

# Use of GIS in Emergency Response (iCRAM: I CAN Read a Map!)

William Purtymun, Rachel Hixson, and  
Alan Woodward

LA-UR-12-20780

“We do not see with our eyes. We see with our brains... What we see is only what our brain tells us we see, and it’s not 100 percent accurate.”

— John Medina, [\*Brain Rules\*](#)

Which direction are we headed in?



# Geographic Information Systems

- GIS has made mapping more accessible.
- Accessibility has lead to a surge in available data.
- Just because maps are now easy to make does NOT mean everyone will understand what your map is showing!
- What you have been asked to create might not be what the end user had in mind.

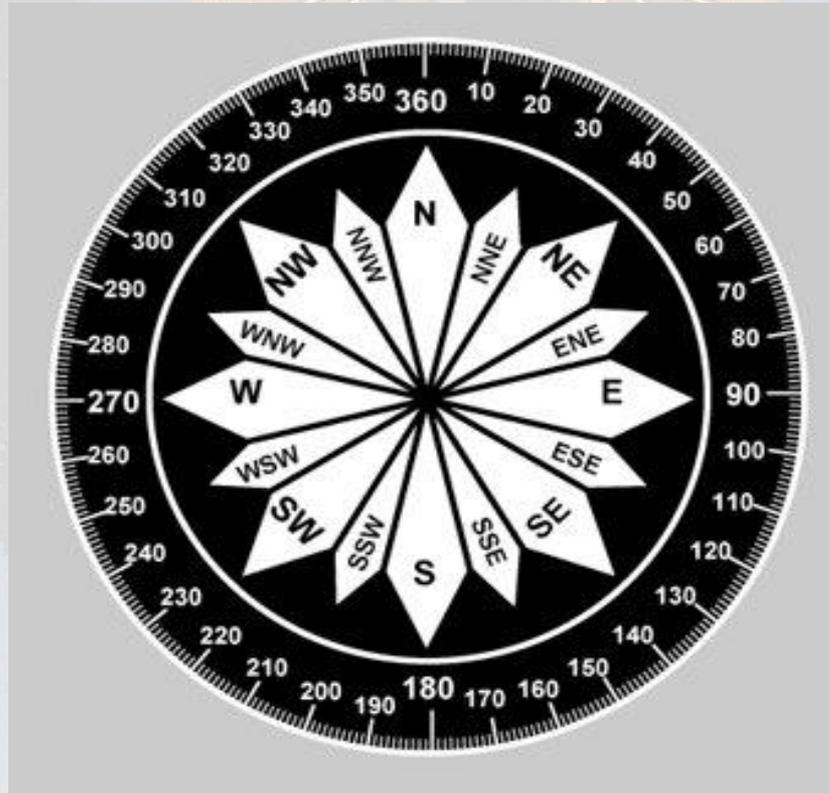
# GIS and Emergency Response

- Wide variety of tools are now available to emergency responders.
- Tools are only as useful as their user's ability to operate them.
- It is particularly important for emergency responders to be able to relate a map to reality.



# What Makes a Good Map?

- Title – a LOT of information can be garnered from the title!
- North Arrow. Usually the top of the map is North, but not always!



# What Makes a Good Map?

- Scale Bar – crucial for knowing distances.
- Theme – you can't show everything in one map.
  - Fire resources
  - Water resources
  - Transportation
  - Power lines
  - Medical facilities
  - Cultural features
  - Response features (i.e. hydrants, muster areas, extinguishers, etc.)
- Legend – tells you what you are looking at!
  - And where acronyms should be spelled out!

# Beware of Acronyms

Acronyms

[https://hseep.dhs.gov/pages/1001\\_Acron.aspx](https://hseep.dhs.gov/pages/1001_Acron.aspx)

- We all use MLAs
- DOE, NNSA, and DHS love acronyms, so does Emergency Management.
- LANL has an acronym book over 150 pages long.
- ICS/NIMS calls for the use of clear communication and limits the use of acronyms.

<b>AAR</b>	After-Action Report
<b>A/V</b>	Audio/Visual
<b>C&amp;O</b>	Concept and Objectives
<b>C/E</b>	Controller and Evaluator
<b>C/E Handbook</b>	Controller and Evaluator Handbook
<b>CBRNE</b>	Chemical Biological Radiological Nuclear or Explosive
<b>CDC</b>	Centers for Disease Control and Prevention
<b>CI/KR</b>	Critical Infrastructure/Key Resources
<b>COSIN</b>	Control Staff Instructions
<b>CPX</b>	Command Post Exercise
<b>CSEPP</b>	Chemical Stockpile Emergency Preparedness Program
<b>CSID</b>	Centralized Scheduling and Information Desk
<b>CST</b>	National Guard Civil Support Team
<b>DHS</b>	U.S. Department of Homeland Security
<b>DoD</b>	U.S. Department of Defense
<b>EEG</b>	Exercise Evaluation Guide
<b>EMA</b>	Emergency Management Agency
<b>EMS</b>	Emergency Medical Services
<b>EMT</b>	Emergency Medical Technician
<b>EOC</b>	Emergency Operations Center
<b>EOD</b>	Explosive Ordnance Disposal
<b>EOP</b>	Emergency Operating Procedure
<b>EPA</b>	U.S. Environmental Protection Agency
<b>EPW</b>	Exercise Plan Workshop
<b>EVPLAN</b>	Evaluation Plan
<b>EXPLAN</b>	Exercise Plan
<b>FAA</b>	Federal Aviation Administration
<b>FBI</b>	Federal Bureau of Investigation
<b>FE</b>	Functional Exercise
<b>FEMA</b>	Federal Emergency Management Agency
<b>FOUO</b>	For Official Use Only
<b>FPC</b>	Final Planning Conference
<b>FSE</b>	Full-Scale Exercise
<b>G&amp;T</b>	Office of Grants and Training
<b>HazMat</b>	Hazardous Materials
<b>HHS</b>	U.S. Department of Health and Human Services
<b>HSEEP</b>	Homeland Security Exercise and Evaluation Program
<b>HSGP</b>	Homeland Security Grant Program
<b>IC</b>	Incident Command
<b>ICS</b>	Incident Command System
<b>IP</b>	Improvement Plan
<b>IPC</b>	Initial Planning Conference
<b>LLIS</b>	Lessons Learned Information Sharing
<b>MOA</b>	Memorandum of Agreement
<b>MOU</b>	Memorandum of Understanding
<b>MAA</b>	Mutual Aid Agreement
<b>MIPT</b>	National Memorial Institute for the Prevention of Terrorism
<b>MPC</b>	Mid-Term Planning Conference
<b>MSDS</b>	Material Safety Data Sheet
<b>MSEL</b>	Master Scenario Events List

