

From FIRES To FLOODS

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

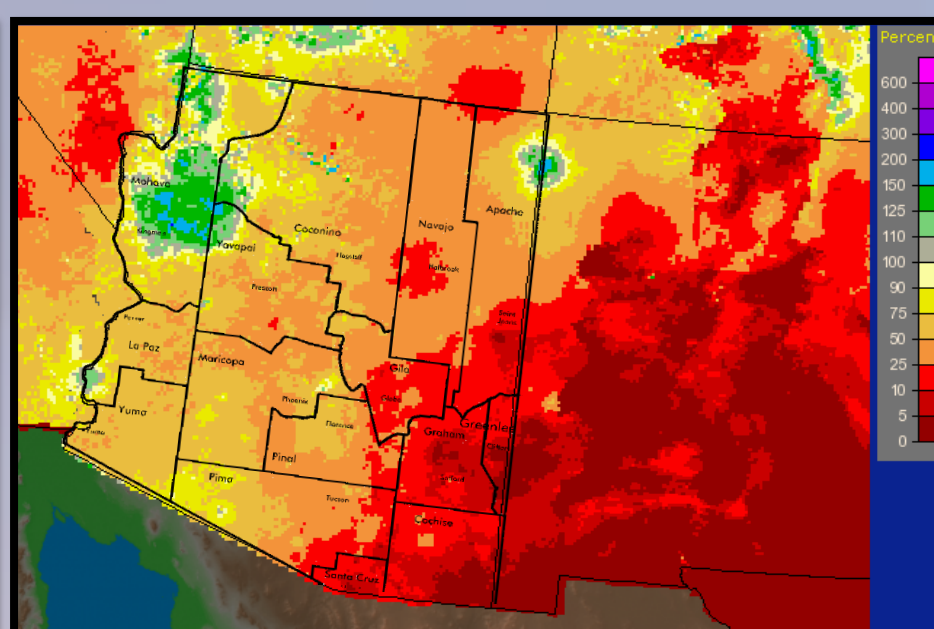
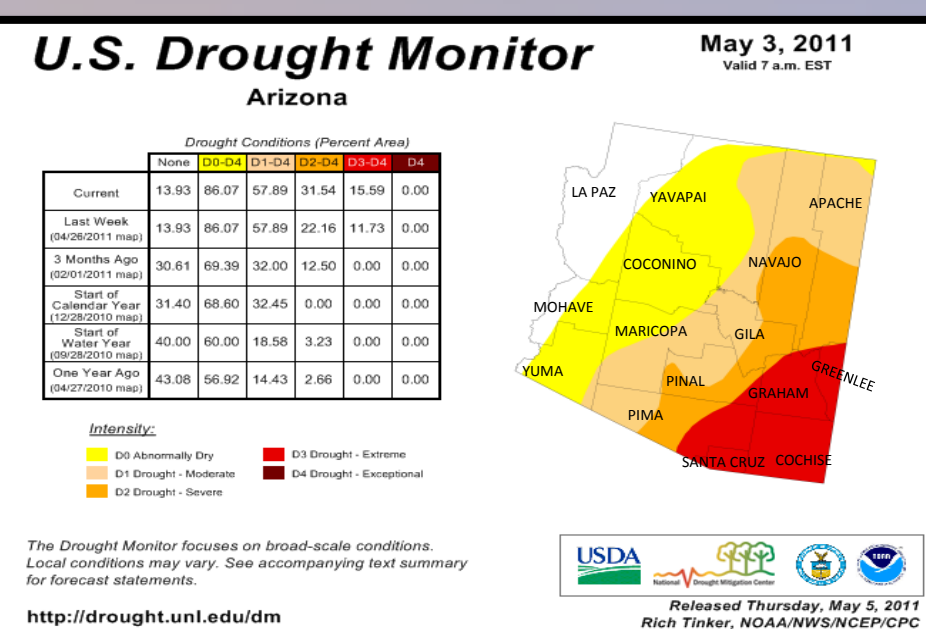
John J. Brost, Ken Drozd, Erin Boyle, Glen Sampson and Ryan Fliehm
NOAA/NWS, Weather Forecast Office, Tucson, Arizona

