

San Diego GIS Response During the 2007 Firestorm

Paul Hardwick
Regional GIS Project Manager
SDSU Research Foundation
Regional Technology Center for Homeland Security



Center for Homeland Security

- Interoperable
GIS
- Interoperable
Communications
- Technology
Clearinghouse

Regional Technology
Center

**SDSU Research Foundation
And
SDSU Center for Homeland Security
Technology Assessment**

Governance Structure

Policy &
Funding

SANDAG
Public Safety
Committee

Unified Disaster
Council

Policy Committees

Advisory &
Oversight

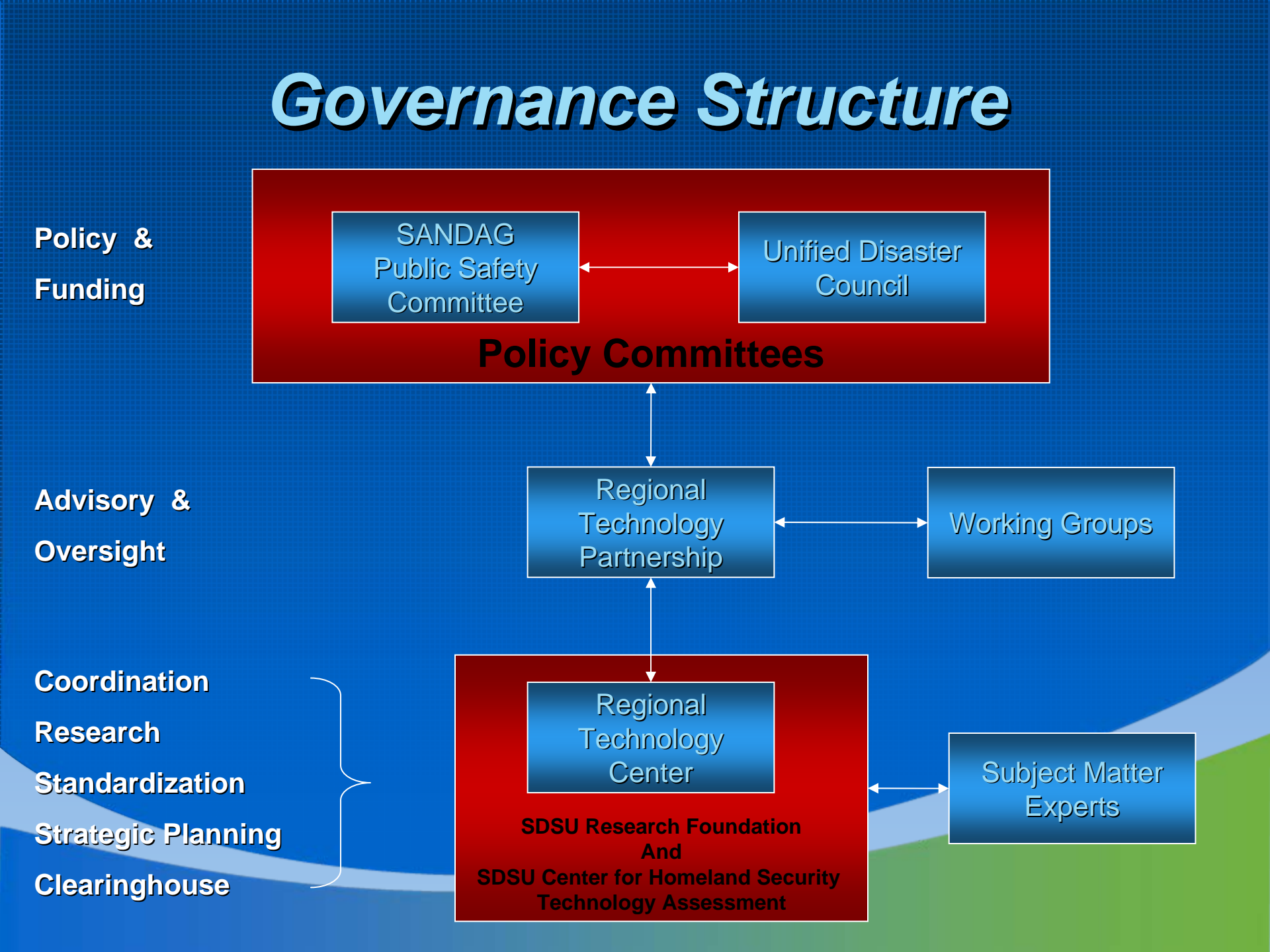
Regional
Technology
Partnership

Working Groups

Coordination
Research
Standardization
Strategic Planning
Clearinghouse

Regional
Technology
Center
SDSU Research Foundation
And
SDSU Center for Homeland Security
Technology Assessment

Subject Matter
Experts



Office of Emergency Services



Geospatial Database

- Critical Infrastructure
- Situational Awareness
- Common Operating Picture
- Information Integrator

Geospatial technology allows for multiple sets of information to be analyzed, modeled, and correlated in order to find patterns that can lead to improved strategies for prevention, response, and mitigation.

2003 Firestorm



2003 Lessons Learned

- Established GIS positions within the County Office of Emergency Services for day to day operations and EOC response during an incident
- Maintain a local geospatial data instance
- Identified key on-line mapping resources from various State and Federal agencies that could provide key information during an incident
- Created mapping templates
- Trained County GIS Analyst as a Geographic Information System Specialist for incident response

GIS SOP

- National Wildfire Coordination Group
www.nwccg.gov
- Geographic Information Systems Emergency Standards of Operation
- Damage Assessment Standard Operating Procedures



COUNTY OF SAN DIEGO • DEPARTMENT OF PLANNING AND LAND USE
BUILDING DIVISION

EMERGENCY RESPONSE & DAMAGE/SAFETY ASSESSMENT STANDARD OPERATING PROCEDURES

BACKGROUND

The unincorporated area of San Diego County is subject to catastrophic events such as wildfires, earthquakes and floods. Following such events, it is an important function of the Building Division to assess the structural stability of private structures damaged in a disaster in order to determine whether structures are safe for occupancy. It is also important to maintain a written record of the damage inspected in order to provide the information to the media, Board of Supervisors, DCAO's Office, County Assessor's Office (property tax purposes) and insurance companies (assist in settlement claims). Depending upon the type of disaster, the department's responsibilities will differ slightly, but the basic damage/safety assessment procedures will be essentially the same.

PURPOSE

The purpose of the Standard Operating Procedures (SOP) is to ensure public safety, health, and welfare during a declared emergency by receiving, assessing, and recording damage information on PRIVATE structures resulting from a disaster or other emergency incident in the County of San Diego. This document expands upon the roles and responsibilities assigned to the Department of Planning and Land Use (DPLU), as outlined in the *Unified San Diego County Emergency Services Organization's Operational Area Emergency Plan, Annex N* and are intended to provide guidance for the Building Division and GIS staff during these disasters.

PROGRAM ORGANIZATION

The organizational chart for the Building Division Damage/Safety Assessment Response program is outlined in attached Exhibit A. At the top of the organization are various coordinators who are assigned specific responsibilities that must be implemented in response to a catastrophic event. The chart below identifies the program title, the Building Division position tasked to fill the title and a listing of general responsibilities (For specific responsibilities, refer to the section entitled "Duties and Responsibilities").

DAMAGE/SAFETY ASSESSMENT COORDINATORS

Title	Position	General Responsibility
Building Department Disaster Coordinator	Chief, Building Division	Department contact at the Emergency Operations Center.
Database Management-Report Writing Coordinator	Permit Processing Coordinator	Assessment data entry/management and completion of the final written report
Office Coordinator	Permit Processing Coordinator	Emergency plan check review and permit issuance (e.g. Emergency Temporary Occupancy Permits)

WebEOC

The screenshot shows two overlapping Internet Explorer windows. The foreground window is titled "https://www.aireoc.com - File Library - Microsoft Internet Explorer". The page content is a "Folder List" with the following items:

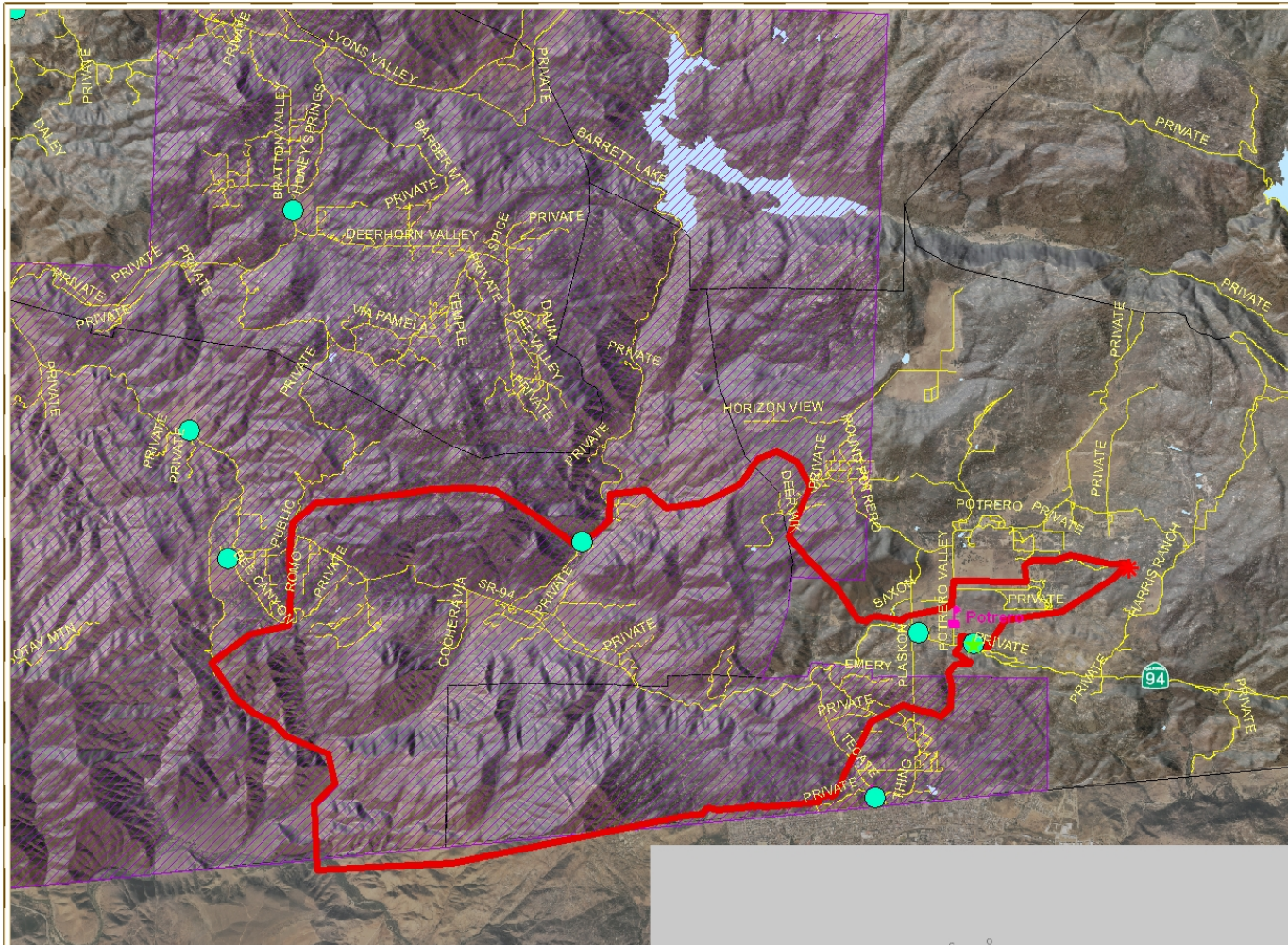
	Name
1.	COOP - BoS
2.	COOP - CSG
3.	COOP - FG3
4.	COOP - HHSA
5.	COOP - LUEG
6.	COOP - PSG
7.	County OES Documents
8.	Incident Data
9.	Maps
10.	Public
11.	WebEOC Images