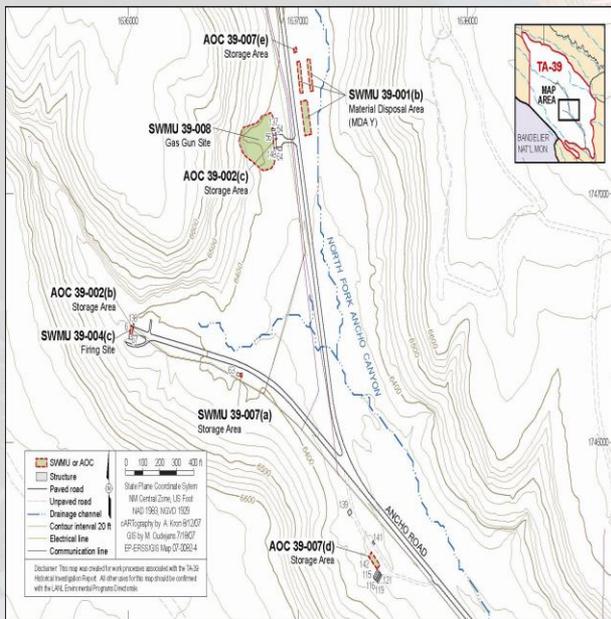
2 of 3

4/17/12 12:46 PM

# Ancho Fire Example

**“Often the stress lies in the interpretation of the event not the event itself.”**

With no legend on the original map the AOC acronym not defined. A guess was made AOC= Area of Contamination so it was assumed we had a contamination event. But an AOC in this case was defined as Area Of Concern which is a release that may warrant investigation or remediation and is not a solid waste management unit (SWMU).



**Ancho Canyon Fire, June 2008**

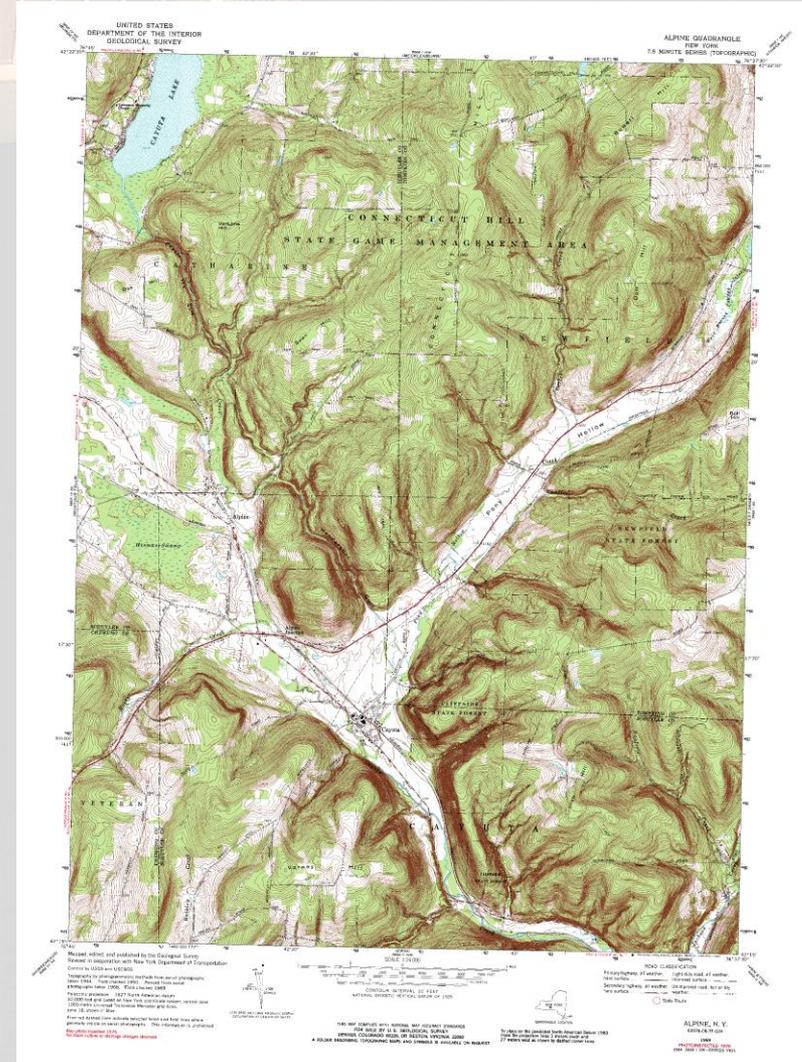
**Locations of of TA-39 SWMUs and AOCs in Subaggregate Area 2, central area**

# We Are Where?



# Maps

- There is an art to creating a useful map.
- Different information needed by different users.
- Different organizations need different types of maps.
- Different groups within organizations require different types of information on a map.





# Creating a Useful Tool

- Create a map with the USER in mind.
- Make it as intuitive as possible.
- Teach the user what standard symbols, acronyms, are for your organization.
- Encourage questions and check before the map goes out to the field.

