



Introduction/Abstract

Historic wildfires burned across southeast Arizona drawing national media attention in June 2011. The Horseshoe 2 and Monument fires destroyed or damaged over 80 residences, businesses and other structures. Additionally these fires modified soil conditions such that flash flood occurrence and severity could be magnified by over an order of magnitude. Thus the post-wildfire flash flooding and debris flows may cause damage more devastating than the fires.

Southeast Arizona rapidly transitioned from the spring drought conditions to the wet summer Monsoon season by the first week of July. The Monsoon season is characterized by frequent thunderstorm activity (almost daily over the mountains), severe convection, heavy rainfall and flash flooding. The National Weather Service recognized the immediate need to raise awareness of the increased potential for flash flooding and debris flows in the burned areas. Within a few days of the Monument fire becoming contained, heavy rainfall caused a flash flood which damaged multiple homes, closed major roads, caused a debris flow and re-sculptured the water channels.

The Drought – Leading into the Fire Season



U.S. Drought Monitor from May 3rd, 2013 noting the large portion of southeast Arizona under "Extreme Drought Conditions"



The extreme drought conditions favored an active fire season. NWS Tucson issued "Multimedia Climate Briefings" to highlight the impacts of the drought including the potential for wildfires.



Wallow Fire

History **32 Homes Destroyed, 5 Damaged** 62 Total structures lost Burned from May 29th through July Horseshoe 2 Fire **Destroyed 9 Homes** Burned from May 8th through June 25th **Monument Fire** Sierra Vista **Over 100 structures impacted** Severe Burn Areas Created

"How the NWS Office in Tucson, AZ Increased Flash Flood Awareness After a Historic Wildfire Season"



The Fires and Impacts on the Soil/Hydrology

WALLOW FIRE

257.349 489

120 951 2

Total Acres = 538,049

ORSESHOE 2 FIRE

Acres

27,730 12%

66,226 30%

84,852 38%

Unburned 44,093 20%

Total Acres = 222,954

MONUMENT FIRE

Fire 98 % Contained: 7/6/2011

Soil Burn Severity Acres Percent

Low

Unburned

Total

2318

12946 40.0%

4317 13.7%

Moderate 12493 39.0%

32,074

Soil Burn Severity

High

Soil Burn Severity





Promoting



(Based on July 15,

2011 NOAA/NWS

Schaffner and Kahler).

report by Reed,

Raising Awareness – Building a Weather Ready Community



NWS Tucson staff participated in numerous community meetings in communities near the burn areas.



- ouild over the mountains typically early in the day) Dark areas under the understorm clouds i
- heavy rainfall • The rain may not fall on you emember, flooding occurs downstream of the heavy rai
- Get Set—Monitor the News and
- 60—Flash Flood Warning issue your area • The News or weather bservations may also indicate flooding is

mminent for your area

pare Now-The 5 P's of

- Pictures—Irreplaceable Memorie Prescriptions—Medications
- Eyeglasses, Hearing Aids Personal Computer—Information on
- Hard Drives, Disks, or Back-Up Drives Do not wait for the flood waters to become prepared



NWS Tucson developed a burn area "Decision Support Page" mainly for Emergency Managers and other decision makers.

NWS Tucson also prepared numerous "Multi-Media" briefings regarding the fires, drought status, and monsoon precipitation outlook.



John J. Brost, Ken Drozd, Erin Boyle, Glen Sampson and Ryan Fliehman NOAA/NWS, Weather Forecast Office, Tucson, Arizona

> April 1 through Sept. 30 products issued by NWS Tucson. Red colors indicate a "Red Flag Warning" while the Green colors indicate either a "Flood or Flash Flood Warning". Note the dramatic shift in product type near the end of June. This corresponds to the start of the Monsoon Season.



Have multiple evacuation

Be sure your roof is fitted

with proper gutters a

plans and routes

Two types of fliers were developed to highlight the flash flooding risk and suggested actions.

