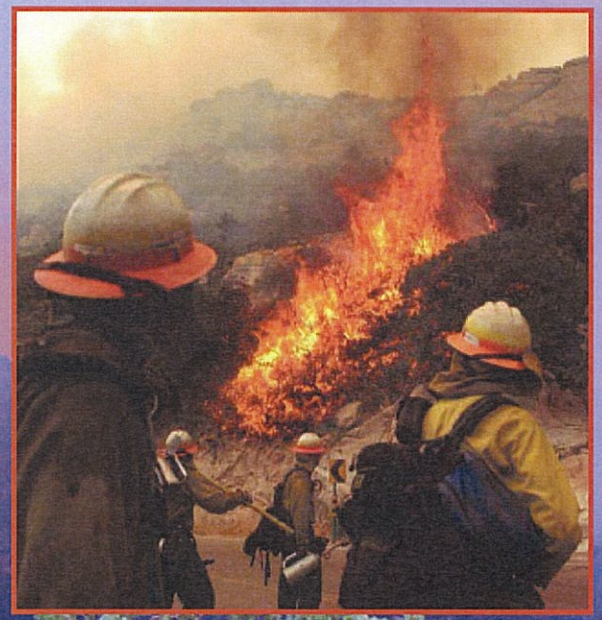
# Appendix E

*Fire on the Mountain*

# The Aspen Fire



*In the summer of 2003, the devastating Aspen Fire on the Santa Catalina Mountains burned the majority of the Summerhaven community and touched the lives of all Pima County residents who treasure this sky island wonder of nature. Shared by all, the mountain has been changed in ways most people can't comprehend; however, through this trag ic event, the spirit of Summerhaven residents, Pima County, and other agencies demonstrated courage, determination and generosity.*

*This event, while tragic, shows how government agencies and residents can best work together. The level of interagency cooperation and out-pouring of assistance by all involved was inspirational. Numerous agencies provided emergency service during the fire and recovery. We have recognized many of these agencies in this report, but if an agency is not mentioned, it is an oversight on our part and their help is sincerely appreciated. There are too many individuals to recognize personally, but two Summerhaven residents stand out. Ross Quigley and John Jones deserve special mention for their support and assistance during and after the fire.*

*We are most pleased and honored with the contributions of Pima County Departments and employees that worked nonstop to aid in fire suppression, evacuations, emergency recovery efforts, and rebuilding the Summerhaven community. In six short months, a remarkable amount of effort and work has been accomplished that might take other communities years to complete.*

*Very truly yours,*

*Raymond J. Carroll,*
*Supervisor, District 4*

*Ann Day,*
*Supervisor, District 1*

*Ramón Valadez,*
*Supervisor, District 2*

*Sharon Bronson, Chair,*
*Supervisor, District 3*

*Richard Elías,*
*Supervisor, District 5*

*C. H. Huckelberry,*
*County Administrator*

# The following Pima County departments, agencies, businesses, and groups were involved in the Aspen Fire response efforts*

## Federal

- American Red Cross
- Federal Emergency Management Agency
- Natural Resources Conservation Service
- U.S. Forest Service
- U.S. Marine Corps

## State

- Arizona Department of Fish and Wildlife
- Arizona Division of Emergency Management
- Arizona State Lands Department

## Local

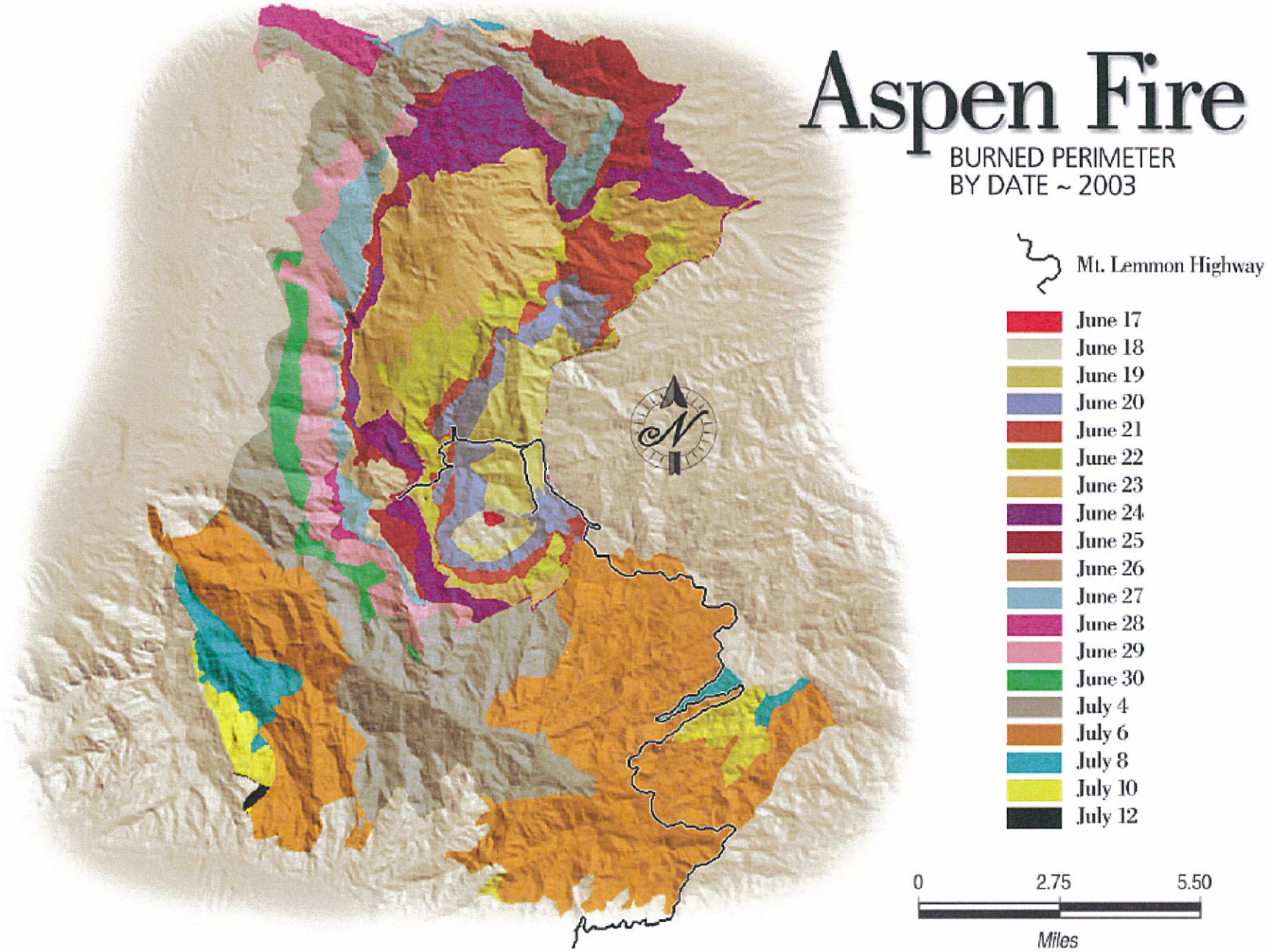
- AmeriGas
- City of Tucson Water
- Fire Departments and Fire Districts
- Local, state, and national news media via print, television, and radio
- Mt. Lemmon Homeowners Association
- Mt. Lemmon Water Cooperative
- Nextel Wireless Phone Company
- Pima County
- Pinal County
- Q-West Telephone
- Southern Arizona Chapter of the American Red Cross
- Trico Electric
- Tucson Wildlife Center
- Volunteer Center of Southern Arizona
- Volunteer Organizations Active in Disasters
- Zimmerman School

