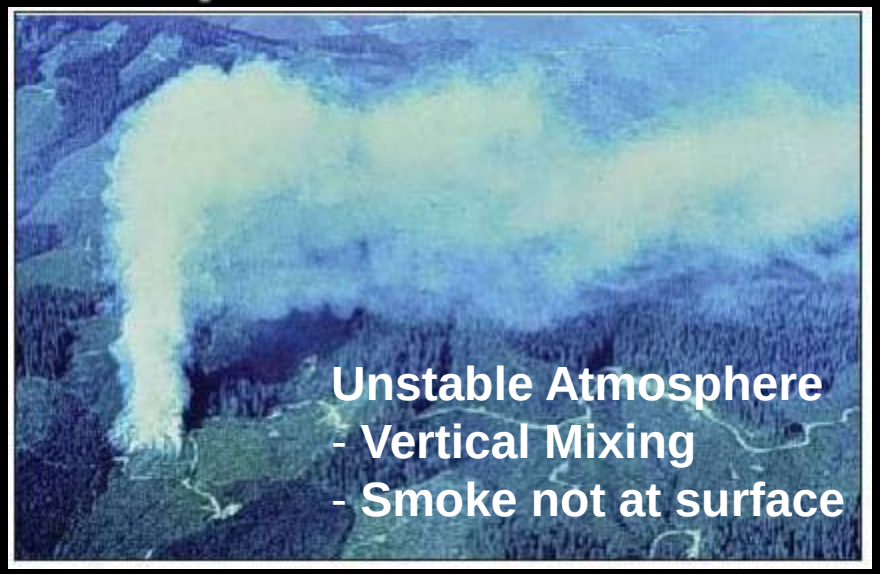
- Smoke Management is about managing the emissions from fire to reduce downwind impacts.
- Smoke is unlike most other pollutant sources – a control can not be put on it to scrub the emissions.
- Smoke Management Guide for Prescribed and Wildland Fire, 2001 (http://www.treesearch.fs.fed.us/pubs/5388)

Smoke Dispersion

- Where is my smoke going to go? How thick could it be?
  - Identify Meteorological Conditions promoting smoke dispersion
  - Identify Sensitive Receptors
  - Smoke Dispersion Modeling
    - Simple Smoke Screening Tool
    - Standalone Dispersion Models (ex. VSMOKE)
    - Centralized web-based smoke dispersion systems (ex. BlueSky)

Smoke Behavior
Atmospheric Dispersion

- Meteorological information can help with managing smoke
  - Pressure
  - Atmospheric Stability
  - Mixing Height
  - Temperature Inversions
  - Wind Speed and Direction