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



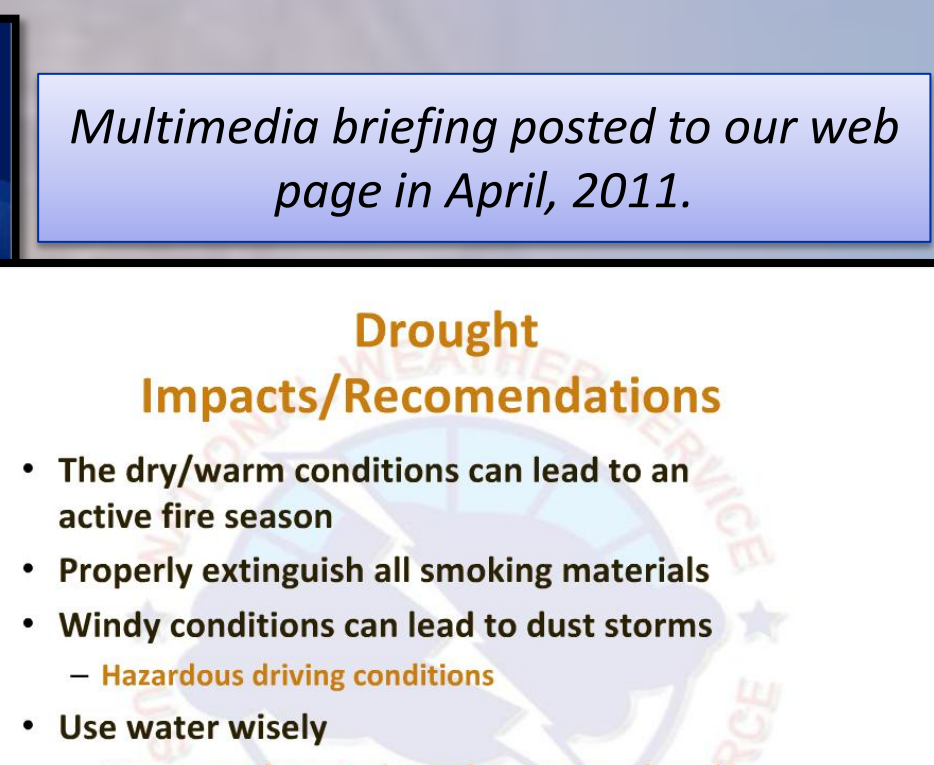
U.S. Drought Monitor from May 3rd, 2011 noting the large portion of southeast Arizona under "Extreme Drought Conditions"

Radar estimated "Percent of Normal Precipitation" for 90 day period ending on May 15th, 2011.

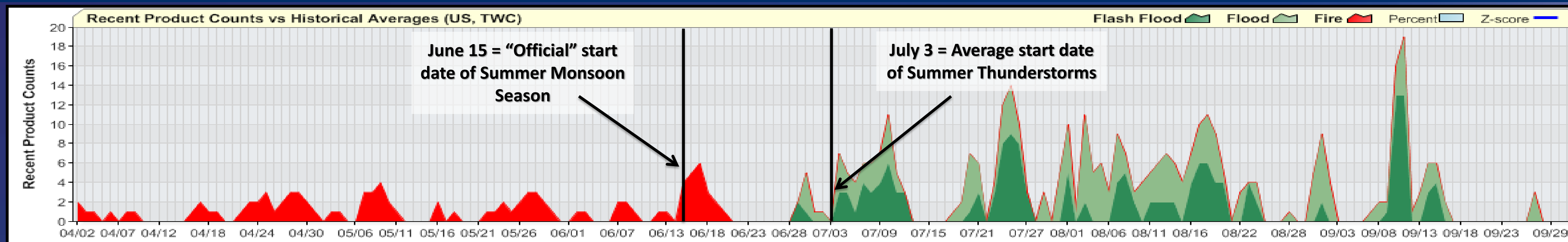
The extreme drought conditions favored an active fire season. NWS Tucson issued "Multimedia Climate Briefings" to highlight the impacts of the drought including the potential for wildfires.



Multimedia briefing posted to our web page in October, 2010.