**Many others, not listed, were also involved and deserve credit for their efforts*

## Pima County Departments involved in the Aspen Fire

- Assessor
- Auto Services
- Community Services
- County Administration
- Department of Environmental Quality
- Development Services
- Facilities Management
- Finance
- Flood Control
- Information Technology
- Office of Emergency Management
- Public Works Administration
- Risk Management
- Sheriff
- Solid Waste
- Transportation
- Wastewater Management

*Report produced by Pima County Public Works, March 2004*
*Design and layout: Peter Corrao, Pima County Graphic Services Design Division*
*Editor: Jonathan Crowe, Pima County Department of Transportation and Flood Control District*
*Production: Pima County Graphic Services Production Division*


Aspen Fire
BURNED PERIMETER
BY DATE ~ 2003
Mt. Lemmon Highway
June 17
June 18
June 19
June 20
June 21
June 22
June 23
June 24
June 25
June 26
June 27
June 28
June 29
June 30
July 4
July 6
July 8
July 10
July 12
N
0
2.75
5.50
Miles

# Preface

*We are pleased to have prepared this Aspen Fire Report entitled,* ***Fire on the Mountain****. You will note that the report has a look and feel that is different from Pima County's typical summary reports. As we gathered the data for this report, it was agreed that the magnitude of the event and its impact on the community could not simply be communicated in black and white text, much less without the graphic reminders of an experience that touched the lives of an entire community.*

*Federal, State, County, and City entities have worked cooperatively in fire suppression, debris removal, and recovery efforts. As of this date, rebuilding efforts are underway and many have volunteered to help rebuild the Summerhaven community by dedicating personal time for fundraisers or by providing gratuitous professional services in the design of a better-built, fire-retardant, unified community that will safely welcome future generations of visitors.*

***The Fire on the Mountain*** *– although a recounting of tragic structural loss – is a report that inspires us to learn from past choices and heartbreaking events to insure that the likelihood of this ever happening again is lessened. With this report, we reflected on one of the largest catastrophic events in Tucson/Pima County history and attempted to capture the essence of what has transpired these last few months: collaboration and reform.*

*We will be forever thankful that we did not experience the loss of a single precious human life.*

***Pima County Staff***

# Aspen Fire Timeline

**JUNE 17**
Fire Starts, Pima County initiates emergency response through OEM & HS

**JUNE 18**
Fire crosses Marshall Gulch trail, moves toward Summerhaven, Pima County declares State of Emergency

**JUNE 19**
Summerhaven burns, 314 buildings destroyed, Governor declares State of Emergency

**JUNE 20**
Fern Ridge burns, 11 cabins destroyed

**JUNE 24**
First town meeting for Summerhaven residents held

**JUNE 27**
Pima County Assessors Office and Risk Management inventories & photographs all properties

**JUNE 30**
US Forest Service transfers Catalina Highway control to Pima County Sheriff

**JULY 1**
Board of Supervisors hold public hearing to discuss Aspen Fire and Summerhaven recovery

**JULY 2**
Pima County Public Works takes over recovery efforts

**JULY 4**
Willow Canyon, Organization Ridge burn, 9 cabins destroyed

**JULY 11**
Natural Resources Conservation Service begins emergency watershed protection and revegetation efforts

**JULY 14**
President Bush declares Aspen Fire a major disaster, fire suppression efforts conclude

**JULY 16**
US Small Business Administration declares Aspen Fire a major disaster

**JULY 17**
Summerhaven reentry, coordinated by Development Services Department

**JULY 30**
Planning and Zoning Commission approves amendments to Mt. Lemmon comprehensive plan, zoning code and building code

**AUGUST 11**
President Bush visits Mt. Lemmon. Board of Supervisors adopts amendments to Mt. Lemmon comprehensive plan, zoning code and building code

**AUGUST 16-19**
Aerial seeding and mulch dropped on 225 acres

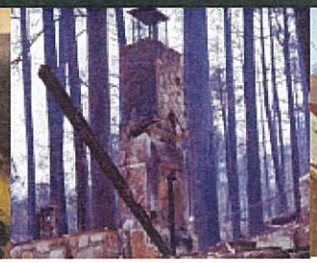
**AUGUST 21**
Mt. Lemmon opens to public

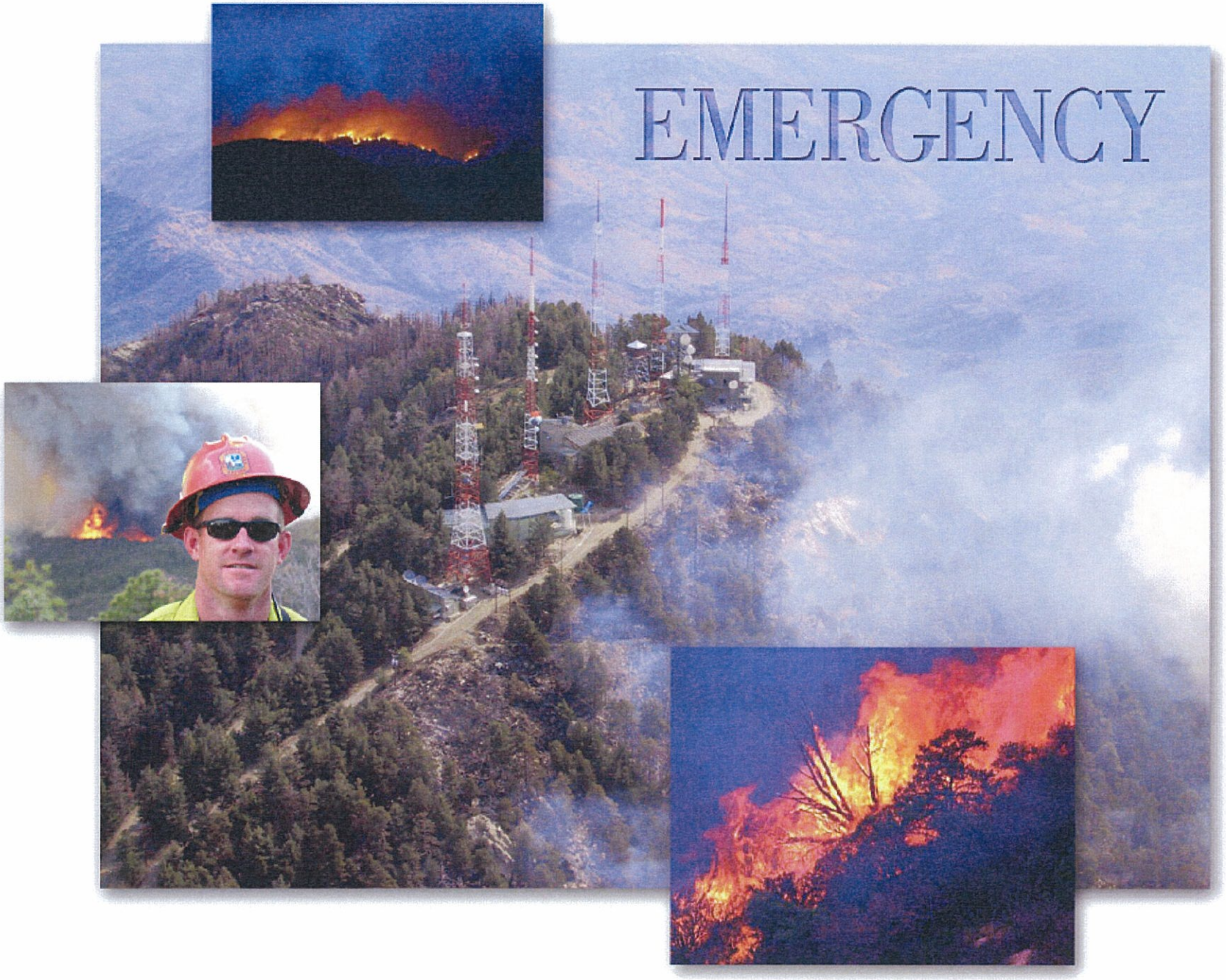
**SEPTEMBER 2**
Board of Supervisors establish Mt. Lemmon Domestic Water Improvement District

**JANUARY 14**
FEMA deadline for completion of emergency and debris removal phase

**JANUARY 20**
Board of Supervisors approves 2004 Bond Election Ballot Language including $1million for Mt. Lemmon Community Center and $7.2 Million for Mt. Lemmon Waste Water Treatment Facility

**2003 JUNE** | **JULY** | **AUGUST** | **SEPTEMBER–JANUARY**




EMERGENCY

# 1

# EMERGENCY

## Introduction

This report summarizes the emergency, suppression and recovery efforts by Pima County in response to the Aspen Fire. Expenses to Pima County and reimbursements by state and federal agencies are also reported. Many other departments and agencies were involved and those efforts are reported to the extent known. Pima County's response to this emergency demonstrated a true partnership within and between all Pima County participants.