Smoke Behavior
Valley Flows

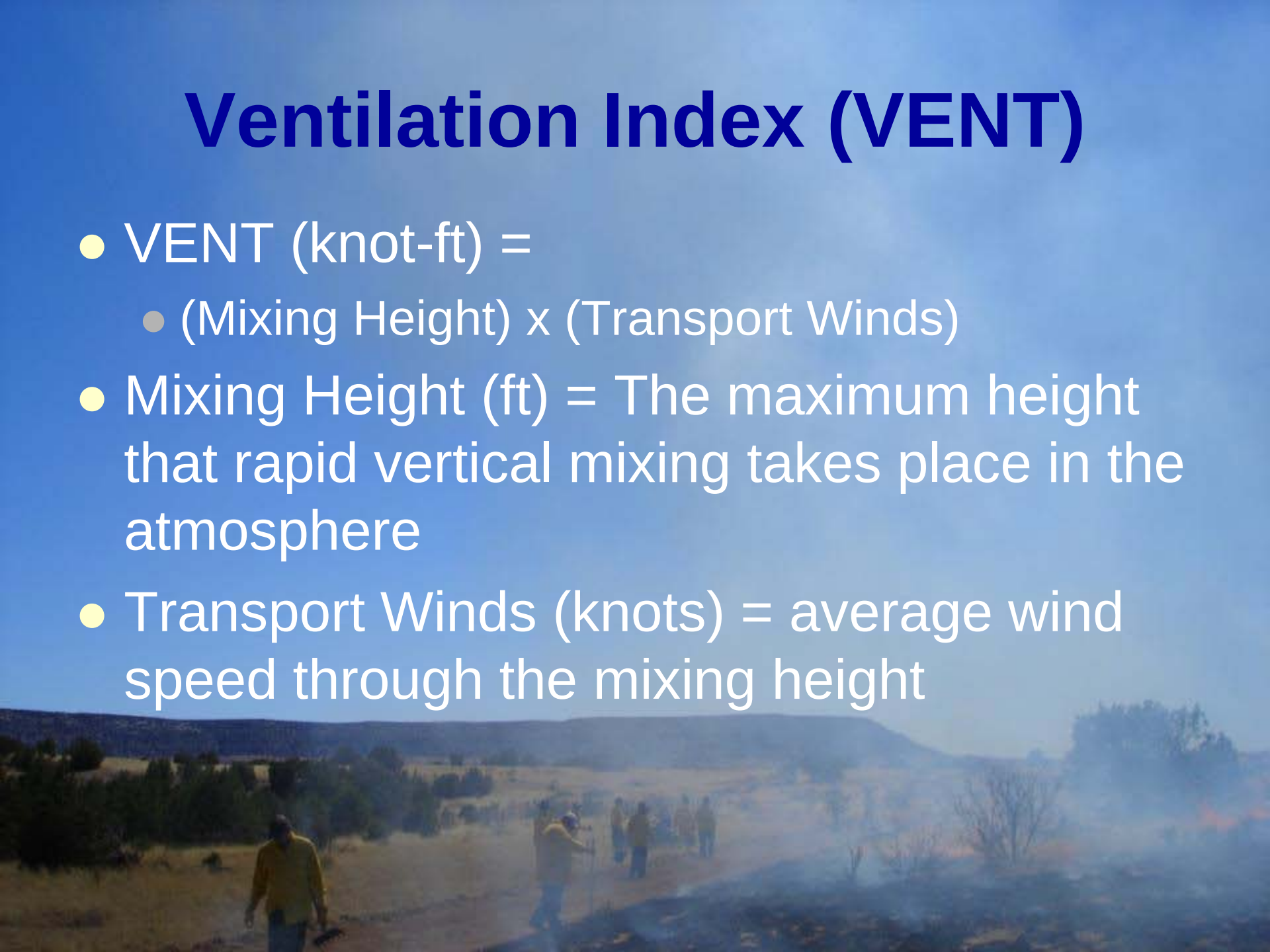

Photo by Roger Ottmar.

- Smoke caught under a valley inversion