The "Maps" folder is highlighted with a mouse cursor. The background window shows a form with fields for "Entry", "Save", "Spell Ch...", "Recommend fo...", "Post to Task Tr...", "Cont...", and "Quan...". The taskbar at the bottom shows "Done" and "Internet" icons.

2007 Fires



2007 Fires



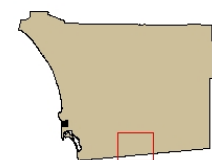
Harris Fire Fire Perimeter 1700 Hours October 21, 2007

Legend

-  origin
-  ICP Location
-  Schools
-  Roads
-  Schools
-  Approx. Evacuation Area
-  Approx. Fire Perimeter

Data Source: San GIS

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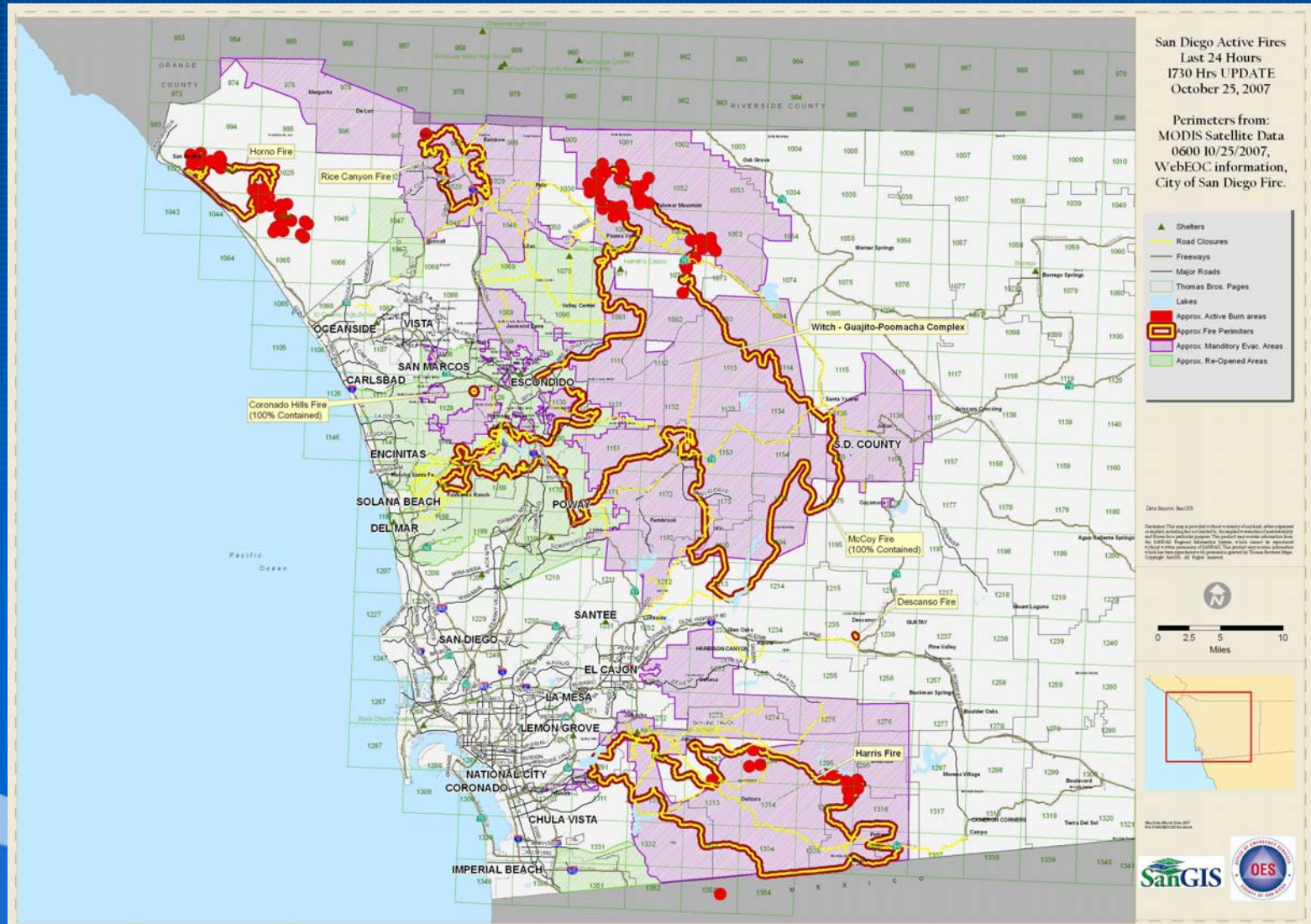