## Emergency Response

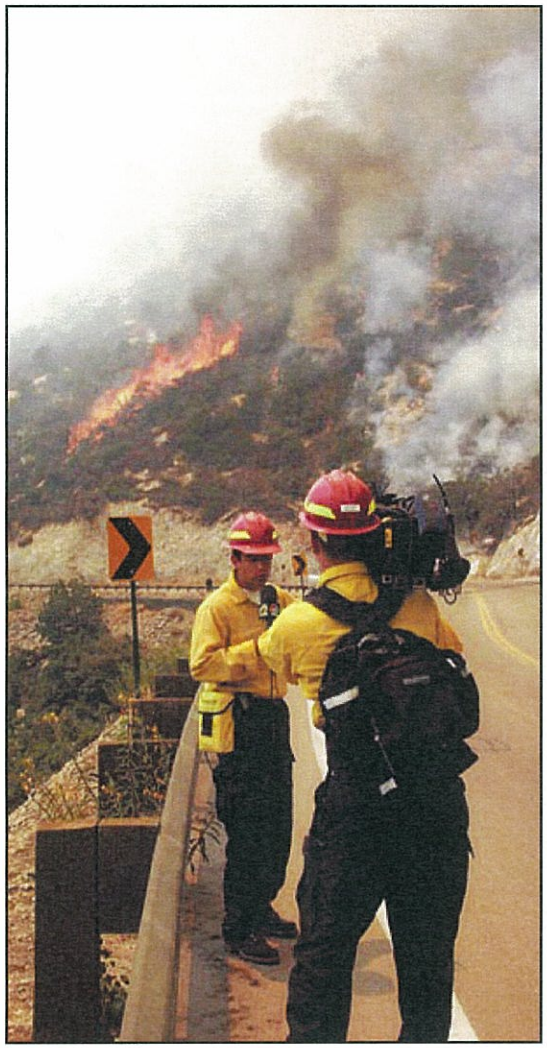
Pima County's emergency response to the Aspen Fire followed the established protocol for a local disaster. At the start of the fire, the Sheriff's Department established an Incident Command Post at the Rincon Substation to coordinate efforts between Pima County and outside resources. An Emergency Operations Center coordinator acted as a liaison with the Incident Command Post, later relocated to Sabino High School. Almost immediately, Pima County established communication with Mt. Lemmon homeowners and businesses, outside agencies, community stakeholders and the media through a variety of techniques including a telephone hotline, press conferences, a web page (www.aspenfirerecovery.org), e-mail alerts, mailings, and community meetings. Stakeholders included local and national media, Federal Emergency Management Agency (FEMA), U.S. Forest Service (USFS), U.S. Small Business Administration, Arizona Division of Emergency Management (ADEM), Arizona State Land Department and volunteer agencies.

The Pima County Office of Emergency Management and Homeland Security assumed the lead role from June 17 to June 30, and was responsible for the activities at the Emergency Operations Center and for coordinating with the Southwest Interagency Team. That team included members from the Bureau of Land Management, the United States Forest Service, the National Park Service, and the State Land Department. The Office of Emergency Management (Office) coordinated emergency and logistical response and collected and disseminated information through press releases, television interviews and other means. The Office arranged for portable comfort stations, telephone lines, computers, water tankers, tree removal, barricades, and medical and hazardous materials teams. The Office maintained constant communications with ADEM and FEMA. The Office coordinated property damage assessments and facilitated meetings with insurance and utility companies, Pima County Risk Management, and the Information Center.

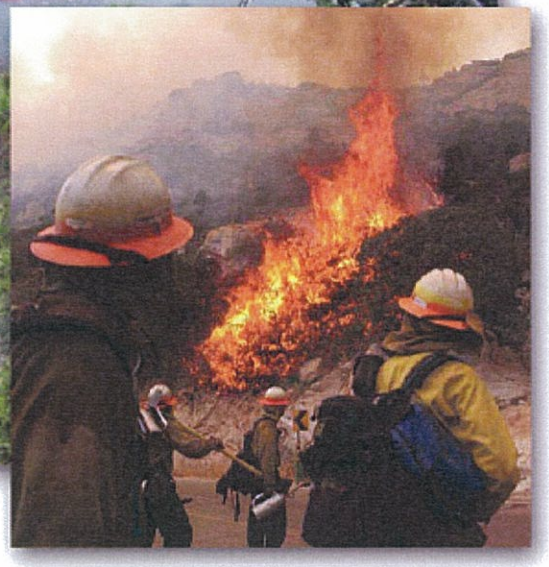
## State Financial Assistance

On June 18, the Board of Supervisors declared a state of emergency. When it became clear that Pima County would be overwhelmed by the magnitude of the damage, assistance was sought from the State through the Arizona Division of Emergency Management. On June 19, the Governor declared Summerhaven and adjacent communities a state of

emergency, activated the state's emergency plan, and committed state resources. This paved the way for federal disaster relief. Pima County documented the costs incurred from the onset of the fire to provide state and, later, federal emergency management representatives with the information needed to determine eligibility for reimbursement.



# SUPPRESSION



# 2

# SUPPRESSION

## Fire Suppression

Pima County provided critical support during the suppression phase of the fire.

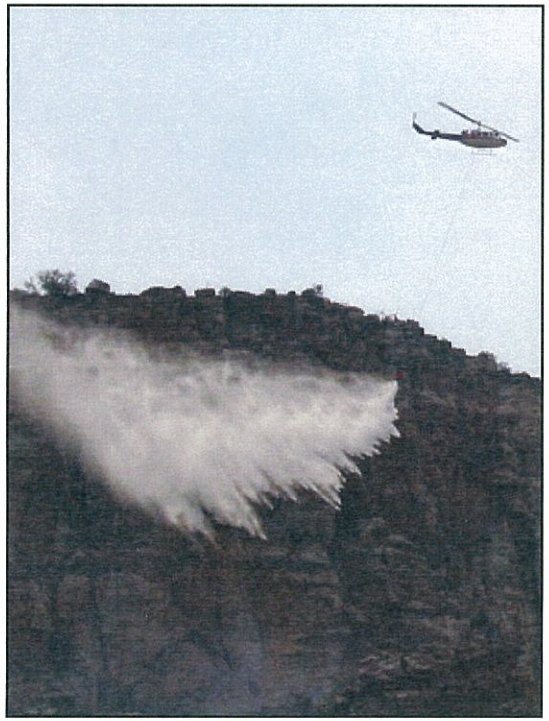
On June 18, the Transportation Department was asked to assist law enforcement with traffic control devices, personnel, equipment and materials for fire suppression. The Department used a 'limited competition' procurement process to contract with Southern Arizona Paving for emergency trucking and labor. Tank trucks hauled water from locations north of Tucson to the fire fighters. The Fleet Services Department provided four-wheel drive vehicles for use by responders and on-site equipment maintenance and heavy truck repair. On June 30, the USFS relinquished control of the Catalina Highway to the Pima County Sheriff's Department.