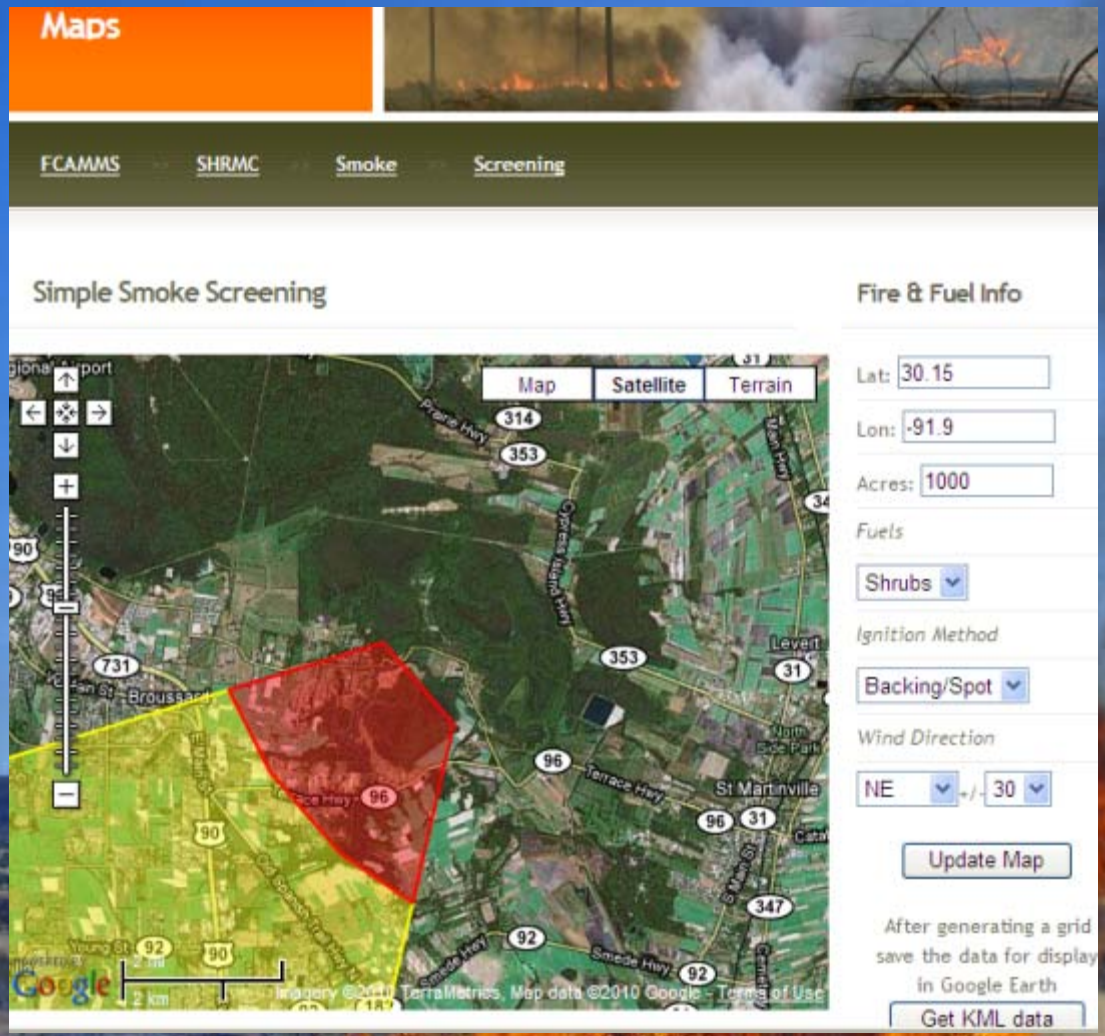
- Smoke can be transported by down-valley winds in the morning