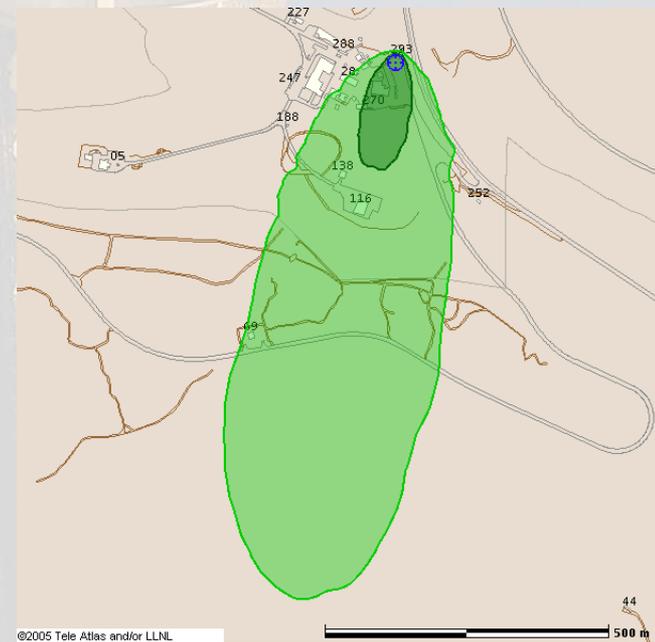
# GIS for Emergency Response

- GIS for ER is essentially an interactive map.
- Creating an intuitive map with GIS is achieved by:
  - User input
  - User training
  - Incorporating changes as lessons are learned
- GIS can help speed up response if users are familiar with their tools.

LA-UR-12-20780

# LANL EOC Examples

- Training – we try to be consistent with symbology in maps and GIS.
- There are still some areas of confusion:
  - NARAC Protective Action Areas vs. Area of Potential Contamination.
  - NARAC reports are great if they are read.
- If a map has no legend then people Make Stuff Up or MSU.



What is this?? Whar's the rest of the report ???  
Whar's the Legend???

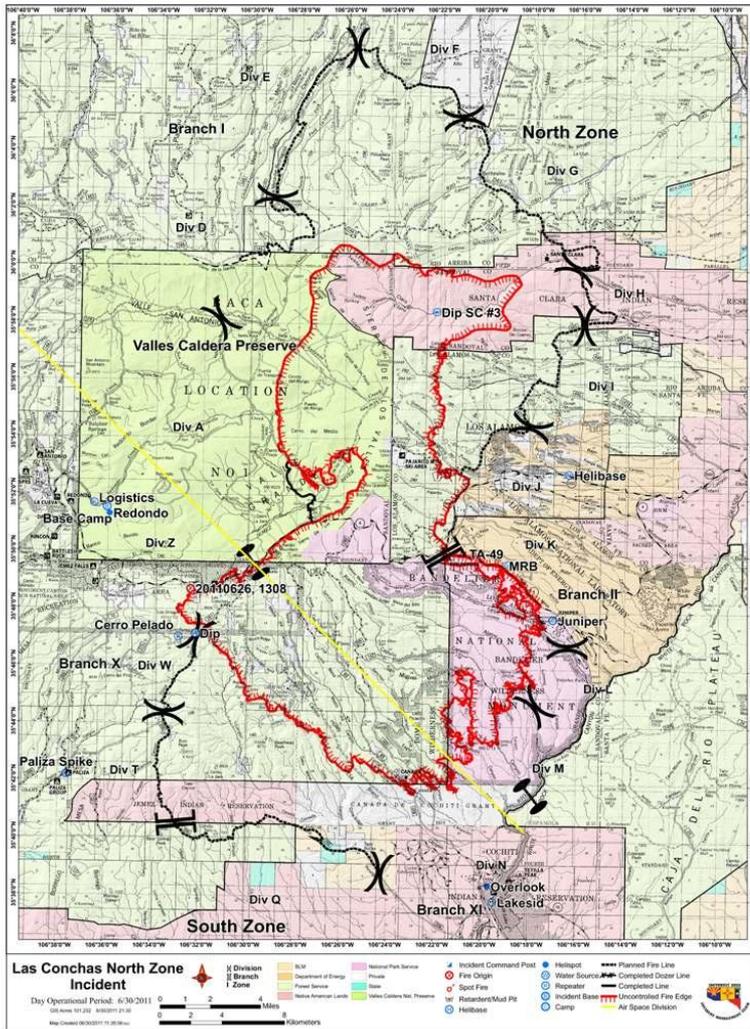
# LANL EOC Examples



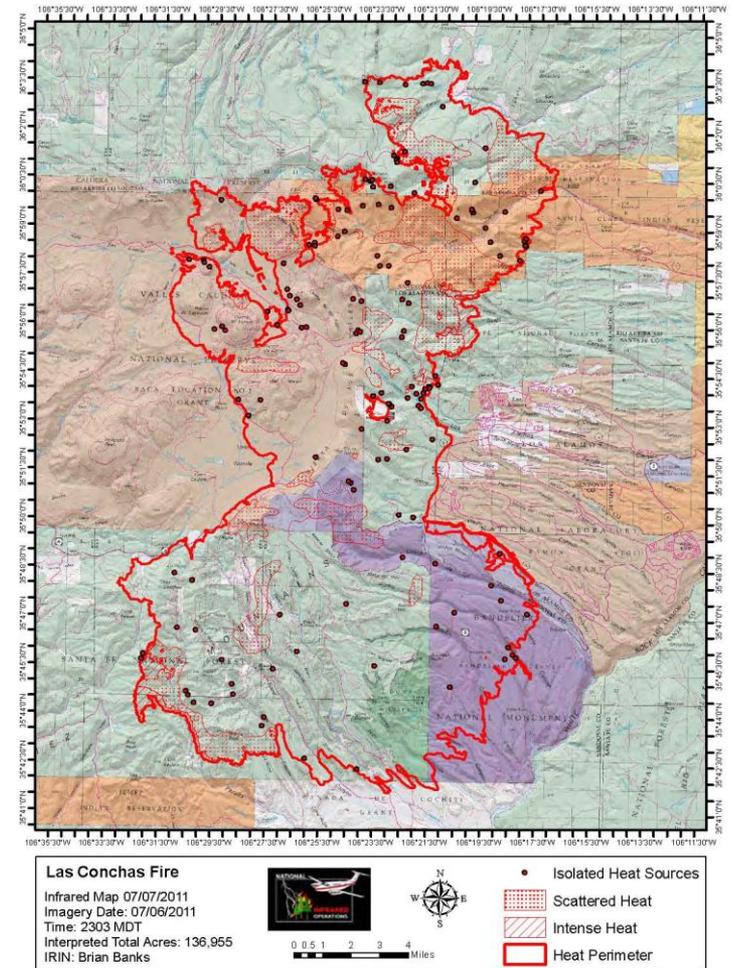
Model simulation does not necessarily predict the exact course of reality.