To preserve radio communications, the Fleet Services Department temporarily removed most of the radio equipment from the Mt. Lemmon repeater site. The equipment served the Sheriff's Department and most Pima County departments, as well as the National Oceanographic and Atmospheric Agency and the National Weather Service. The Arizona Department of Public Safety also had equipment temporarily located at this site. An emergency generator provided electricity during the almost two months that commercial power to the site was lost. A supplemental radio repeater site, located on a hilltop overlooking Summerhaven, was established for the Sheriff's Department during the suppression and recovery phases. A portable generator powered the Pima County Sheriff Department's Mobile Command Center located at the bottom of the Mt. Lemmon Highway. The Heavy Equipment Shop maintained and fueled the generator throughout the incident until the road was re-opened to the general public.

## The following agencies were involved in the fire suppression efforts:

- *AmeriGas*
- *Arizona Division of Emergency Management*
  *Arizona Office of Emergency Management*
- *Arizona State Lands Department*
- *City of Tucson Water*
- *Federal Emergency Management Agency*
- *Fire Departments and Fire Districts*
- *Local, state, and national news media via print, television, and radio*
- *Mt. Lemmon Homeowners Association*
- *Mt. Lemmon Water Cooperative*
- *Nextel Wireless Phone Company*
- *Pima County*
- *Pinal County*
- *Q-West Telephone*
- *Southern Arizona Chapter of the American Red Cross*
- *Trico Electric*
- *U.S. Forest Service*
- *Volunteer Center of Southern Arizona*
- *Volunteer Organizations Active in Disasters*

On July 1, the County Administrator presented the Board of Supervisors with an update on the fire, the financial challenge of restoring electrical and water services to Mt. Lemmon and the Summerhaven community, and recommendations for changes to Summerhaven zoning and comprehensive plans. He recommended extending financial credit to the Mt. Lemmon Fire Department and assisting the Mt. Lemmon Water Co-operative to become a Domestic Water Improvement District. Representatives from the Mt. Lemmon Water Co-operative, the Mt. Lemmon Fire Department, the Mt. Lemmon Homeowners Association and the Mt. Lemmon Women's Club, who had formed an ad hoc organization named "Rebuilding Mount Lemmon Communities Committee", addressed the Board of Supervisors and supported the recommendations.

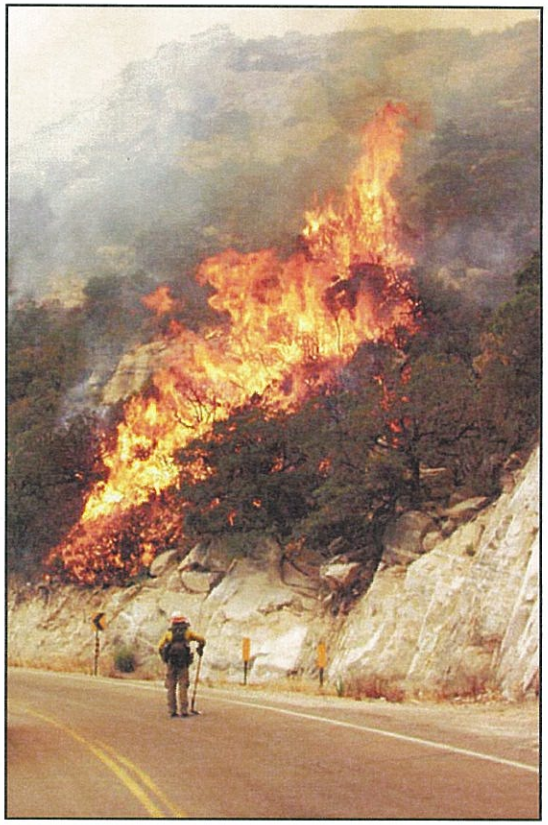


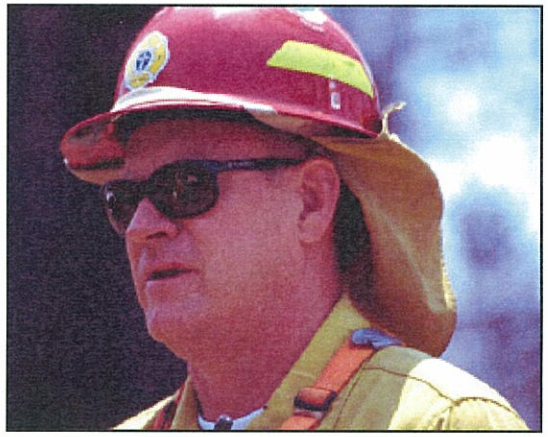
## Pima County Fire Suppression Expenses

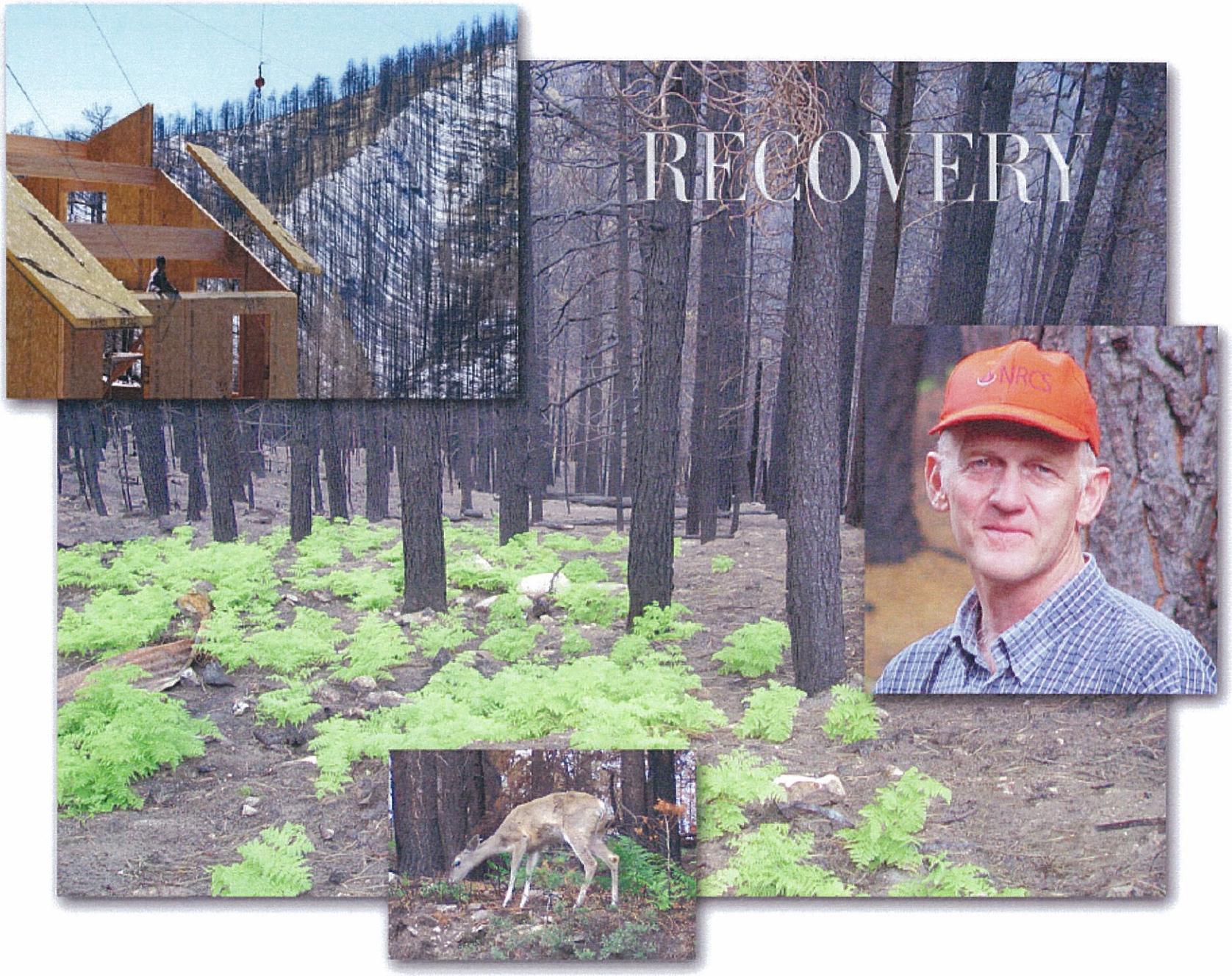
Fire suppression efforts officially concluded on July 14 and cost Pima County $383,000. The Transportation and Sheriff's Departments incurred 84% of those costs. The Health Department and Emergency Operations Center staff worked for more than 2,000 hours during this phase at a cost of $46,000, including accounting support. All fire suppression costs were reimbursed by the Arizona State Lands Department.