Map Date: March, 2006
Map Scale: 200' to 1" on Map

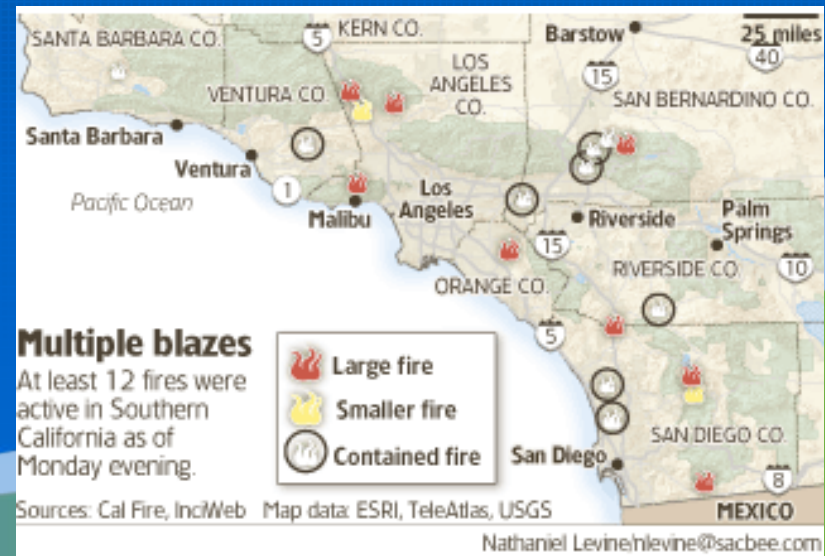


M E X I C O

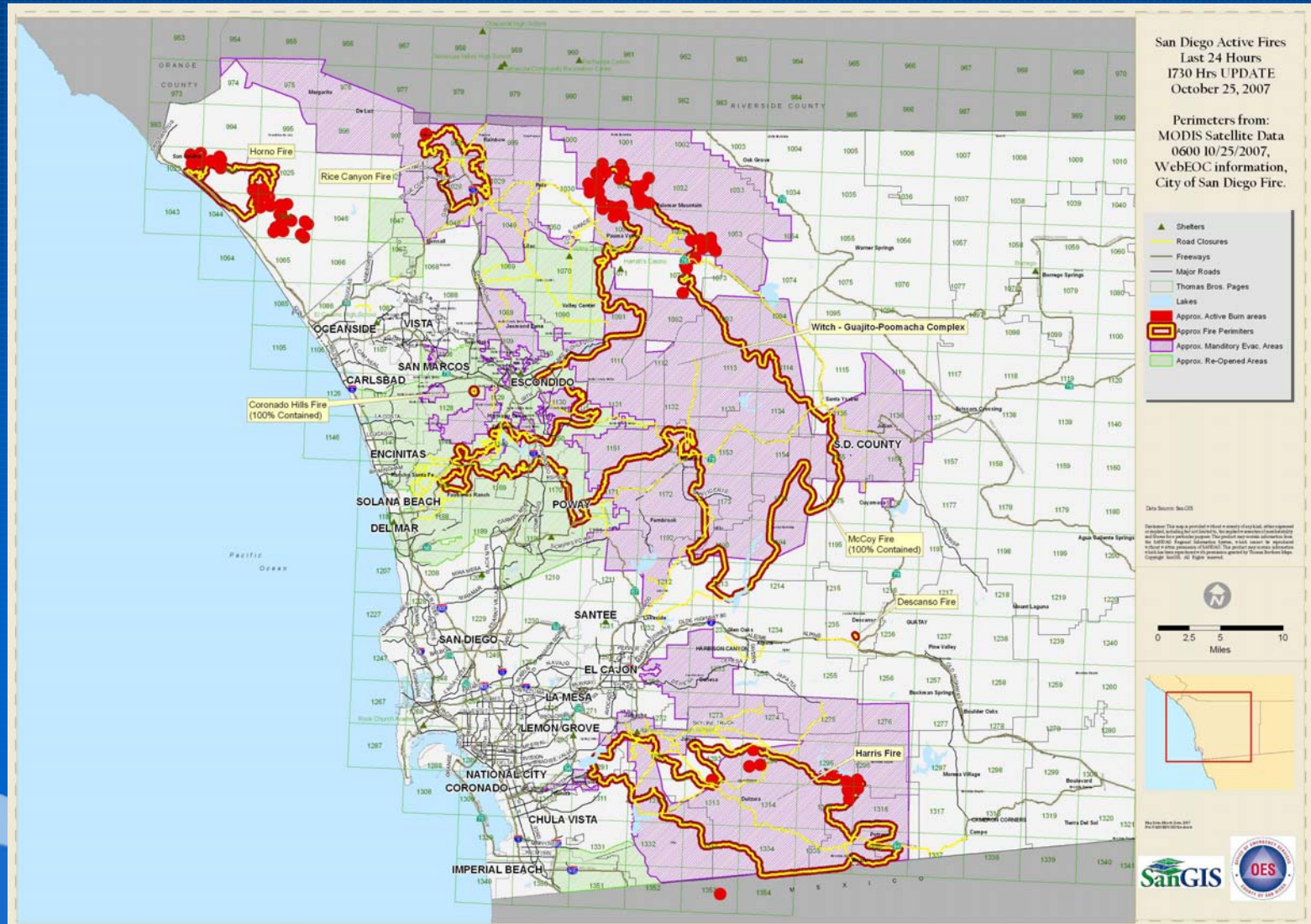
2007 Fires



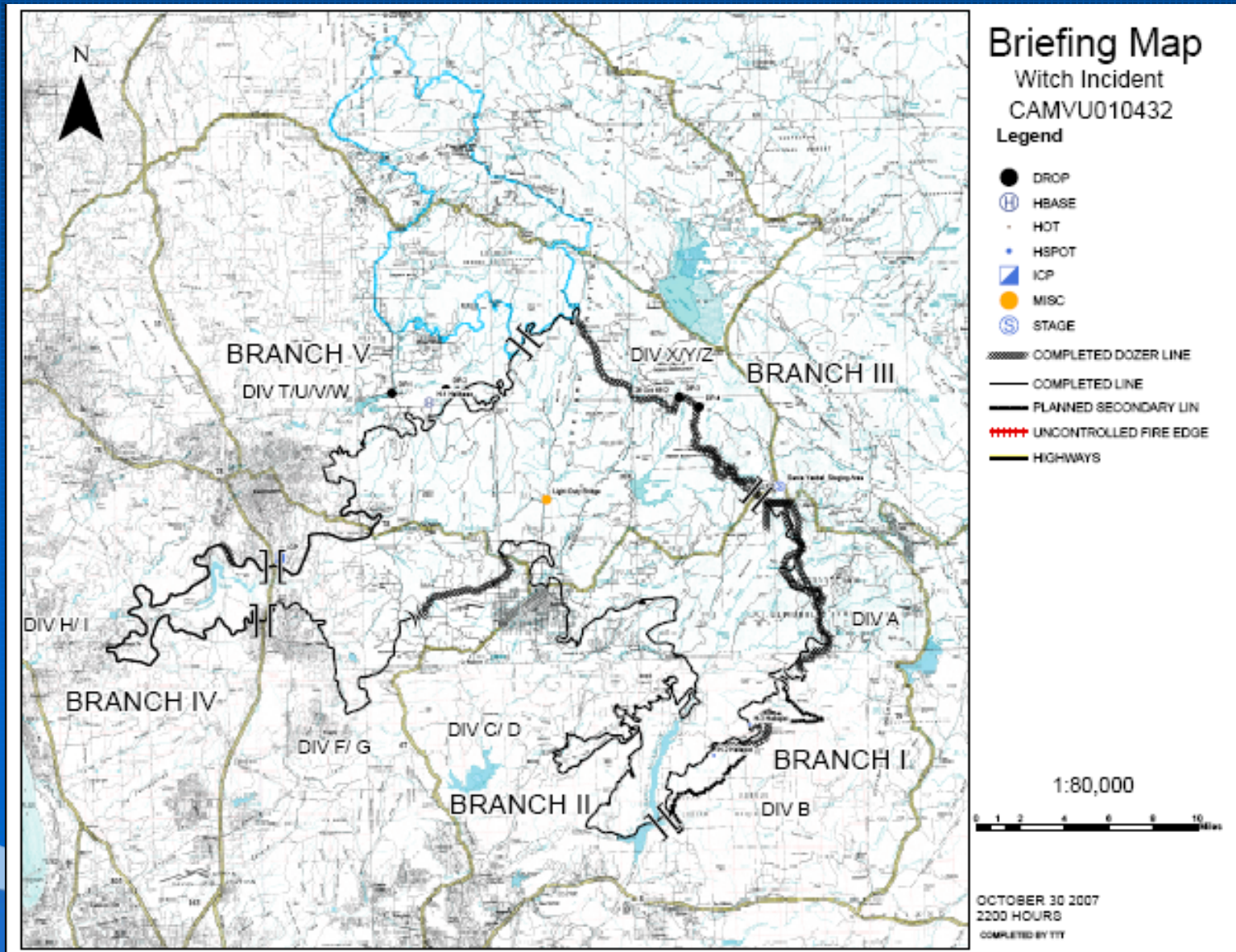
2003 Fires



2007 Fires

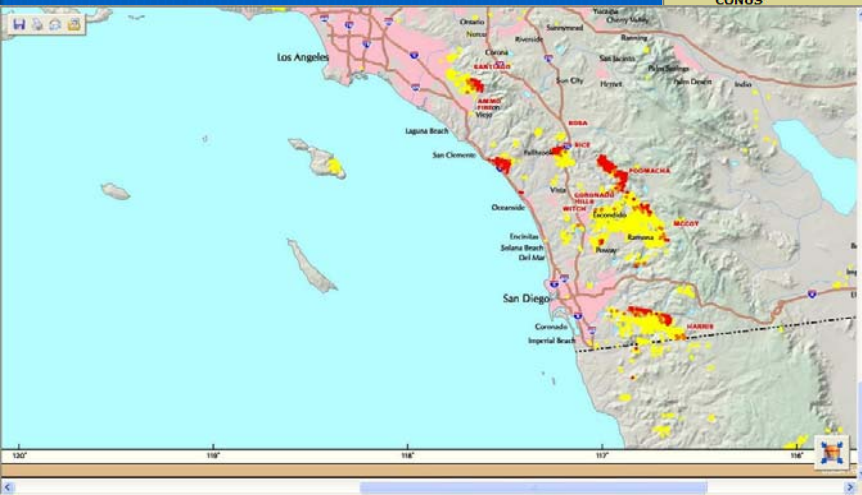


CalFire



MODIS Data

- Moderate Resolution Imaging Spectroradiometer
- Terra & Aqua
- 36 Spectral Bands
- 1KM Resolution



USDA FOREST SERVICE REMOTE SENSING APPLICATIONS CENTER

MODIS Active Fire Mapping Program

Search

- ▶ RSAC Home
- ▶ About Us
- ▶ Contact Us
- ▶ Programs and Services
- ▶ BAER
- ▼ Active Fire Maps
 - Current Large Fires
 - United States
 - Canada
 - Regional Maps
 - United States
 - Canada
 - ArcIMS Maps
 - CONUS

250-meter Georeferenced MODIS Surface Reflectance Subsets

Download this subset as 3-band JPEG or GeoTIFF, or as a 7-band BSQ (band sequential) image. [Click here](#) for a description of the MODIS spectral bands used for land remote sensing and subset projection information.

- JPEG
Bands 1, 4, 3 (True Color)
773.94 KB
- JPEG
Bands 7, 2, 1 (False Color)
820.68 KB
- BSQ
Bands 1 - 7 (BSQ)
24.45 MB
- True and False Color (GeoTIFF)
14.3 MB

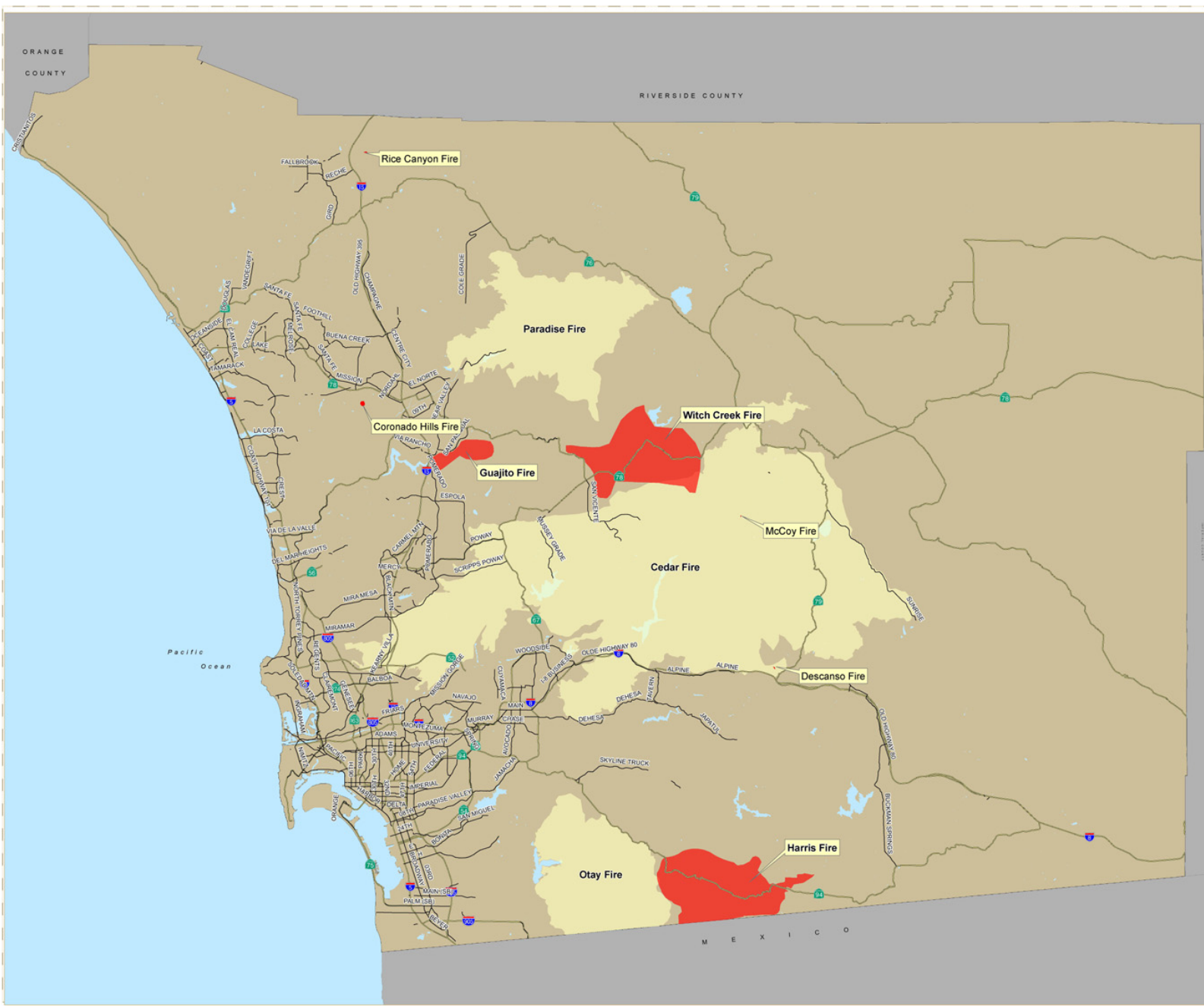
California_south
10/23/2007
21:38:18 GMT
Satellite: Aqua

Subset Acquisition Calendar

October 2007						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
30	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	1	2	3

These fire information products were compiled at the USDA Forest Service (USFS) Remote Sensing Applications Center in cooperation with NASA Goddard Space Flight Center, the University of Maryland, the National Interagency Fire Center, and the USFS Missoula Fire Sciences Lab.