# Las Conchas Fire Examples

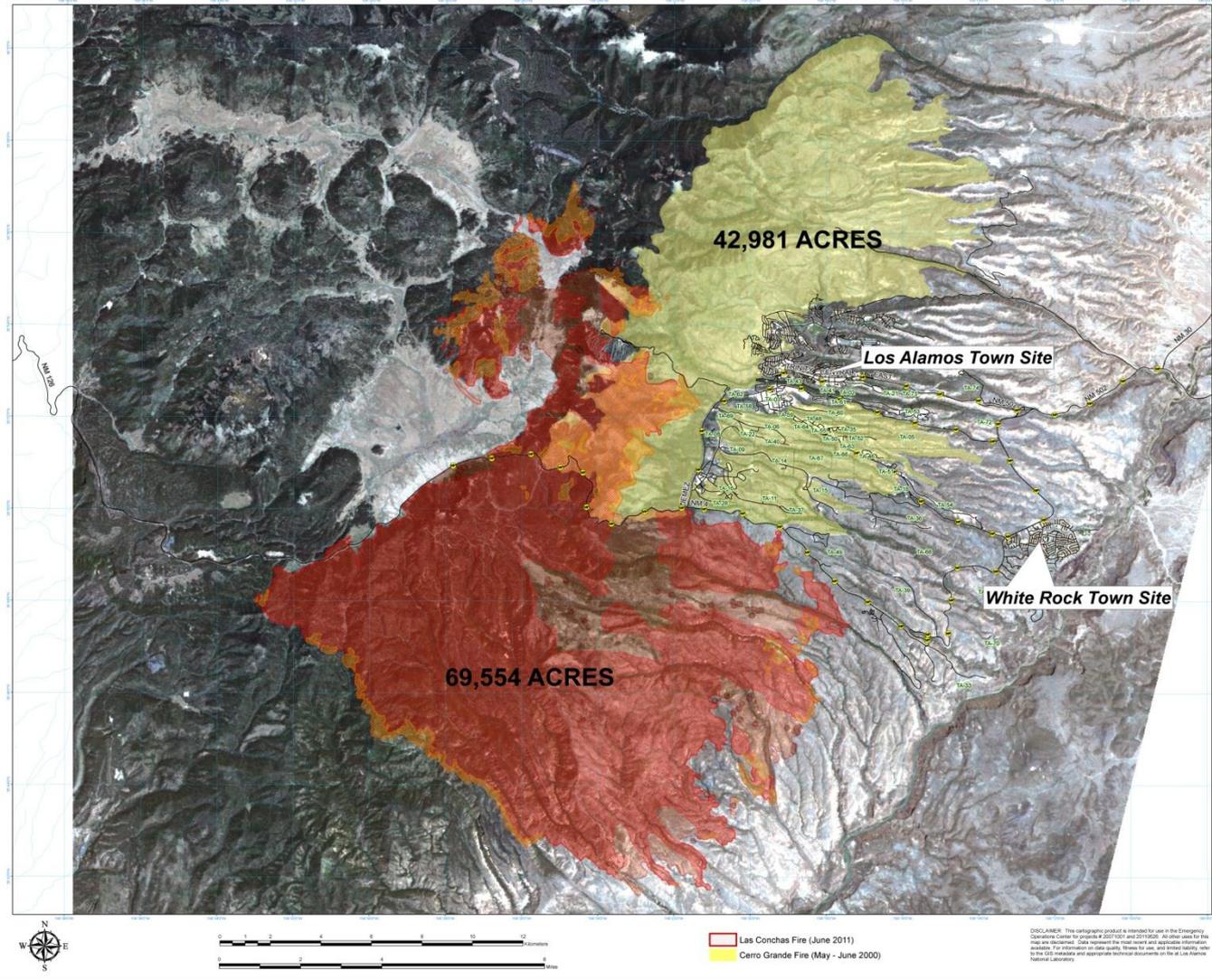
- Many types of maps were needed during response to Las Conchas Fire:
  - Forest Service IR Burn Area Delineation Maps
  - Firefighting Divisions Map
  - Overlay of this fire vs. Cerro Grande
  - EOS map from MODUS.....
    - Caused problems with resolution and grid cells
  - Depiction allowed us to gather additional data outside of LANL
  - Fire Progression Maps
  - Fire Mitigation Maps
  - General maps of Los Alamos for out of town fire fighters