### Pima County Fire Suppression Expenses

| | | |
|---|---|---|
| Sheriff | $175,334 | (46%) |
| Transportation | $147,773 | (38%) |
| Health | $ 45,984 | (12%) |
| Environmental Quality | $ 13,596 | (4%) |
| Total | $382,687 | (100%) |






RECOVERY
NRCS

# 3

# RECOVERY

## Recovery Planning

On July 2, Pima County Public Works assumed primary responsibility for the recovery efforts. The Aspen Fire Recovery Planning Committee was formed to coordinate the reentry and recovery efforts, and John S. Jones was contracted to act as a liaison with the Mt. Lemmon community. Media coordination transitioned to the Aspen Fire Co-Chairs and the Public Information Officers within Public Works. Residents established their own website (www.summerhavenfire.com), e-mail alerts and a newsletter "The Echoes." The Fleet Services Department provided handheld radios and communications logistics during the recovery phase. Outside agencies that contributed to the suppression and recovery efforts included the United States Forest Service, the State Department of Corrections, the State Land Department, and various satellite city and outlying town's fire departments.

The Recovery Planning Committee included staff from Pima County Public Works departments, the Office of Emergency Management, the Health Department, the Sheriff's Department, Community Services, Risk Management, various state and federal agencies, utility companies, community services organizations, and community representatives. The Committee originally set the reentry date for residents for July 10, based on the ability of the various agencies to complete emergency activities required to protect public safety. These activities included roadway repair, erosion control, debris removal, and utility and other infrastructure repair. Due to the resurgence of the fire, the reentry date was postponed to July 17.

## Federal Disaster Relief

On July 14, President Bush signed a Federal Disaster Declaration authorizing the use of federal funds to repair or replace disaster-damaged public facilities. Federal assistance is determined based upon recommendations from the Federal Emergency Management Agency, which provides supplemental aid to communities and states to help them recover from disasters as quickly as possible. Titled "Public Assistance", the Stafford Act allows for the federal government to reimburse governmental and non-profit entities at 75 percent and the State of Arizona at 15 percent of eligible costs incurred.

The Small Business Administration, on July 16, also declared the Aspen Fire a disaster thereby making low interest loans available to businesses

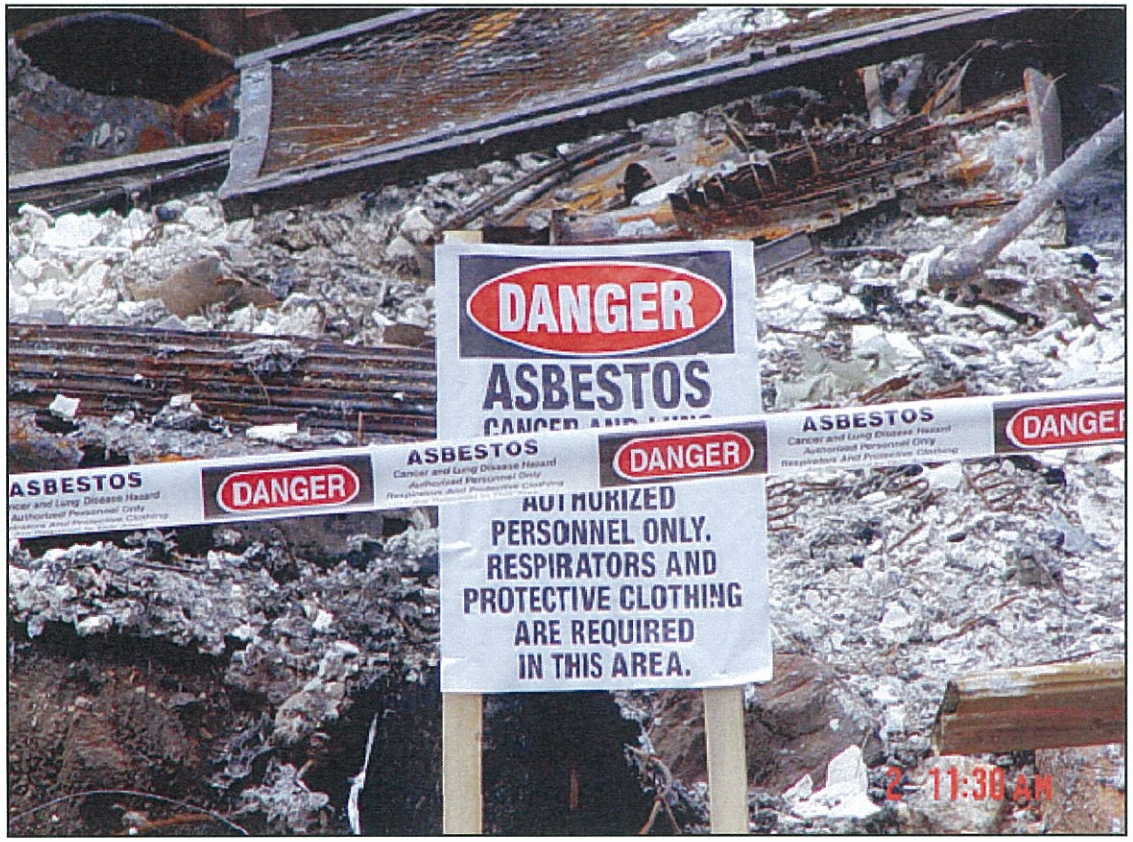
and some property owners suffering catastrophic losses. There were no provisions made for the reimbursement to private citizens suffering losses as a result of the fire, but the Mt. Lemmon Cooperative Water Company, the Mt. Lemmon Fire District and Trico Electric Cooperative met qualification requirements for reimbursement.

## Reentry and Recovery Activities

The Development Services Department coordinated the logistics of reentry into Summerhaven with the media, the Red Cross and insurance adjustors. Staff from the Office of Risk Management and the Sheriff's Department distributed informational packages and safety equipment, including breathing masks and gloves, to residents with their reentry pass. Staff from the Department of Transportation and Flood Control District, the Department of Environmental Quality, the Sheriffs Department, the Fleet Services Department and other departments directed recovery efforts. These activities included material removal, erosion control and revegetation, roadway repair, septic system and wastewater repair, environmental sampling, cleanup, transport, and disposal of ash, metal, and masonry materials.

## Metal and Masonry Removal

Thousands of tons of burned material were removed during the first stage of the recovery effort. Pima County established metal and masonry recycling facilities to minimize transport and landfill disposal. Tucson Iron and Metal recycled and disposed of more than 1,000 tons of metal over a four-month period at a cost of more than $63,000. Hunter Contracting Company crushed more than 8,000 cubic yards of masonry into reusable material for roadbed or fill material at a cost of $200,000. Over



6,000 cubic yards of crushed material were hauled to unimproved roadway sites in the Summerhaven area, where private contractors graded, rolled, and compacted roadbeds.