San Diego Fires
01:00 October 22, 2007



Legend:

- Major Roads
- Freeways
- Current Fire Perimeters
- 2003 Fire Perimeters
- Lakes

Data Source: SanGIS
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North Arrow
 10 50 1 2 3 4 Miles



Mapfile: 0804_001_001
 10/22/07 08:00:00

SanGIS logo
 PART OF UNIVERSITY OF CALIFORNIA
 OES
 COUNTY OF SAN DIEGO

San Diego County
1100 Hrs UPDATE
October 31, 2007

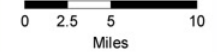
Perimeters from:
CAL Fire
MODIS Satellite Data
WebEOC information,
City of San Diego Fire.

- Local Assistance Centers
- Shelters
- Freeways
- Thomas Bros. Pages
- Lakes
- Approx. Fire Perimeters
- Cleveland National Forest
- Approx. Re-Opened Areas

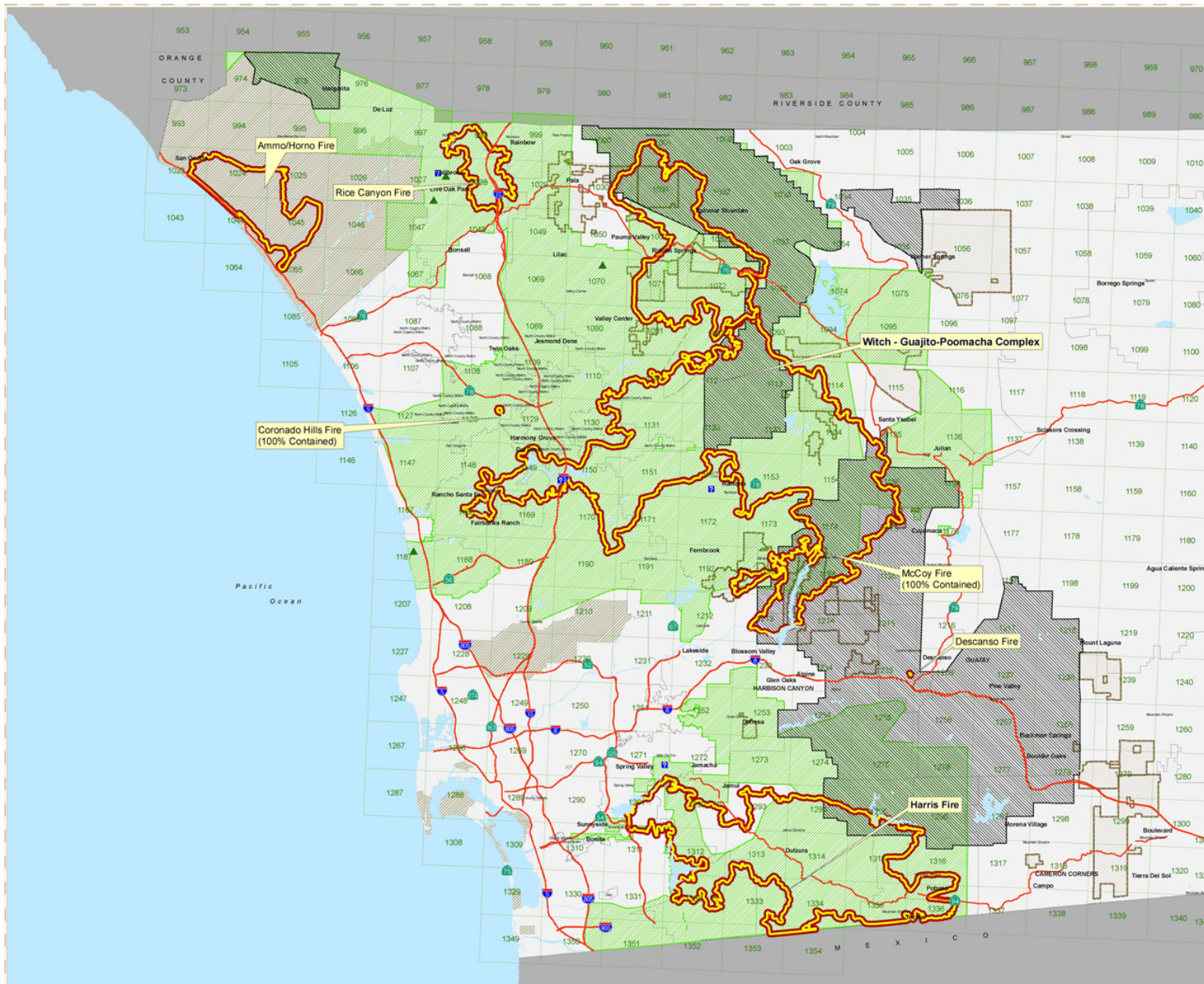
*Cleveland National Forest and BLM lands remain closed.

Data Source: SanGIS

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Map Date: October 31, 2007
Map File: FirePerimOct31.mxd



Staffing

- GIS Unit Leader
- GIS Logistics/Policy
- 2-3 Analyst/Technician
- GIS Communications Specialist
- Off-Site Analyst
- Field Analyst/Observer

12 hour shifts





ORANGE COUNTY

Respiratory Related Emergency Department Visits and 9-1-1 Calls 10/22/07 through 10/25/07

RIVERSIDE COUNTY

IMPERIAL COUNTY

Legend



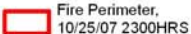
Participating ED



Hospital w/ED



Respiratory Related
9-1-1 Calls



Fire Perimeter,
10/25/07 2300HRS

Respiratory ED Visits



1 - 3



3 - 6



6 - 10



10 - 15



15 - 19



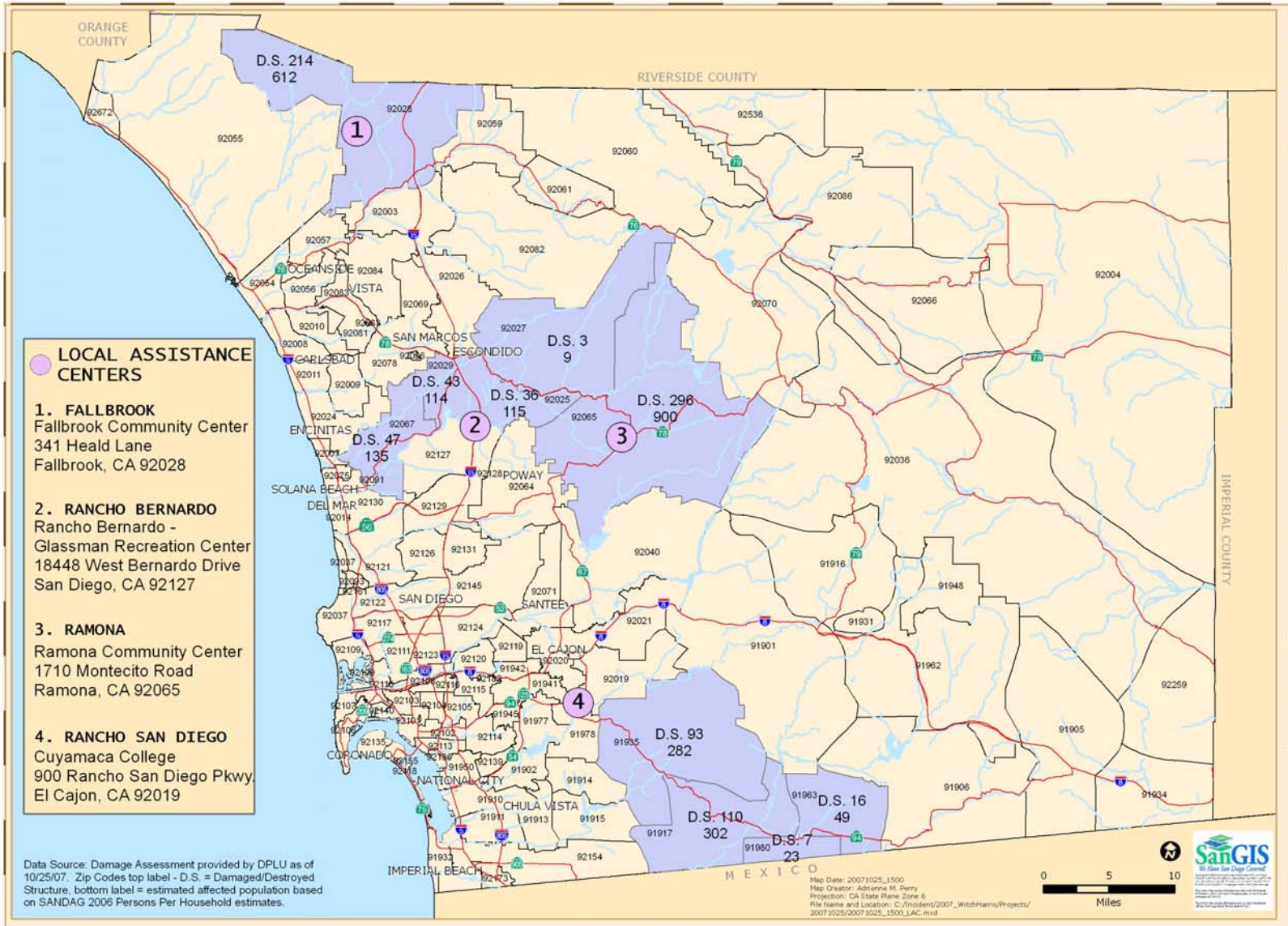
No Visits to Participating
Hospitals

Data Sources: Community Epidemiology Branch Surveillance Data; acquired from 8 participating hospitals (ED encounter data; Zip Code of residence), 3 participating call centers and FirstWatch (911 call data). Based on respiratory-related chief complaints for encounters and calls between 10/22/2007 and 10/25/2007.