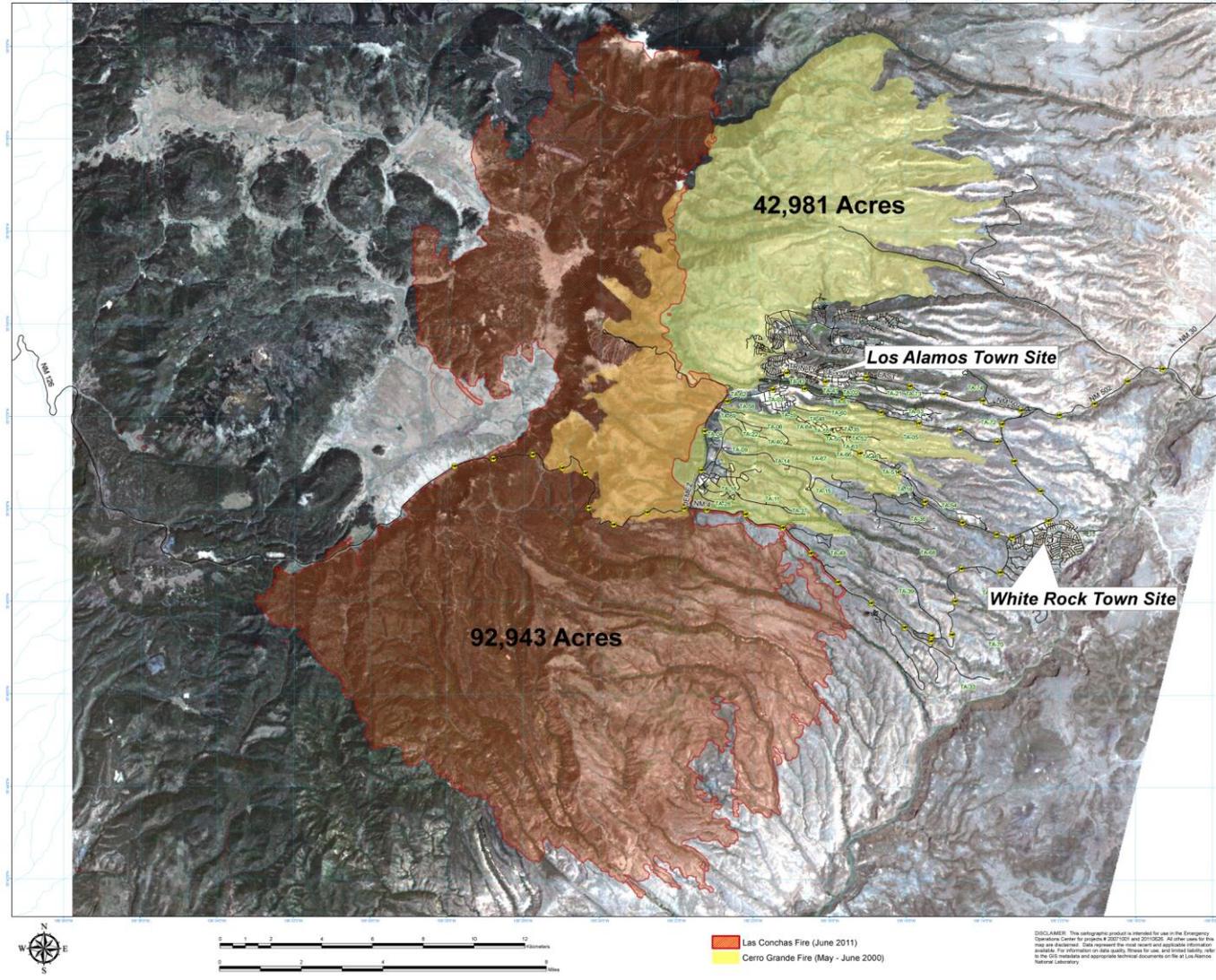
Division Map



IR Map



## Las Conchas Fire / Cerro Grande Fire Overlay

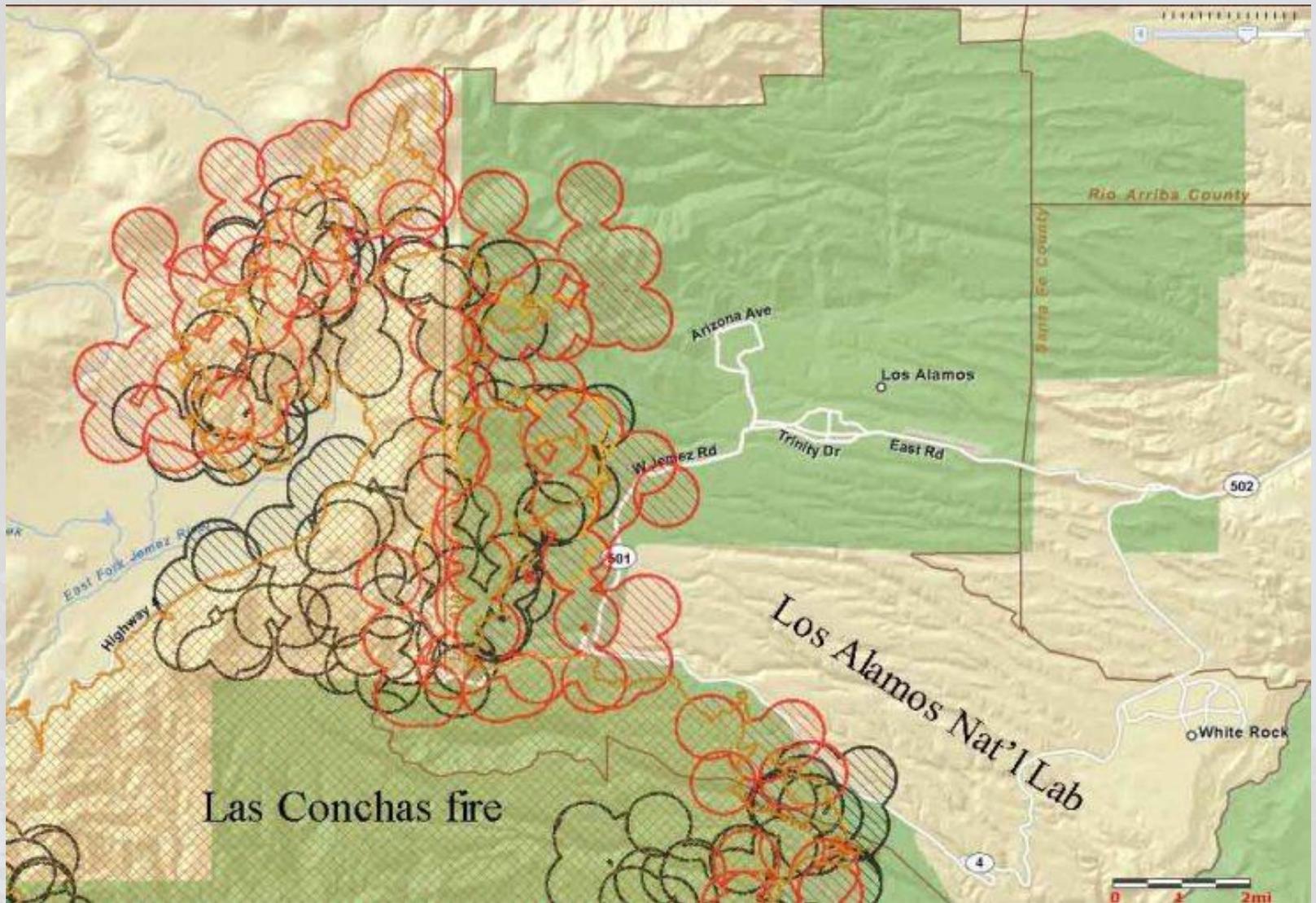