## Ash Removal

Some of the homes that burned contained asbestos, which may be found in some building materials. The County contracted with the Kleinfelder company to sample ash for asbestos and assist homeowners in properly bagging and transporting waste. In order to protect public health, the Department of Environmental Quality asked people to dampen ash debris, double-bag the ash debris in plastic, and dispose of the ash in approved landfills. A total of 1,034 tons of ash were received at Pima County's Tangerine Road Landfill and 128 tons of ash were received at the City of Tucson's Los Reales Landfill.

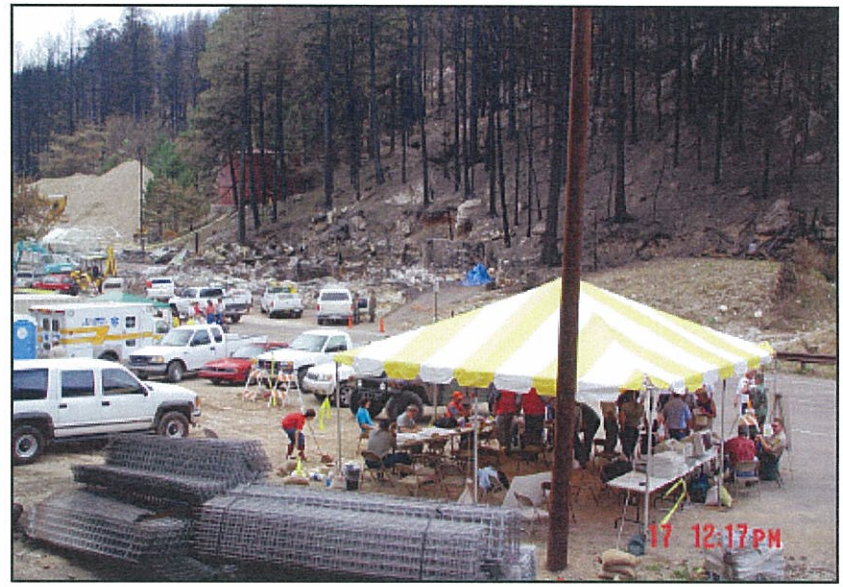
## Timber Removal

Tens of thousands of trees were destroyed or damaged in the fire, creating numerous hazards. Pima County contracted with the State Land Department for State Department of Corrections work crews to fell and remove hazardous timber. To eliminate immediate health hazards, facilitate snow removal, and provide a firebreak, the crews removed all trees located in public right-of-way within ten feet of the roadway. Trico Electric also cleared trees in utility easements. The Hunter Contracting Company removed and chipped or incinerated more than one million board feet of lumber.

## Wastewater Management

The Department of Wastewater Management staff repaired minor damage to the public sewer system and wastewater treatment facility and delivered thirteen portable restrooms to various outlying locations. To prevent future flood damage, workers welded shut manhole covers, placed Jersey Barricades and sandbags at or near the wastewater treatment facility and at Carter Canyon, and removed chain link fencing that could have collected storm runoff debris. The cost for these services exceeded $48,000. The Department also developed a Mt. Lemmon Master Sewer Plan that included criteria for connecting up to 30 additional residences and structures to the public sewer system.

## Private Septic Systems




Some properties sustained damage that exposed plumbing systems and were at risk of further damage. Staff from the departments of Environmental Quality and Development Services capped exposed lines. Staff accomplished most of this work during regular working hours and those costs were not eligible for reimbursement under Arizona Department of Emergency Management guidelines. To ensure that all damaged private septic systems are properly repaired and functional, staff will require that all systems be inspected and permitted prior to use.

## Flood Control

Due to the loss of so many trees and forest vegetation, flooding and erosion danger increased substantially thereby putting the community of Summerhaven and downstream areas at risk. The Flood Control District (District) undertook substantial efforts to minimize these risks, working closely with the United States Forest Service and other agencies. The District contracted with The Groundskeeper for erosion control and re-vegetation services. Work teams removed debris and felled trees that continued to fall or were swept into drainages. Channel clearing costs for major drainage ways within the Summerhaven area were much higher than originally anticipated due to ongoing utility restoration activities. The cost of erosion control, watershed protection and revegetation was $727,000. Additional bank protection is planned for the Carter Canyon Wash area for the Zimmerman School and Wastewater Treatment Facility.

District staff worked closely with the Natural Resource Conservation Service and local conservation districts to staff the "yellow tent" in Summerhaven for the first six weeks after resident reentry in order to answer questions pertaining to erosion hazards and revegetation methods. Staff also distributed sandbags, seed and mulch to residents.

At a cost of $47,000, District staff repaired damages to the ALERT Flood Warning System and added more monitoring sites and equipment to reduce the risk of future catastrophic flooding. The District also initiated four studies at a total cost of $170,000 to evaluate the hydrologic conditions within the different watersheds in the post-fire era. The National Resource Conservation Service will reimburse the District for approximately $500,000.

## Property Tax Amendments

The Pima County Assessor's Office, in conjunction with the Office of Risk Management, completed an on-site inventory and photographed all of the destroyed and standing structures on Mt. Lemmon. Their June 27 report confirmed that out of 600 structures, 324 were destroyed, 251 were still standing, 5 sustained fire damage and 20 were unverified. Damages sustained to Organization Ridge and Willow Canyon were not included in the initial report. The Assessor's office telephoned all of the property owners, sent written verification, and amended tax records to reflect property loss or devaluation.

## Cost Recovery

Approximately half of the $3.1 million in expenses for fire suppression and recovery are eligible for reimbursement by the state and federal government. The federal government reimburses 75% of those expenses, the State of Arizona reimburses 15%. Pima County is responsible for the remaining 10% of eligible expenses. Transportation and Flood Control incurred the majority (69%) of expenses for suppression and recovery, with the remaining departments making up the difference. Of the total $3.1 million in costs, more than $1.6 million (51%) are eligible for reimbursement, and Pima County has requested another $500,000 in reimbursements. As of January 9, 2004, Pima County had received $1,008,200 in reimbursements. Final payments may take anywhere from two to four years. The federal government will audit the expenditures and reimbursements for proof of eligibility within five years.

## Pima County Aspen Fire Expenses and Reimbursements, by Department

| | *Expenses* | *Eligible Reimbursements* |
|---|---|---|
| Assessor | $13,620 | - |
| Auto Services | $16,293 | $3,769 |
| Community Services | $990 | - |
| County Administration | $1,385 | - |
| Development Services | $84,867 | - |
| Emergency Management | $59,531 | - |
| Environmental Quality | $50,875 | - |
| Facilities Management | $75,109 | - |
| Finance | $3,001 | - |
| Flood Control | $845,525 | $17,293 |
| Information Technology | $70 | - |
| Public Works Administration | $41,091 | - |
| Risk Management | $249,230 | - |
| Sheriff | $201,396 | $42,938 |
| Solid Waste | $93,803 | - |
| Transportation | $1,329,313 | $984,062 |
| Wastewater Management | $100,800 | $40,338 |
| Other, to be allocated | - | 537,414 |
| Totals through December 31, 2003 | $3,166,899 | $1,625,814 |