Ventilation Index (VENT)

- VENT (knot-ft) =
  - (Mixing Height) x (Transport Winds)
- Mixing Height (ft) = The maximum height that rapid vertical mixing takes place in the atmosphere
- Transport Winds (knots) = average wind speed through the mixing height



Simple Smoke Screening Tool

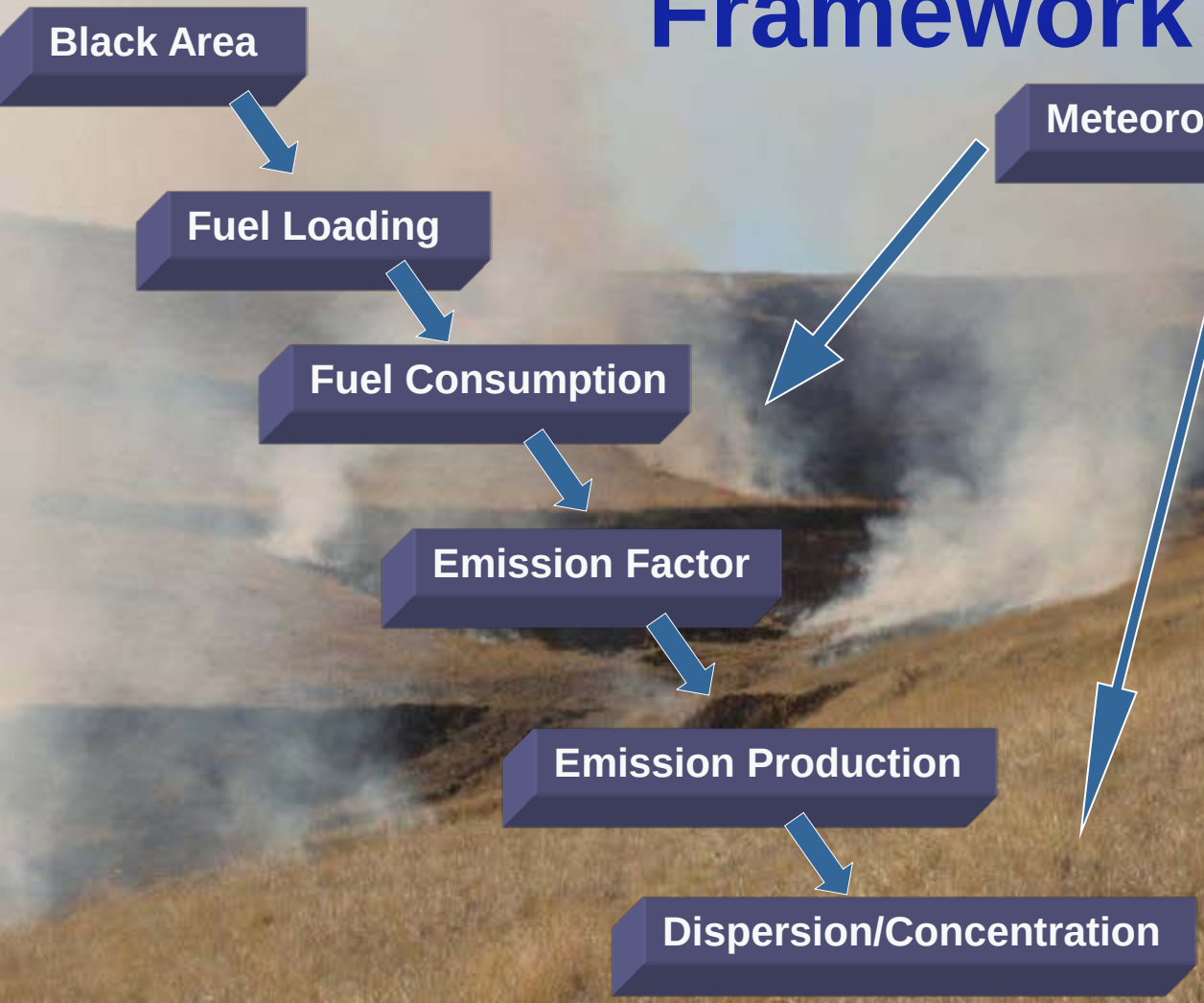


http://shrmc.ggy.uga.edu/

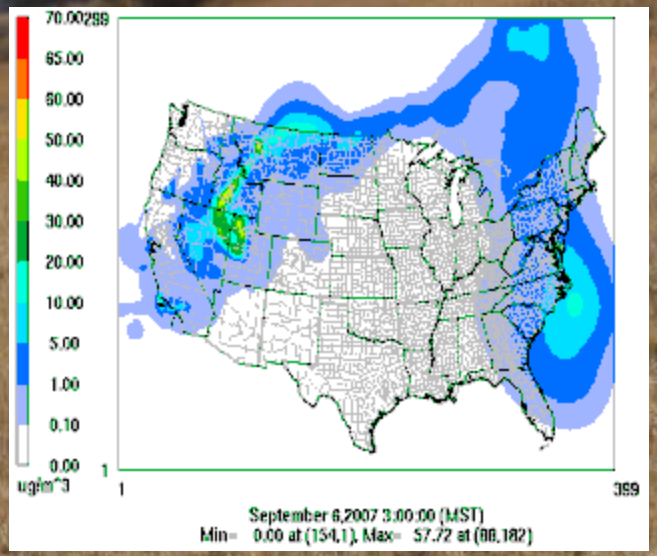
- Select: Smoke Products -> Smoke Screening
- Google Map application
  - Zoom-in
  - View Smoke Sensitive Areas
- Enter Location, Acres, Fuel type, ignition method, wind direction
- Can also do manually on a map

From the Southern Forestry Smoke Management Guide
http://www.srs.fs.usda.gov/pubs/viewpub.php?index=683

BlueSky Smoke Modeling Framework



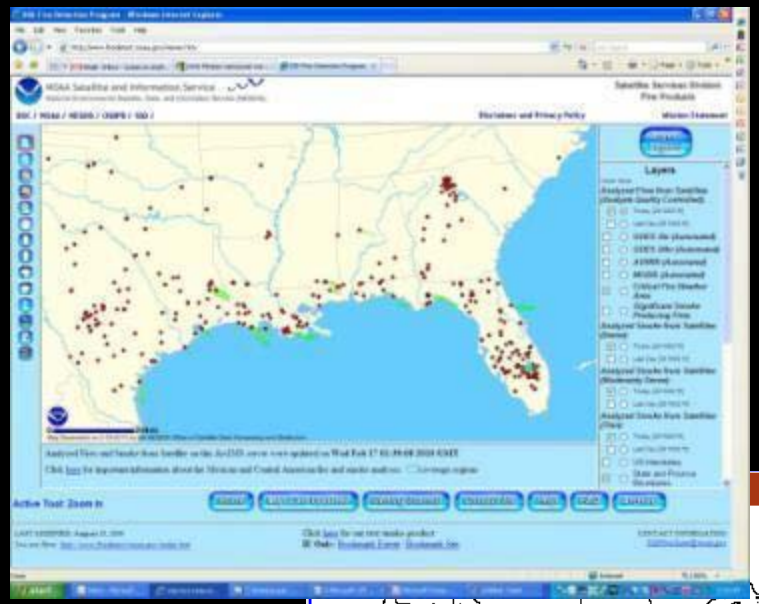
- Surface PM2.5 Concentrations from wildfire and prescribed fires
- Centralized web-based