Map Date: 20071026_1130
Map Creator: Adrienne H. Perry
Projection: CA State Plane Zone 6
File Name and Location: C:\TrickAnd\2007_WB\Harris\Projects\20071026\20071026_1130_EDVisits.mxd



SanGIS
We Have You Under Control



Caltrans District 11 San Diego



Legend

State Route Status

- Tier I - OK To Open
- Tier II - Open - Reduced Speed
- Tier III - Closed - Subject to County OED Full Approval For DOT Routes - Subject to County OED Full Approval

Damage Assessments - Field Review Data

- Sign Damage
- MSGR
- Road Damage and Spalling
- ROW Fence
- Crash Cushion, Solar Panel, Call Box, Electrical
- CMP Culvert
- ROW Fence - Buried Segments
- Missing Guardrail Segments

ESTIMATED FIRE PERIMETERS 10/29/07 1415 HRS
 MANDATORY EVAC AREAS 10/27/07 0630 HRS
 REOPENED AREAS 10/27/07 0630 HRS



Portions of this map contain geographic information copyrighted by Geacris. All rights reserved.
 Map Produced October 27, 2007

0 1.5 3 4.5 6 7.5 9 12 Miles

Tier II - CLOSED
 SR-56 East of S. Broadway Center Rd
 (Status Being Determined)

Tier II - CLOSED
 Bently Canyon to National Highways

Tier II - OPEN
 (Reduced Speed)
 Signs in Place

Tier I - OK To OPEN

Tier II - Reduced Speed
 (Local Access Only)
 Scheduled to Open
 Monday 10/29
 SR-56 East of SR-163

Tier II - OPEN
 (Reduced Speed/Local Access Only)
 Signs Lanes Not to Be Used (East Side)

Tier II - Reduced Speed
 (Local Access Only)
 Scheduled to Open
 Monday 10/29
 US/Mexico Border to SR-56 (East Side Only)

Trucks PCB
 Scheduled to Open
 Monday 10/29
 (Passenger Cars Only)

Population

POPULATION AND HOUSING ESTIMATES (2007) 2007 Wildfire Evacuation Areas



The following population and housing unit data are based on parcel-level housing counts from the San Diego County Assessor's Office, the U.S. Census Bureau, and SANDAG's Regional Information System.

POPULATION (January 1, 2007)		HOUSING (January 1, 2007)	
	Persons		Units
Total Population	515,677	Housing Units	187,785
Household Population	507,976	Single Family - Detached	127,101
Group Quarters Population	7,101	Single Family - Multi-Unit	14,340
		Multiple Family	39,672
		Mobile Home and Other	6,672

It is not possible to reliably estimate detailed demographic characteristics for this area. The following information provides the characteristics of a larger geographic area that includes the study area. While not a precise representation of the study area, it does provide an indication of its general demographic and economic characteristics.

HOUSING TENURE (January 1, 2007)

	Occupied Units	Vacancy Rate	Persons per Household
Occupied Housing Units	177,776	5.3%	2.86
Single Family - Detached	68%	--	--
Single Family - Multi-Unit	8%	--	--
Multiple Family	20%	--	--
Mobile Home and Other	4%	--	--

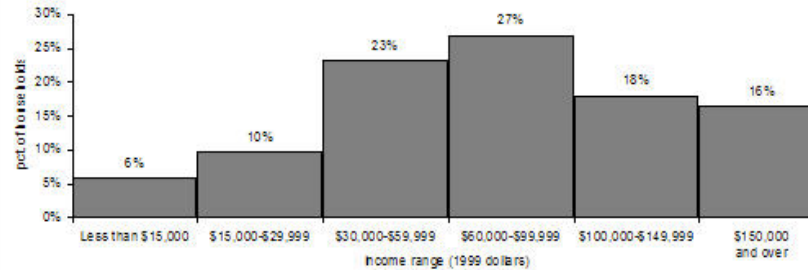
GENDER AND AGE (January 1, 2007)

	Male	Female
0 to 17	12%	12%
18 to 34	11%	9%
35 to 64	21%	22%
65 and older	6%	7%
Total Population	50%	50%

RACE AND ETHNICITY (January 1, 2007)

	Percent
Hispanic	18%
Non-Hispanic	82%
White	67%
Black	3%
American Indian	1%
Asian & Pacific Islander	9%
Other	3%

HOUSEHOLD INCOME DISTRIBUTION (real 1999 dollars, adjusted for inflation)



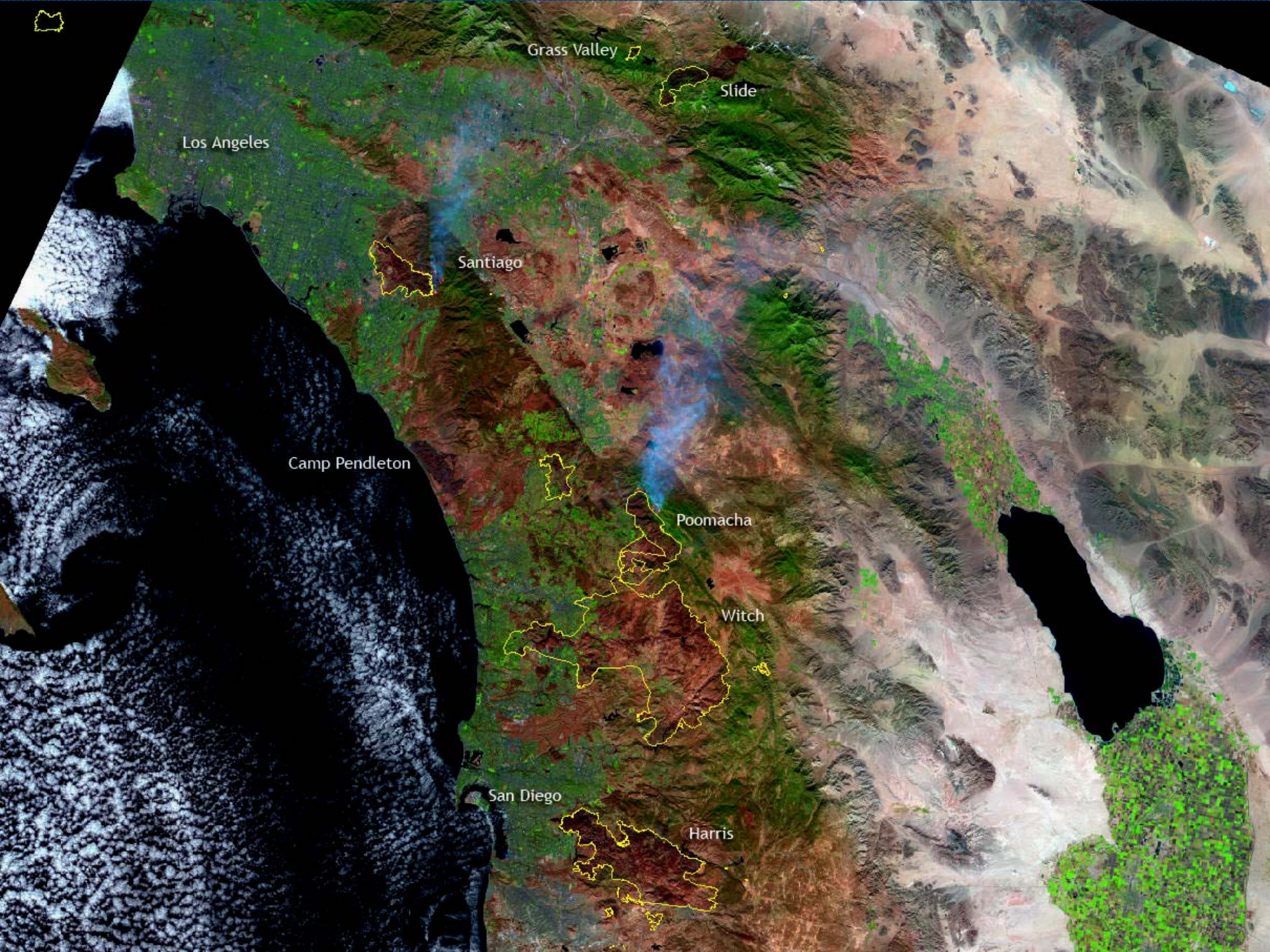
Median Household Income

Adjusted for inflation (1999 \$)	\$74,496
Not adjusted for inflation (current \$)	\$96,339

Source: SANDAG, Current Estimates (2007)

October 2007





Small yellow outline in the top left corner.

Grass Valley

Slide

Los Angeles

Santiago

Camp Pendleton

Poomacha

Witch

San Diego

Harris

San Diego Active Fires
 Predator Imagery
 20071028 1130hrs



- Local Assistance Centers
- Shelters
- Freeways
- Major Roads
- Thomas Bros. Pages
- Lakes
- Approx. Fire Perimeters
- Approx. Active Burn areas

Data Source: SanGIS

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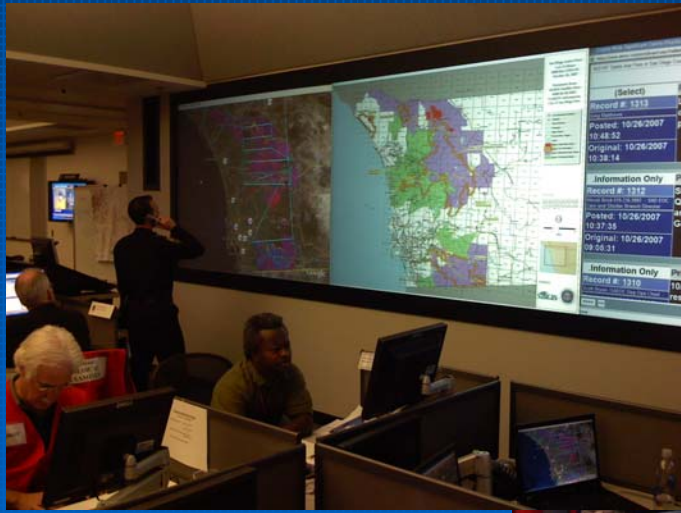