## Las Conchas Fire / Cerro Grande Fire Overlay

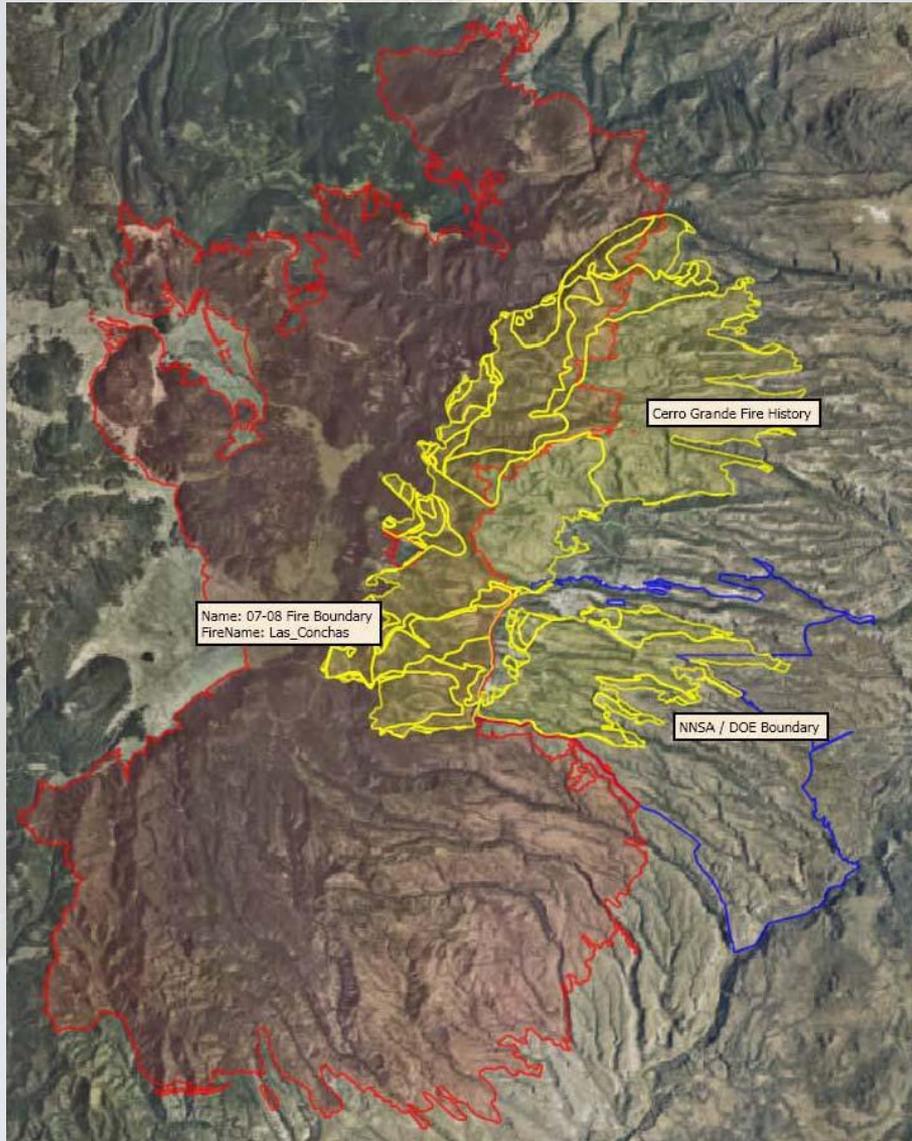
LA-UR-12-20780



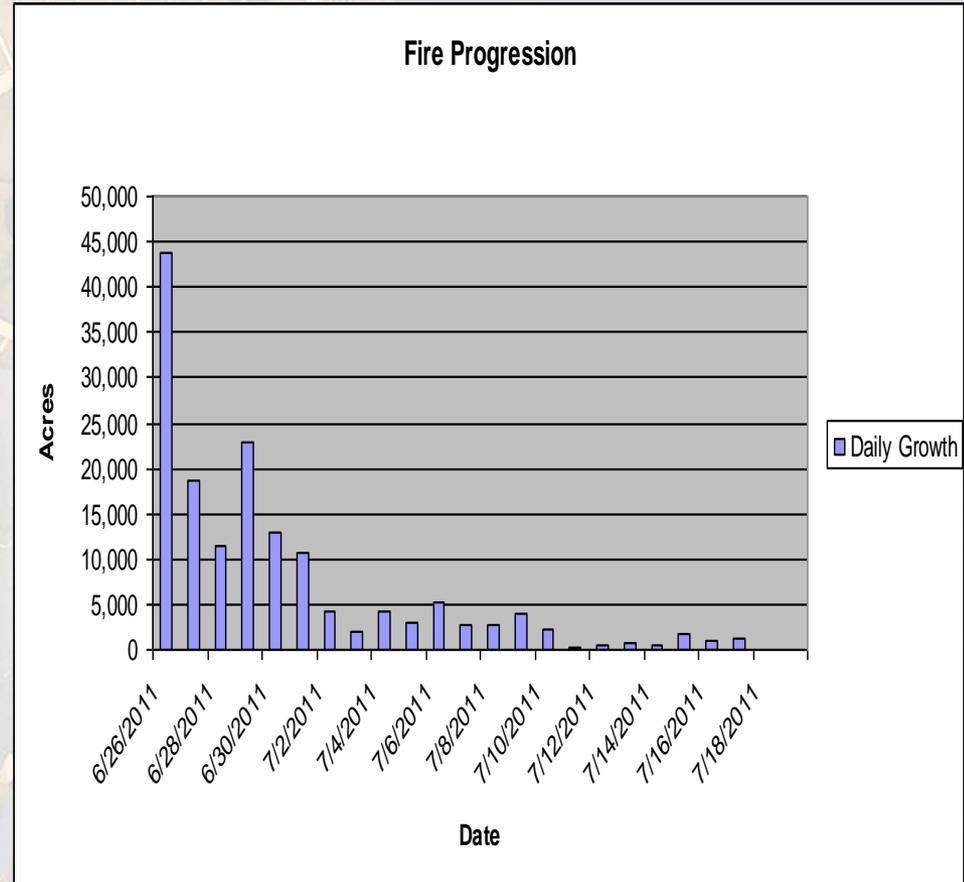
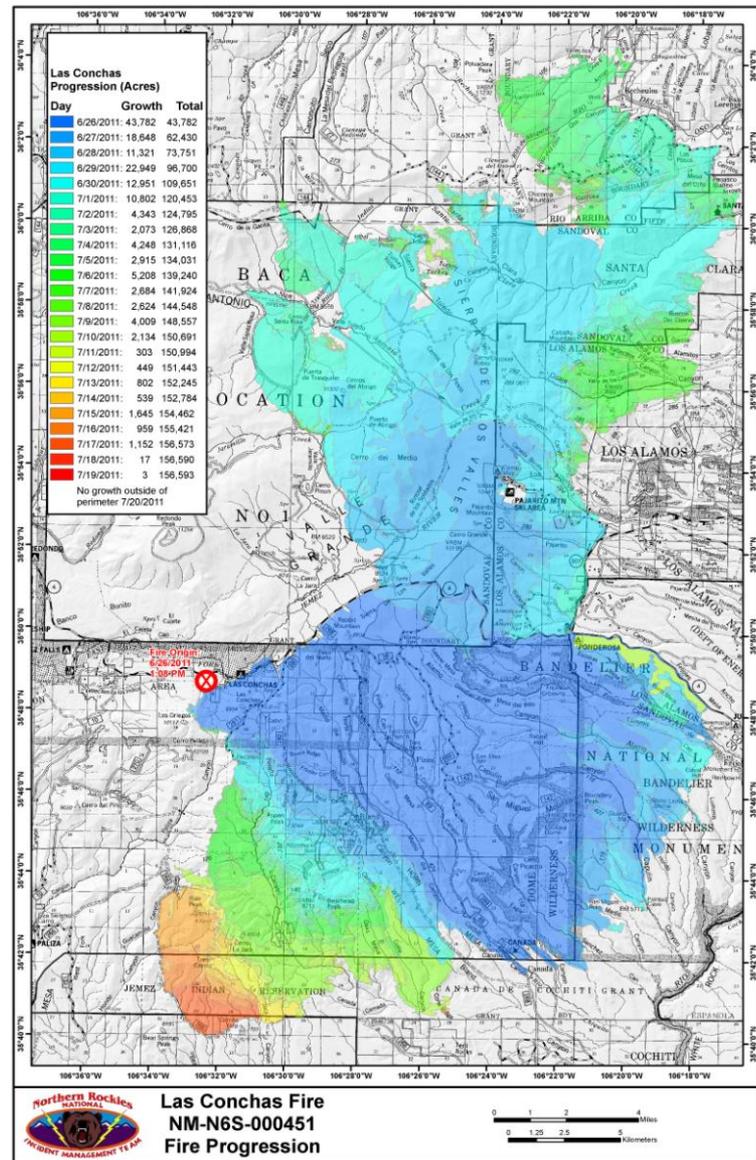
Earth Observing System (EOS) Satellite View



Due to coarse resolution of NASA's MODIS satellite, the fire appeared to the public to be on Lab property.