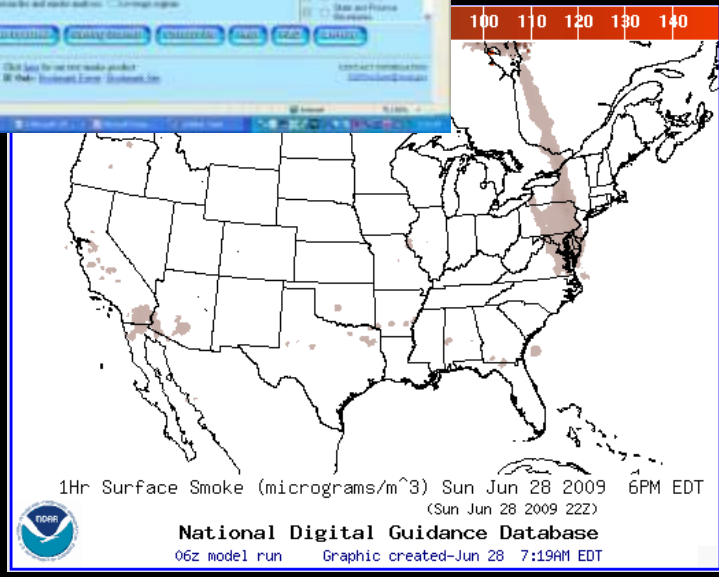


Centralized websites under development:
www.blueskyframework.org, www.getbluesky.org

Satellite Fire Detections and Smoke Plumes

- NOAA Hazard Mapping System (HMS)
  - Satellite Fire Detections, Plume Analysis
  - Current conditions
- NOAA HYSPLIT Dispersion Model
  - Smoke Plume Forecast
  - Based on Satellite Fire Detections





- http://www.osdpd.noaa.gov/ml/land/hms.html
- http://www.arl.noaa.gov/smoke_forecast.php

- NASA Earth Observatory
- Natural Hazards

http://earthobservatory.nasa.gov/

NWCG Smoke Committee (SmoC)

- One of 14 Committees chartered under the National Wildfire Coordinating Group (NWCG)
- Current Members: USFS, NPS, FWS, BLM, BIA, NASF, NRCS, NACAA
- Products, Topics and Issues
  - Training
  - National Smoke Management Website: www.nifc.gov/smoke
  - www.myfirecommunity.net “Air Quality and Fire Issues” Neighborhood
  - Fire emissions: Black Carbon, NO2, GHGs, PM2.5, Ozone precursors
  - Smoke Monitoring
  - Exceptional Events
  - Federal Fire Policy


The Great Smoke-Out of ‘75
White River
Roosevelt Lake
Photo Damage
Globe
Sun City
Scotts-dale
Mesa
Apache Jct
Phoenix
Arizona Smoke Management Program

Arizona Smoke Management Program

- 1) Wildland and Prescribed Fires
  - Federal and State Agencies follow
  - TNC and Tribes voluntarily participate
  - Each burn permitted daily
    - up to 20-30 burns/day
  - USFS and BLM fund a smoke coordinator, AQ DEQ provides work/office space
- http://www.azdeq.gov/environ/air/smoke/index.html