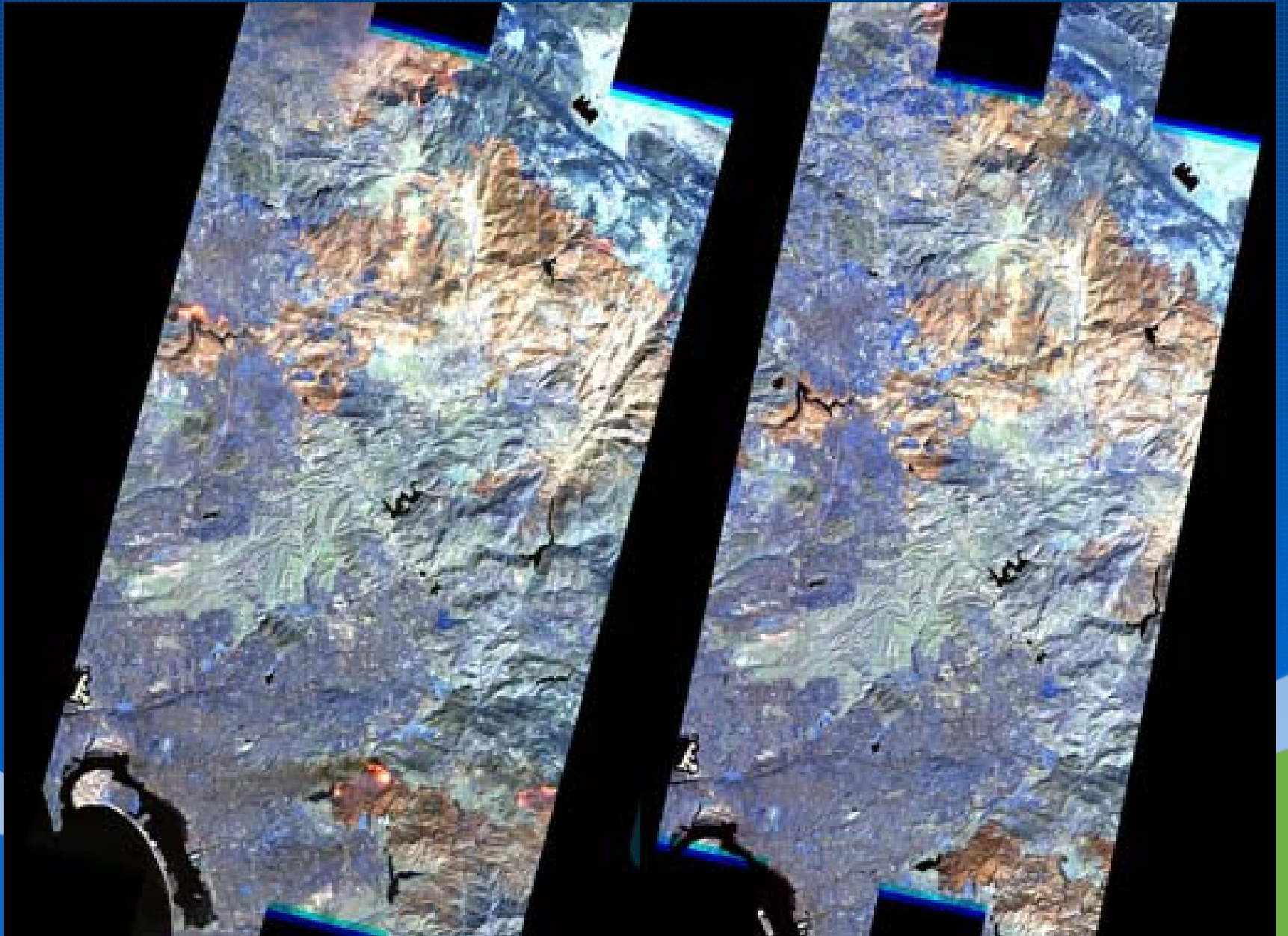
0 0.250.5 1
 Miles



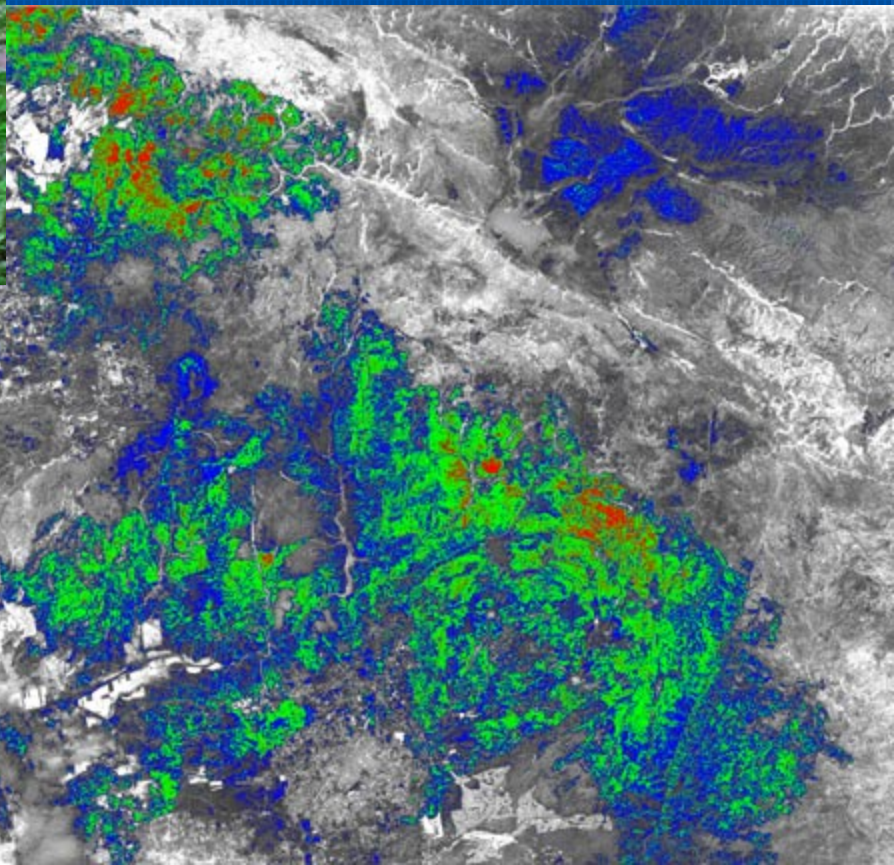
Map Date: 10/28/07
 Data Date: 10/28/07



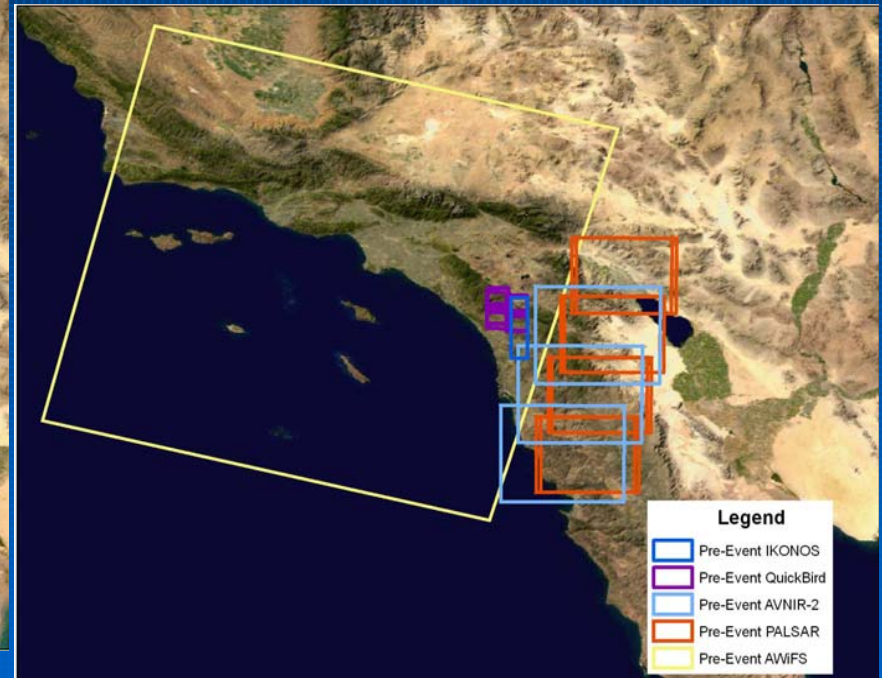
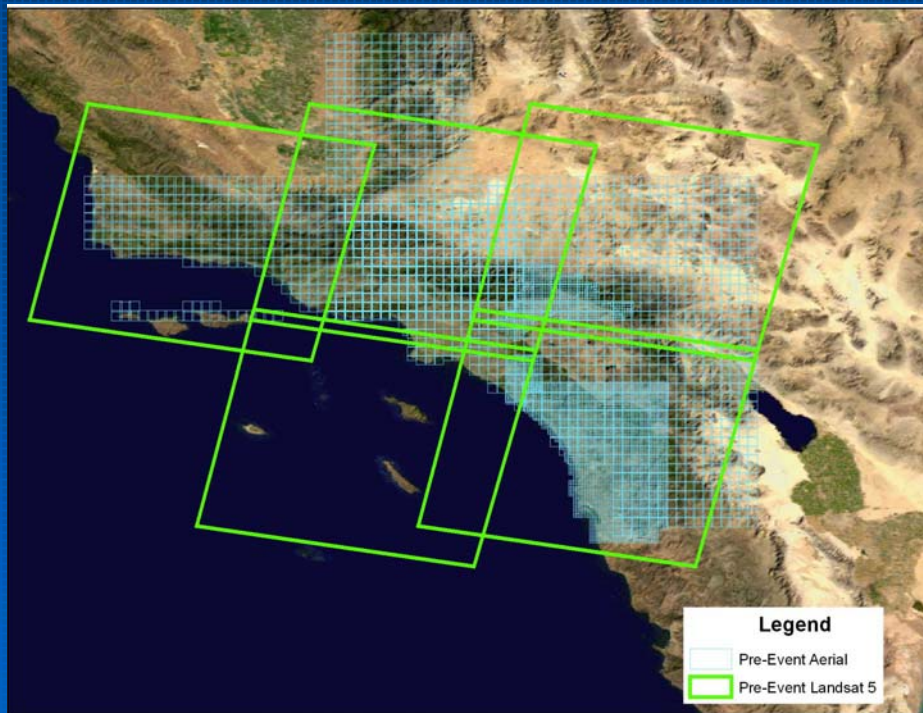