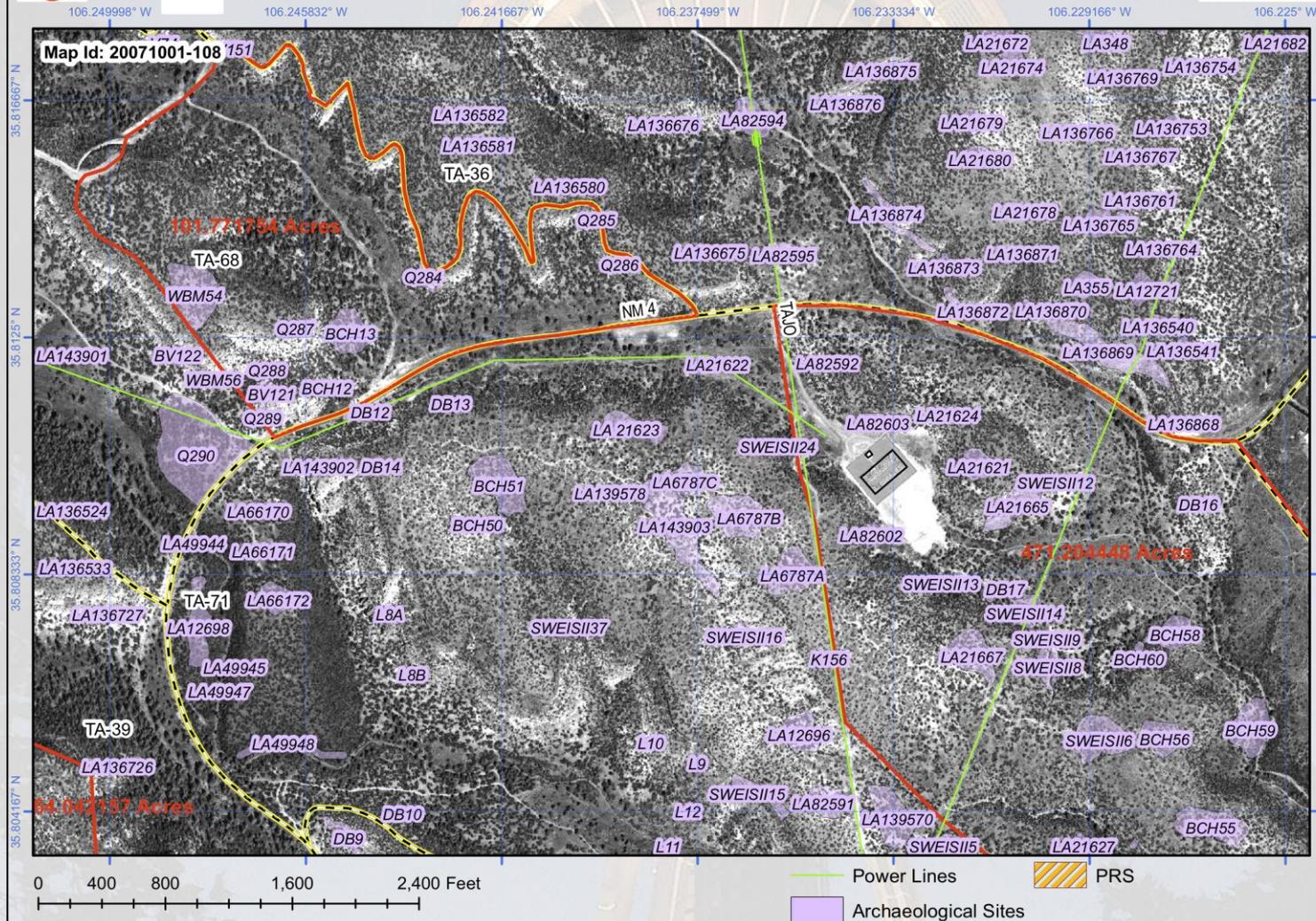
Raw data from Depiction enabling us to show the full extent of the fire.



USFS fire progression map and graph.



# State Road 4 TA-68 LOS ALAMOS NATIONAL LABORATORY



Mitigation map

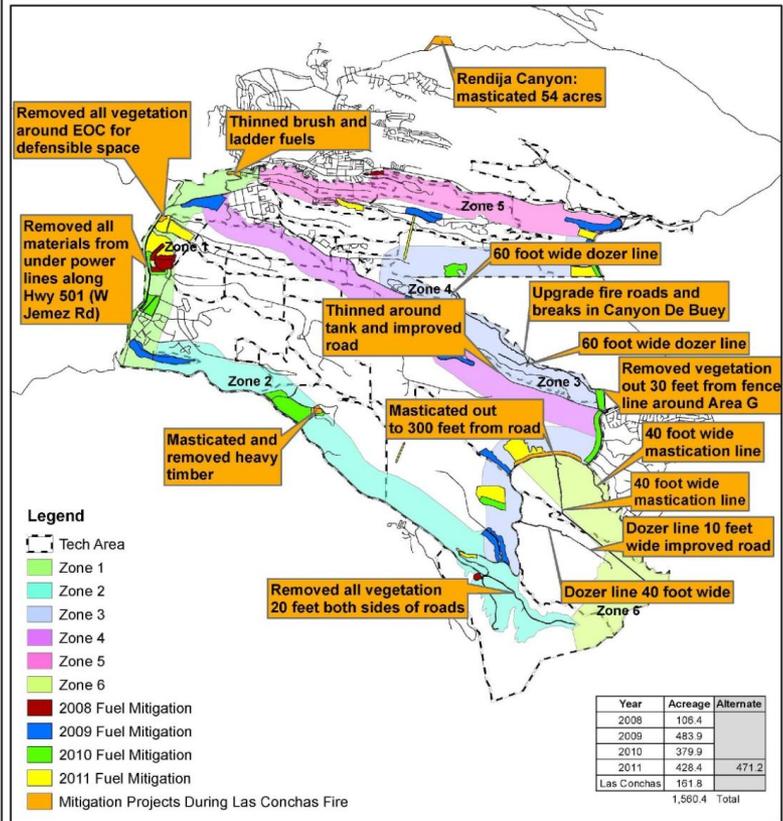
LA-UR-12-20780



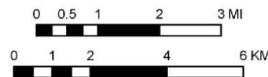
# OVERVIEW MAP

## WILDFIRE MITIGATION PLANNING

### LOS ALAMOS NATIONAL LABORATORY



Emergency Management & Response  
 Date: 20110707  
 Map ID: 20071001-008



## Mitigation map

# Lessons from Las Conchas

- Having a variety of maps lead to some confusion.
  - Clear titles with time and date saved the day.
- Acronyms not clear to everyone.
  - MP in general map stands for “Mile Post” not “Military Post”.
- Having pre-made maps helped with time and usability.



# Lessons (continued)

- Having a variety of maps and GIS can lead to a faster turn around and enhance situational awareness.
- Being able to modify maps for different users is key as response priorities change.
- For planning we now have a variety of base maps in the EOC in preparation for different emergencies.



# Lessons (continued)

- Where are you and where do you stand?
  - Working with your organization so that everyone understands your baseline maps is very important.
  - Training is essential when introducing GIS to an organization.
- Not everyone has extensive experience with maps.
  - Be sure to keep an eye on how maps are being used and what is being said about them.



# Summary

- GIS and maps are essential tools in emergency response situations.
- Training people to read your maps is key to success.
- Having base maps as part of emergency planning is key to successful use in response.



Are we headed in the right direction?