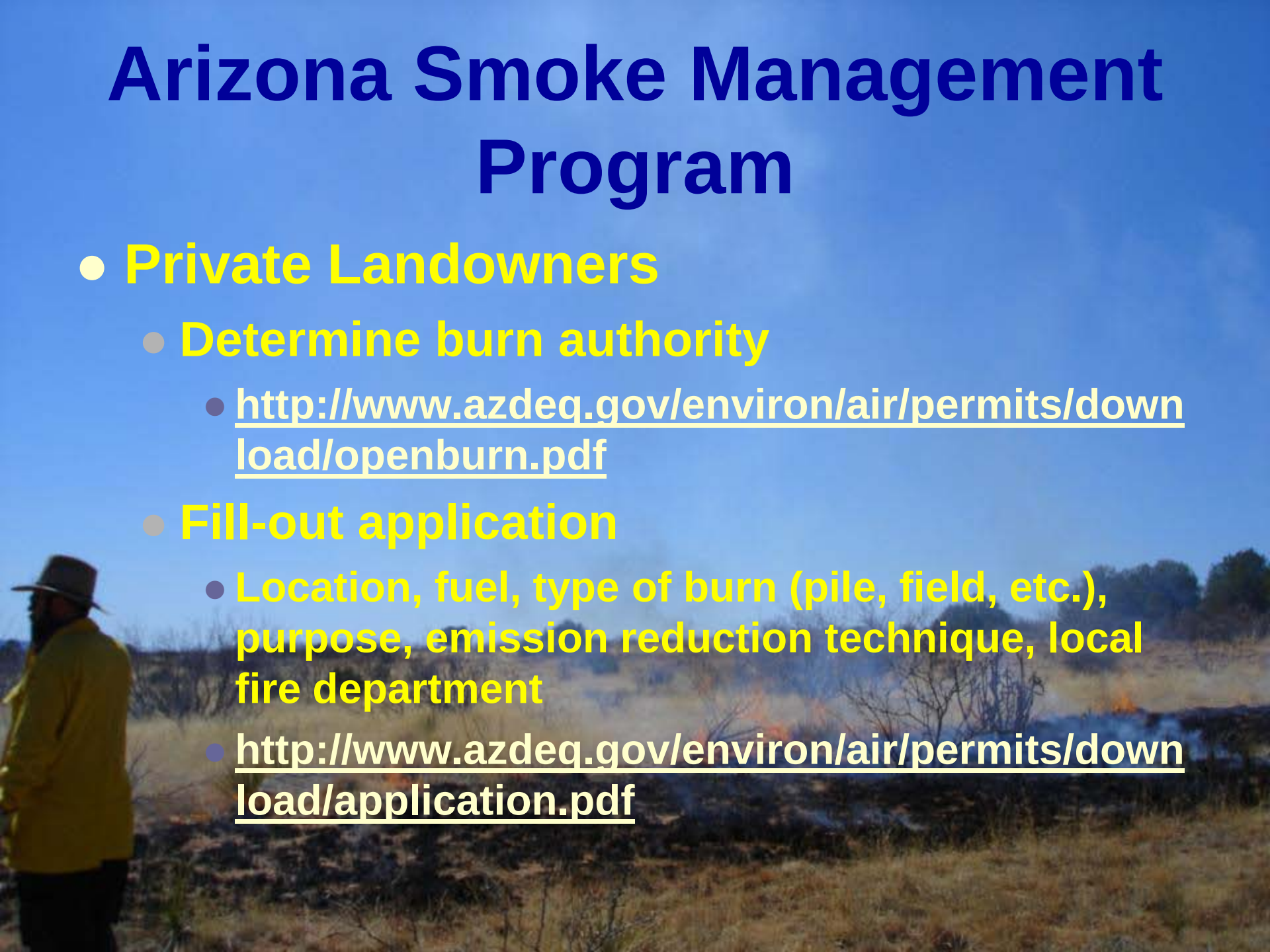
Arizona Smoke Management Program

- 2) Open Burning
  - Private, Agriculture, Rangeland, Backyard Burning
  - Permit is typically an annual permit
  - Work through local jurisdiction or State DEQ
  - Submit annual accomplishment info
  - Private burners can collaborate with federal burners