Pre-Event/Baseline Data Loaded



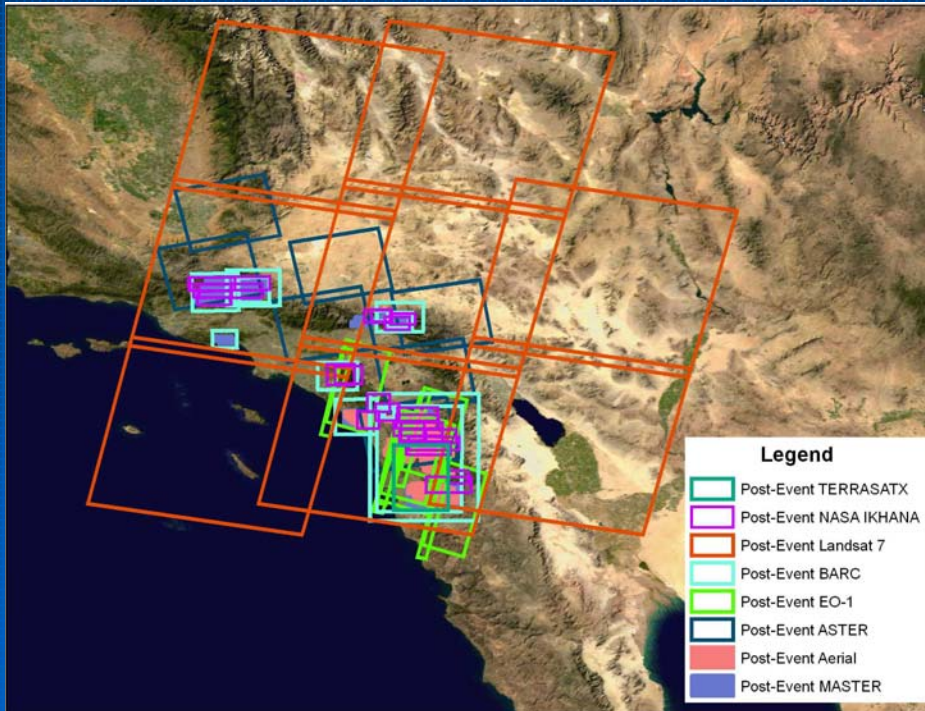
Public Access Data

- Landsat 5
- USDA NAIP
- High-Resolution Urban Area Aerial Data

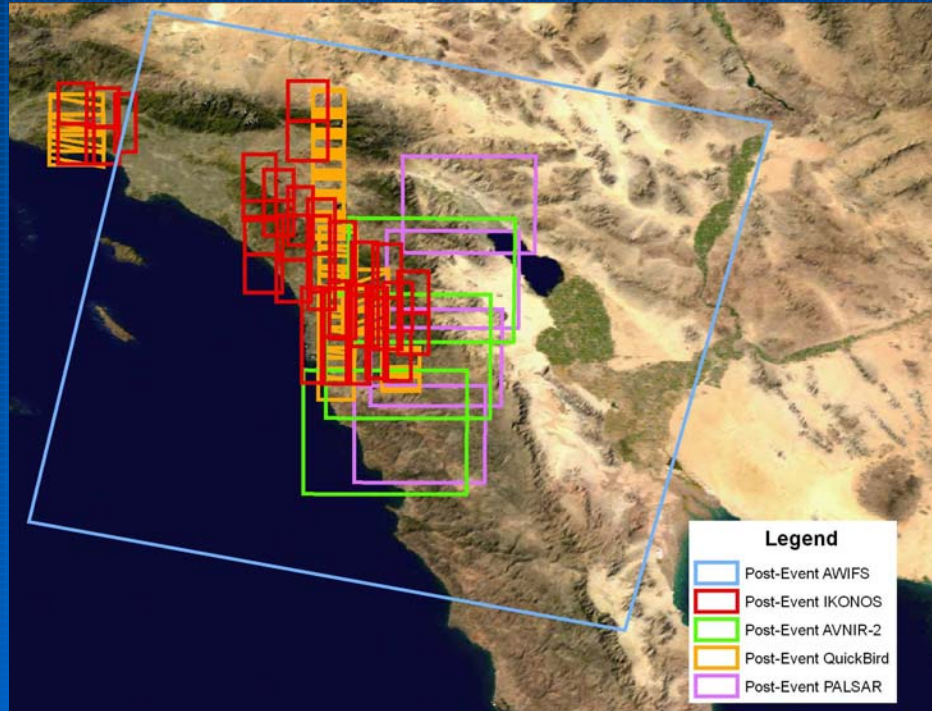
Restricted Access Data

- Ikonos and QuickBird from NGA/WARP
- ALOS AVNIR and PALSAR (JAXA via IC)
- ResourceSAT AWIFS (ISRO Via IC)

Post-Event Data Loaded



Public Access Data

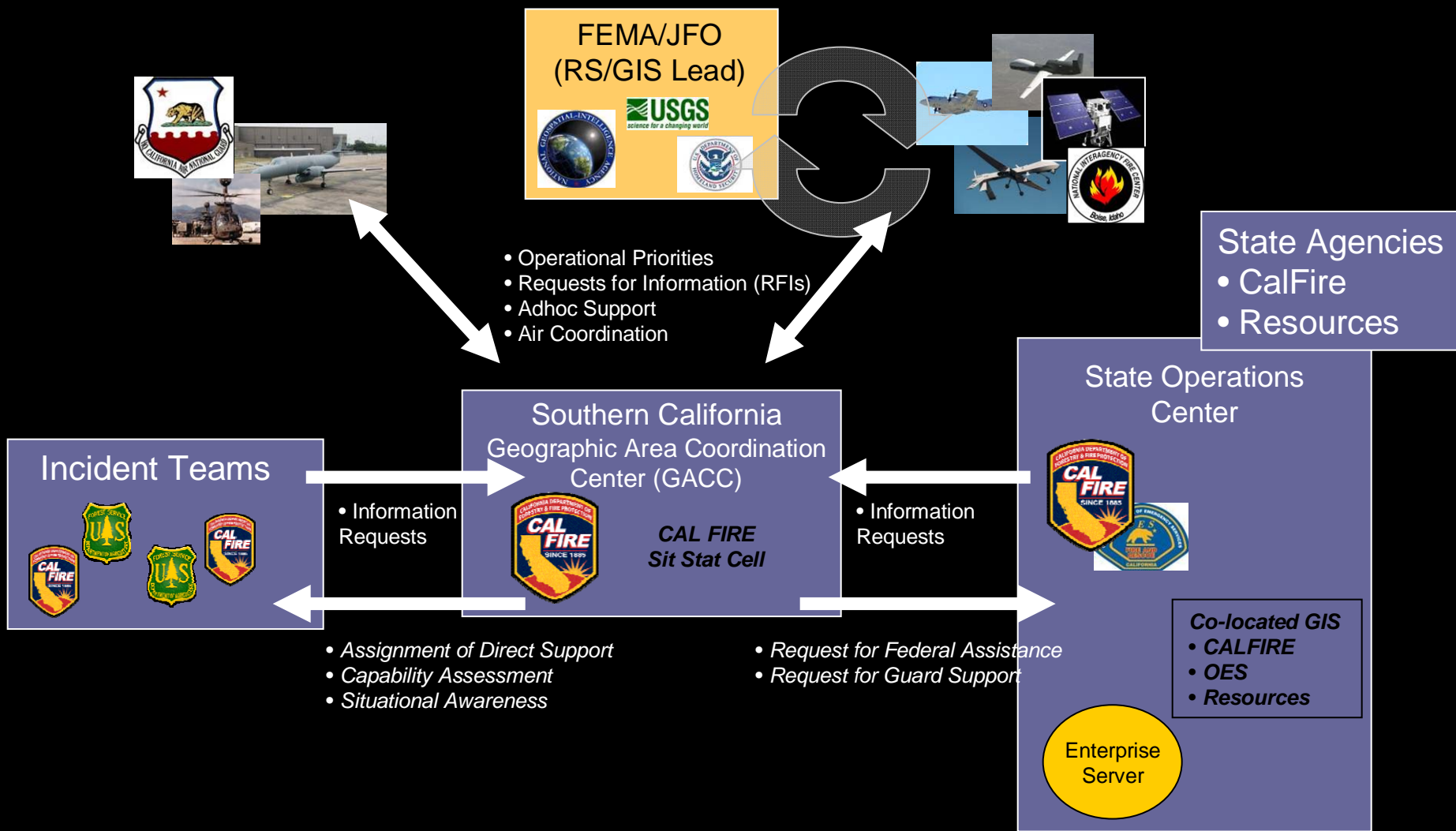


Restricted Access Data





Remote Sensing and GIS Operations



Tasks

■ Prioritize and coordinate Remote Sensing and GIS support

- Prioritize requirements based on incident operations, intelligence and fire weather
- Consolidate information needs across geographic area
- Translate information needs into requirements

CAL FIRE SIT STAT CELL
27 2100L OCT

Collection (28 Oct)

- 1 X Global Hawk
- 1 X NASA Ikhana UAV
- 1 X Aerial Video (1 RC-26)
Ground (Harris, Poomacha/Witch, Slide, Santiago)
- 4 X Civil Air Patrol
- Infrared Fire Perimeter Data
- Commercial Satellite



Requirements

1. Fire Perimeter Mapping to support response efforts within incidents
2. Hot Spots to support resource deployments within incidents
3. Damage Assessment & Environmental Impact
4. Recovery Support

Incident Prioritization (271100L-281100L)

1. Harris
2. Slide
3. Poomacha
4. Santiago
5. Witch
6. Rice
7. Pendleton Complex Ammo
8. Valley

Prioritized Information Requirements

1. Fire Perimeter Mapping to support incident response efforts
2. Hot Spots Detection to support resource deployments within incidents
3. Detection of imminent threats to infrastructure, personnel, or property
4. Damage Assessment and Recovery Assistance

RFI-5 Additional Data

1. Issues:
 - Request 1 look digital imagery of infrastructure within and near fire close out.
 - Low priority requirement for collection from incident to incident
 - Request employment of CAP assets previously collected U-2/GH data
2. Status:
 - Initial target deck attached. Request assessment efforts by NGA/DHS/F prioritize for submission to CAP as.