The fliers were a huge success and appeared on various government agency web pages in digital form.

lorseshoe 2 Flash Flood Decision Support Page Wallow Monumer Alerts National Weather Service Tucson, AZ Severe Weather Summary Pag 🔍 NWS 🔍 Ali NOAA 🚳 Home Site Map News Organization Search for: . > **(** Watches, Warnings, Advisorie Phoenix Globe san Carlos nado Warning(s) • Oro Valley ere Thunderstorm Warning(s) • Tucson ne ash Flood Warning(s) • Green Valley Sierra Vista Nogales Bisbee Last map update: Fri, Dec. 9, 2011 at 10:33:38 ar E-Spotter Current Watches Storm Reports Quantitative Precipitation Forecasts (QPF)

Portable Weather Station Observations and the Floods



Erin Boyle, produced burn area background maps and amended the Flash Flood Guidance to increase situational awareness within WFO Tucson.



Science and Operations Officer, J.J. Brost, conducts some fine tuning to the weather station as representatives from the US Park Service and NWS Tucson monitor the progress.



in since midnight 2011-07-26 15:44:06 -> 2011-07-26 20:25:59 UT(



Images Courtesy of Portal resident Helen S.

Rainfall observations from the portable weather station located in the Horseshoe 2 burn area of the Chiricahua Mountains on July 26th, 2011.

Initial Flash Flood Warning issued at 1720 UTC for Chiricahua Mts.

a. "AUTOMATED GAUGE REPORTS INDICATE THAT UP TO 1.00 INCHE OF RAIN HAS OCCURED IN THE BASINS THAT FEED INTO STREAMS RUNNING THROUGH PARADISE AND PORTAL."

. Second Flash Flood Warning issued at 18:51 UTC for Chiricahua Mts.

a. Warning again noted Portal as an impacted area

3. Significant Flash Flooding report near Portal, Arizona at 2013 UTC (Use QR Code for Video)



Portable weather station observations helped provide substantial lead time for Portal, AZ.





- > WFO Tucson developed and implemented a plan of action to help build a "Weather Ready" community in southeast Arizona
- Numerous hours were spent conducting outreach, creating awareness materials and communicating with various government agencies
- New tools and research were brought into forecast operations to improve flash flood detection
- Two weather stations were installed in Chiricahua Mountains paid for by WFO Tucson
- The stations provided valuable data that led to high lead times for some flash flood events
- WFO Tucson coordinated with Cochise County, the US Forest Service and Arizona Department of Water Resources (ADWR) to determine the siting of ADWR "ALERT" rain gauges in the Huachuca Mountains (Monument fire burn area)
- BAER (Burned Area Emergency Response) team data was utilized to modify local flash flood guidance
- > Numerous significant flash flood events occurred near the burned areas in 2011
- > No major injuries or fatalities were reported
- Local communities took preventative action to mitigate the flash flood and Debris Flow threat
- Communities placed sand bags and "Jersey" barriers in the high risk areas for flooding/debris flows

Portable Weather Station Fun Facts

- Davis weather stations
- Cost Roughly \$1,500 a piece for total package
- Powered by solar panel and battery pack
- Data transmitted via the APRS HAM radio network —
- > 1 Year data archive available online
- Partnered with the US Forest Service and Park Service for siting
- Utilized US Forest Service helicopter to transport equipment and technicians to the to a remote part of the Chiricahua Mountains to install first station
- Lost data transmission only once since installation
- Suspect a bear pushed over the equipment

Acknowledgments and Contacts

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Also, a special thanks goes to Glen Sampson, MIC at NWS Tucson, for using our limited office budget to purchase the weather stations.

Finally, thank you to the USGS for printing this poster.

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This QR Code will give you contact nformation for John Brost

References

Reed, W., Schaffner, M. & Kahler, C. (2011). Post-Burn Increased Flash Flood Risk Analysis (For the Horseshoe 2 Fire). Internal NOAA/NWS Publication.