## Community Redevelopment

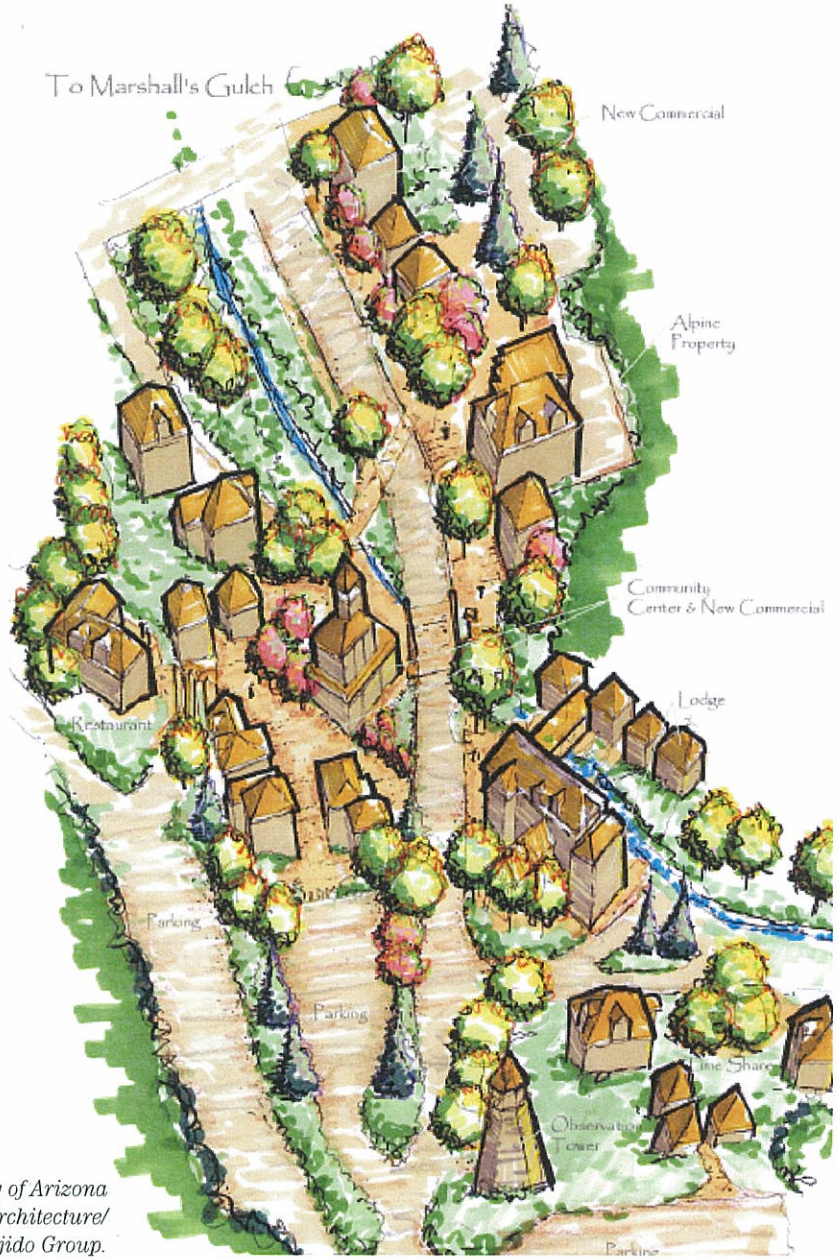
On July 1, the Development Services Department was tasked to prepare amendments to the zoning and building codes to expedite the rebuilding effort and reduce the risk of a recurring fire disaster. The local chapter of the American Institute of Architects offered to develop general design concepts for the commercial area in Summerhaven. The chapter joined with local design and construction experts to form a Restoration Committee. Planning professionals from the Arizona Planning Association and the University of Arizona School of Landscape Architecture helped develop a survey that was sent to all property owners. A design workshop was held to develop alternative designs for the restoration of the commercial district. This process was documented and the Mt. Lemmon/Summerhaven master plan concepts were presented to more than one hundred Mt. Lemmon property owners at a public meeting on February 18, 2004.

The Restoration Committee reviewed all proposed zoning and building code amendments prior to the Planning and Zoning Commission's public hearing on July 30. On August 11, the Board of Supervisors adopted zoning code amendments, rezonings, comprehensive plan amendments, and the International Urban Wildland Interface Code. On August 21, Mt. Lemmon was finally reopened to the public and construction started on seven new cabins and one new business.

On September 2, the Board of Supervisors established the Mt. Lemmon Domestic Water Improvement District. By mid-November, recovery activity slowed and the telephone hotline was discontinued. The Recovery Team continues to monitor calls and e-mails to evaluate ongoing communication needs.

It is expected that most of the structural erosion control treatments will remain functional for the several years that are typically required until natural recovery occurs. Despite significant rainfall events, Pima County staff has observed minimal damage to the remaining structures and only minor erosive damage due to flooding or debris flows on the mountain. However, issues of forest management, tree debris removal, and revegetation will remain for years to come.

## Summerhaven Commercial area redevelopment plan




*Source: University of Arizona School of Landscape Architecture/ The Tejido Group.*

*January 9, 2004*

*Aspen Fire Team,*

*I would like to congratulate Pima County for coming so far in just six months since the devastating Aspen Fire on Mount Lemmon. Not only did it impact the residents of Mount Lemmon and Summerhaven, but many people throughout Arizona who have enjoyed the many attributes of it.*

*The State of Arizona, Division of Emergency Management would like to compliment Pima County for pulling together their many departments and working together as a team to assist in the multiple recovery efforts. Pima County was very cooperative in coordinating their efforts with State and Federal Emergency Management personnel. This collaborative endeavor has been a very positive experience for all parties involved. Never before have we had an applicant so willing to participate in the full recovery process, from the Disaster Field Office and its many meetings to now, and truly be concerned for the welfare of their citizens.*

*Our compliments to your team for your efforts as we look forward to completing the recovery work and to bringing back to the community a new way of life that they can build upon and enjoy now and in the future.*

*Beth Zimmerman*
*Recovery Manager*
*Arizona Department of Emergency & Military Affairs*
*Phoenix, Arizona*

# An Examination of the Summerhaven, Arizona Home Destruction Related to the Local Wildland Fire Behavior during the June 2003 Aspen Fire

Jack D. Cohen
Research Physical Scientist
USDA Forest Service
Rocky Mountain Research Station
Missoula Fire Sciences Laboratory
406-329-4821 jcohen@fs.fed.us

August 1, 2003

**Summary**

I examined the home destruction in Summerhaven associated with the 2003 Aspen Fire on July 31 and August 1. My examination was prompted by questions regarding the wildfire behavior related to home destruction and specifically whether homes could have survived the wildfire in the Summerhaven area. **The evidence revealed by my examination indicates that the wildfire in the Summerhaven area largely spread as a surface fire not as a high intensity crown fire. The differences in the direct flame and firebrand exposures related to the home characteristics resulted in one house surviving next to its destroyed neighbor.** Although the wildland fire largely spread on the surface, high intensity burning occurred in several locations of high structure density. The burn pattern suggests that high intensity fire spread occurred from structure to tree canopy to structure.

**Examination**

The Aspen Fire started on June 16, 2003 in the Santa Catalina Mountains north of Tucson, Arizona. On June 19 the fire spread into the mountain community of Summerhaven. Over 300 homes and cabins burned in association with the wildfire. Photos 1 and 2 show the character of the wildfire. Crown fire occurred in limited patches and on the slopes to the west and above the residential area.

**Photos 1,2—active spreading crown fire occurred above and to the west of Summerhaven but did not spread into the residential area.**

High intensity crown fire spread did not occur in the bottom of the main gulch where Summerhaven resides. Photo 3 shows the post burn situation along the main road down slope and up-wind from structure locations. Photo 4 shows surface fire spread that was typical under the conifer canopy. Although the surface fire spread does not produce high intensity burning, the intensities and durations produced significant canopy needle kill.

**Photos 3,4—surface fire spread principally occurred within the Summerhaven residential area without burning in the tree canopies (crown fire).**

The surface fire spread does not produce direct flame heating sufficient to ignite the wood exteriors of structures beyond about 10-15 feet. Photos 5-9 provide examples from various locations within Summerhaven that represent the destruction of the entire area.