- http://www.azdeq.gov/environ/air/permits/class.html#open

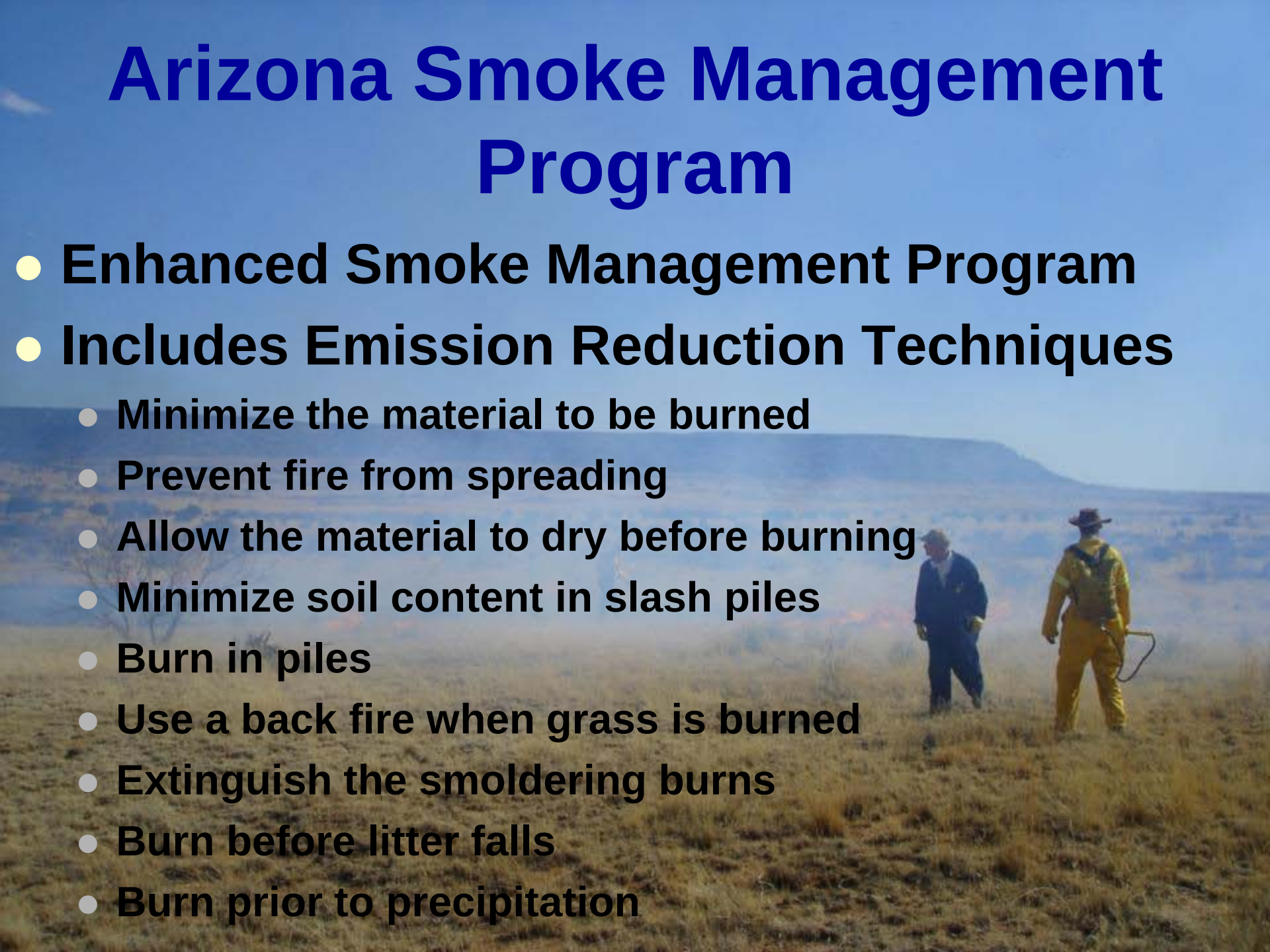
Arizona Smoke Management Program

- Private Landowners
  - Determine burn authority
    - http://www.azdeq.gov/environ/air/permits/download/openburn.pdf
  - Fill-out application
    - Location, fuel, type of burn (pile, field, etc.), purpose, emission reduction technique, local fire department
    - http://www.azdeq.gov/environ/air/permits/download/application.pdf



Arizona Smoke Management Program

- Enhanced Smoke Management Program
- Includes Emission Reduction Techniques
  - Minimize the material to be burned
  - Prevent fire from spreading
  - Allow the material to dry before burning
  - Minimize soil content in slash piles
  - Burn in piles
  - Use a back fire when grass is burned
  - Extinguish the smoldering burns
  - Burn before litter falls
  - Burn prior to precipitation



Arizona Fire Weather

- Arizona NWS Fire Weather Forecasts
  - Mixing Height, Winds (surface, transport), RAWS, Ventilation, Temperature, Humidity, Fire Danger, Point Forecasts
  - Flagstaff: http://www.wrh.noaa.gov/fgz/fwx/fwx.php?wfo=fgz
  - Tucson: http://www.wrh.noaa.gov/twc/firewx.php
  - Phoenix: http://www.wrh.noaa.gov/psr/
- Southwest Coordination Center http://gacc.nifc.gov/swcc/

Thank you! Questions, Comments, Discussion

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Photo courtesy Lorraine Vogt