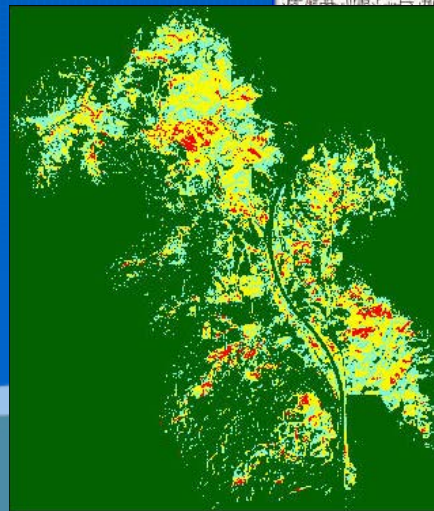
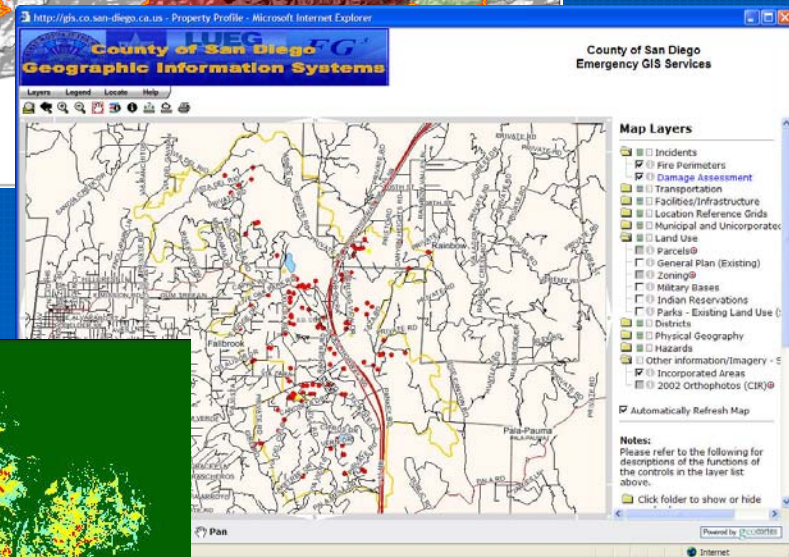
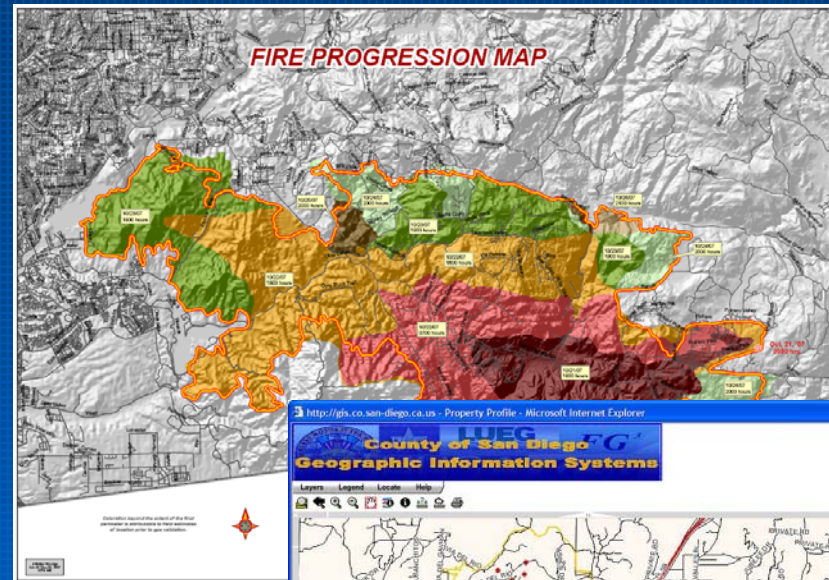
Aerial Imaging S

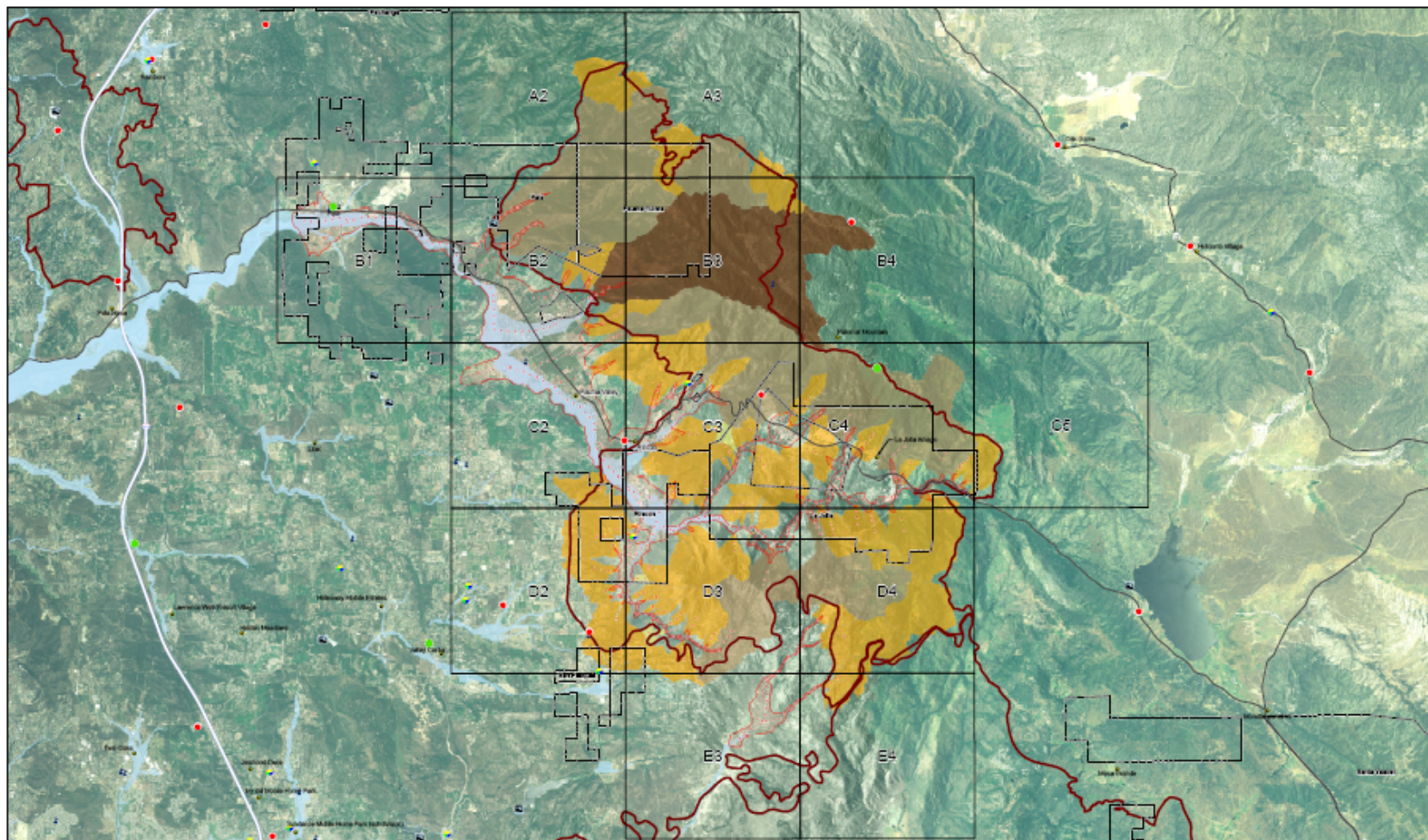
1. FMV:
 - Retain RC-26 support through
 - Release P-3 and request recovery asset.
 - C-130 ScatheView from National
 - OH-58 support on hold pending
2. GH/U-2:
 - Anticipate GH requirement through incidents. Expect release of assets
 - Request FEMA determine/evaluate assets (commercial, etc) for D
3. Civil Air Patrol:
 - Request employment of CAP aircraft (and Archer sensor) as Air Force Auxiliary support for Critical Infrastructure and Damage Assessment.

Number	Status	Priority	Description	EEI
1	Active	High	Fire Perimeter Mapping	Location of fire perimeter
2	Active	High	Active Fire Containment Efforts, Smoke, Breaths, Spitting	Position, direction of fire, smoke, heat, potential emerging threats to infrastructure
3	Active - not yet satisfied	High	High Resolution Imagery	Provide EO/ISR/Intelligence imagery of all commercial and civil satellite imagery to support damage assessment and recovery operations
4	Active - not yet satisfied	High	RFI-5 Data	RFI-5 data of critical infrastructure
5	None	Low	Damage Assessment of Critical Infrastructure	Status of critical infrastructure inside and within 100M of fire perimeter
6	None	High	Damage and Fire Mitigation Analysis	High Resolution Imagery of the Incident Area collected for structure damage assessment and identification of areas where damage occurred

Post Fire Data

- Fire Progression Maps
- Public Land Ownership
- Damage Assessment
 - Structures
 - Agriculture
 - Habitat
- Burned Area Emergency Recovery
 - Soil Erosion
 - Increased Runoff
 - Flooding
- Fuels and Fire Risk





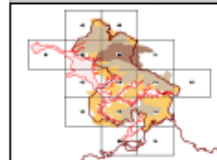
LEGEND

- | | | | |
|--|----------------------------|--|----------------------------------|
| | Populated Places | | FEMA Flood Hazard Areas |
| | Daycare Facilities | | Fire Perimeters |
| | EMS | | FEMA Potential Debris Flow Areas |
| | Schools | | USGS Potential Debris Volume |
| | Fire Station | | 0 to 1,000 cubic meters |
| | Dam | | 1,001 to 10,000 cubic meters |
| | Poomacha Debris Flow Lines | | 10,001 to 100,000 cubic meters |
| | Tidal Lands | | >100,000 cubic meters |

LOCATION MAP



INDEX MAP



Department of Homeland Security
Federal Emergency Management Agency
Date Created: 11/29/07
Author: MASG - Cotton
Version: V 1.0

MAPS FOR ADVISORY PURPOSES ONLY. NOT FOR INSURANCE RATING PURPOSES. For insurance rating purposes, please refer to the Flood Insurance Rate Map currently in effect.
Elevation data information is FEMA provided. Debris flow volumes calculated in response to a 10 year recurrence based on 3 hour duration storm, producing 2.28 inches of rainfall.
Volumes based on a model currently being tested. Debris flow behavior is highly variable and this map shows the best available information at the time of printing.
Populations estimated using 2002 Census data and are calculated for census areas only within the grid index. 2002 Census data does not include Tribal Populations.

2007 Successes

- Quick release of maps and imagery to the press and public
- Mapping of evacuation areas
- Use of the Thomas Brothers map overlays enhanced the ability to interpret and locate the information portrayed
- Draft GIS SOP implemented and tested during the fires
- Outstanding cooperation between EOC GIS staff, State, and Federal agencies facilitated the use of technologies normally reserved for the military or intelligence communities
- Availability of off-site GIS analysts to conduct geospatial analysis away from the flurry of activity within the EOC
- Damage assessment teams ability to collect information on GPS and transfer directly into County GIS
- Pre-mapping of special needs facilities allowed for the evacuation of 2100 medically fragile individuals

2007 Lessons Learned

- GIS staff from jurisdictions, agencies, and utilities that had not been trained in WebEOC and were not aware of information sharing protocols
- Some jurisdictions performed GIS mapping on stand alone computer systems without access to the internet, which resulted in delayed dissemination of data between agencies
- Continue to track incident information if it moves beyond the boundaries of San Diego County
- Standardize terminology among response organizations for geographic locations
- Reverse 911 data is currently not in a GIS compatible format, results in longer mapping times of evacuation areas
- Damage assessment was conducted independently by each jurisdiction; It is unclear if they were using the same criteria for the assessment and the resulting geospatial data sets could not be integrated due to attributes and spatial geometry differences.

Thank You

Paul Hardwick

phardwick@foundation.sdsu.edu

619-594-8992