**Photo 5,6—totally destroyed homes surrounded by unconsumed tree canopies indicate that lower intensity surface fires burned in the structures' surrounding areas.**

**Photos 7,8,9—totally destroyed homes surrounded by unconsumed tree canopies indicate that lower intensity surface fires spread to the structures' surrounding areas.**

The evidence indicates that burning homes commonly burned the adjacent and overhanging trees. Tree canopy burning began at totally destroyed structures. In several areas of higher structure density, the evidence suggests that burning homes ignited the tree canopy that subsequently carried into adjacent structures. As each structure ignited more canopy ignited. The hillside burn pattern indicates that the ignited tree crowns originated at burning home locations. Photo 10 shows the patched pattern of destroyed homes and associated burned trees surrounded by unconsumed tree canopy. The crown fire originates and ends in association with home destruction. Photos 11-12 show the home destruction and canopy consumption within such a patch. Photos 13-14 show evidence of decreasing consumption and the charring of tree trunks and canopies as the distance away from a structure increases. Note the mottled char pattern on the tree trunks. The mottled portion is where all bark was consumed facing the burning house. The side away is charred but bark remains. Without examining the large scale patterns of home destruction associated with tree crowning and the small scale patterns of consumption, one might get the impression that the high intensity crown fire spread into the residential area and caused the destruction rather than the likely sequence of a home or homes burning leading to tree canopy fire involvement.

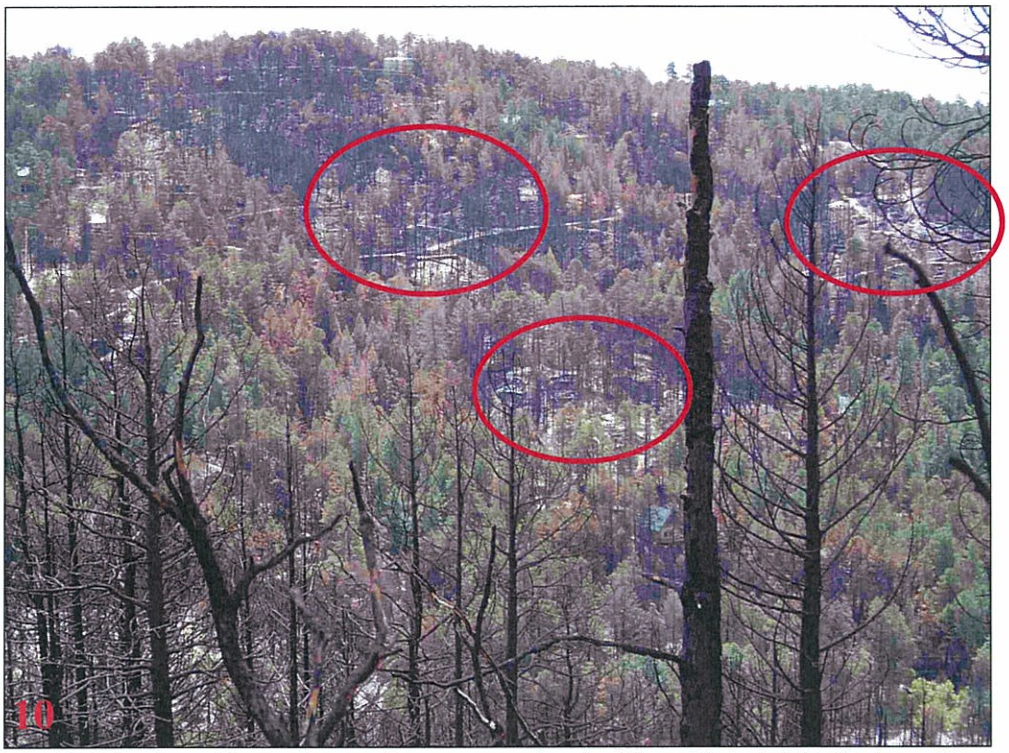
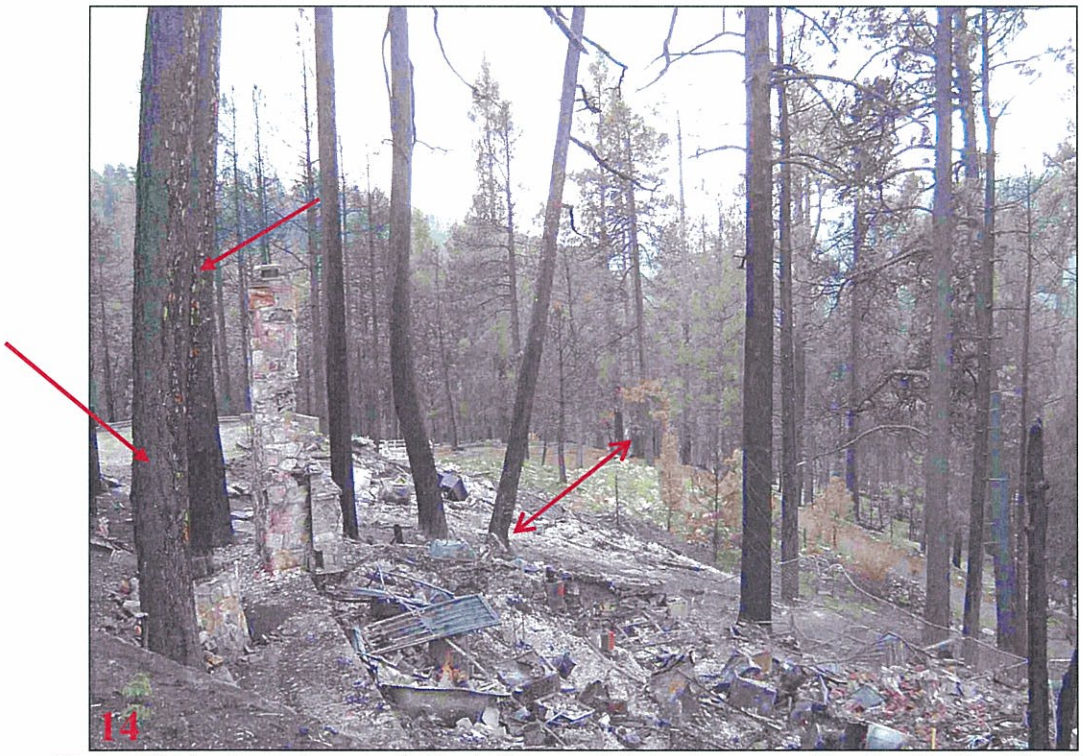



**Photo 10—patches of burned trees that are associated with multiple totally destroyed homes break the largely unconsumed forest canopy. The red ovals show 3 examples of this burn pattern.**

**Photos 11,12—burning homes commonly burn the trees in close proximity. Where homes are close together, the trees burn around and between the homes producing areas of totally destroyed homes and associated burned tree canopies. Note the multiple homes present in each photo.**




**Photos 13,14—the red arrows indicate the complete bark consumption (mottled) on the side facing the burned home and char with remaining bark on the side facing away. The double ended arrow indicates the decreasing consumption and char as the distance from the burned home increases.**

That leaves the question of how one home can survive adjacent to total home destruction. Photos 15-16 show such a situation. Fire does not behave capriciously; it either meets the requirements for combustion or not. If a high intensity crown fire had spread through the entire residential area then the distances between structures would not have made significant differences in the requirements for combustion. But even crown fires do not have the ability to directly ignite wood at distances greater than 100 feet. Thus, when surface fire principally occurs, the ability to directly ignite a home must occur within a few feet of or in contact with the flammable parts of the structure. A structure may ignite directly from firebrands that have come from an intense wildland fire at over ½ mile away, but these ignitions are dependent on the materials and design of the structure. Thus, significant differences in the requirements for combustion can occur from one house to an adjacent house. These differences in the direct flame and firebrand exposures related to the home characteristics result in one house surviving next to its destroyed neighbor.

**Photos 15,16—homes destroyed adjacent to homes survived indicates that significant differences existed in the fire and home characteristics necessary to meet the requirements for home ignition.**