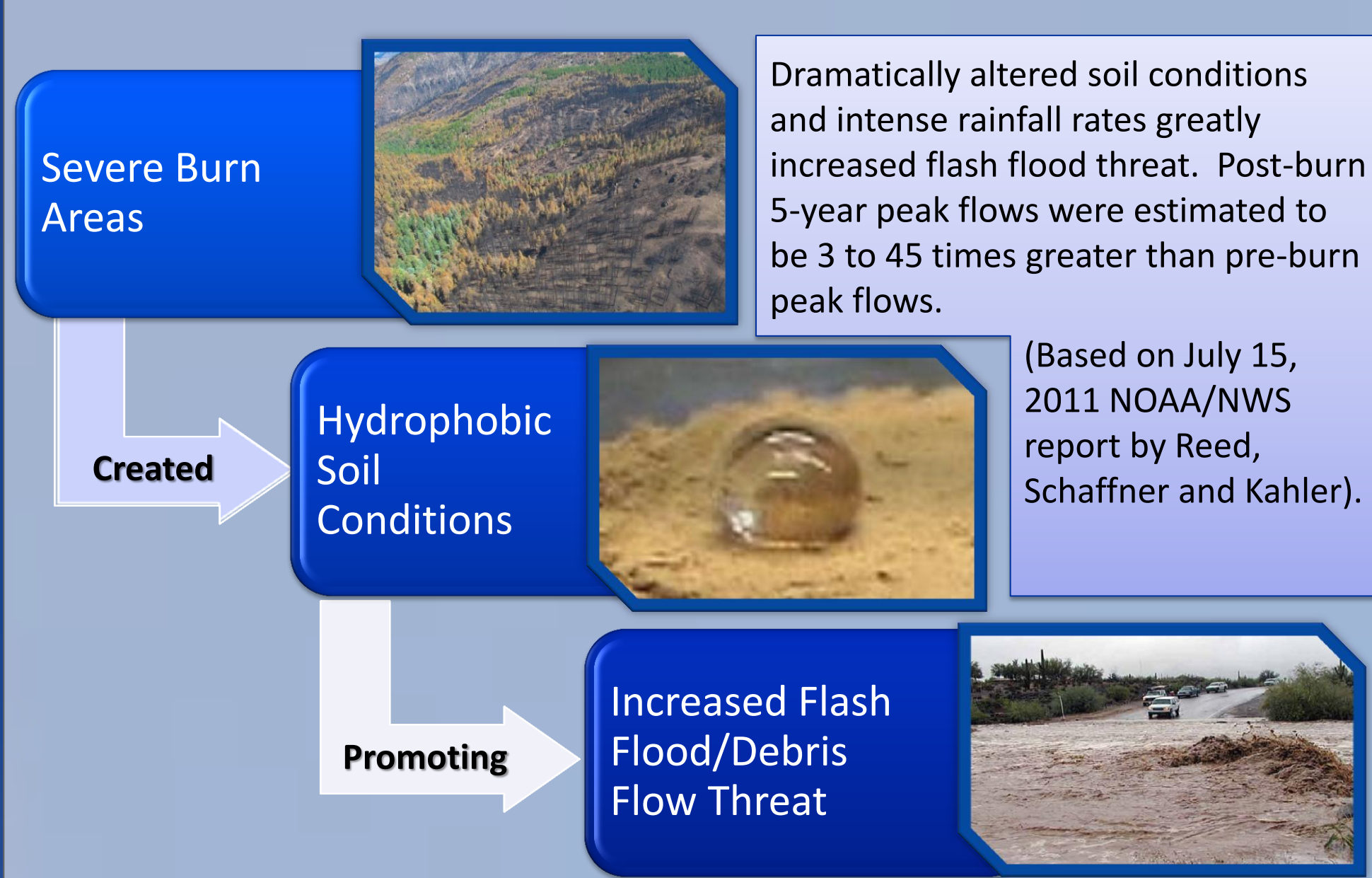
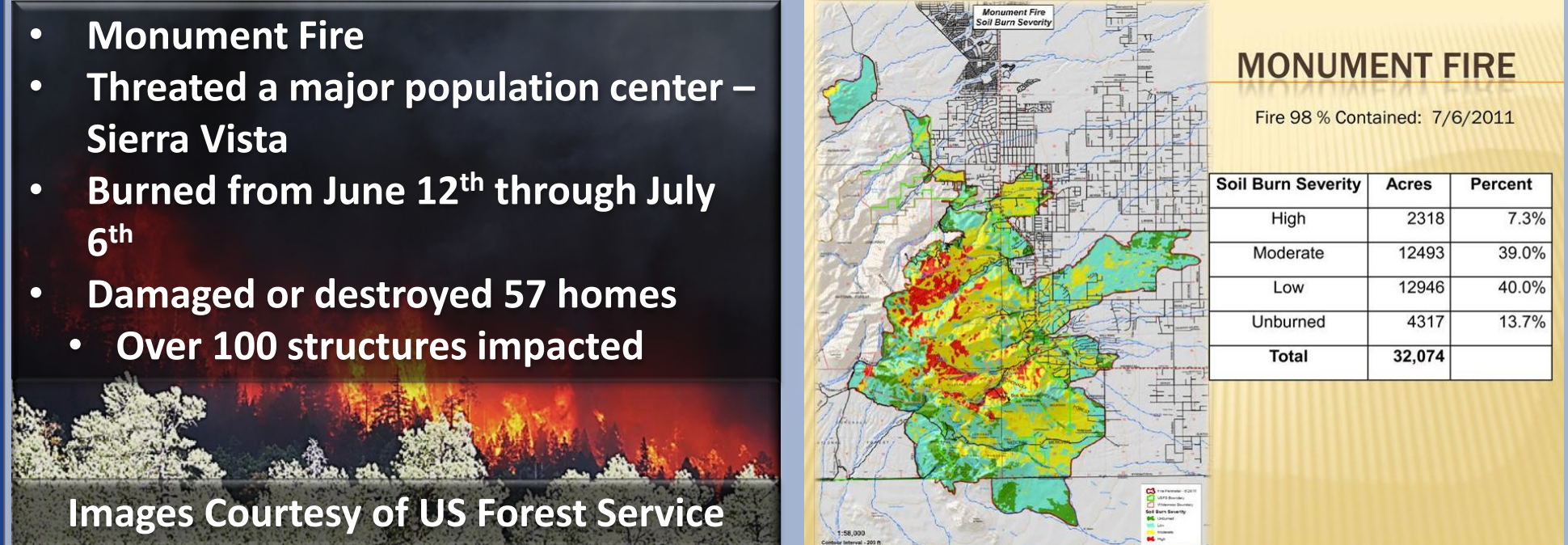
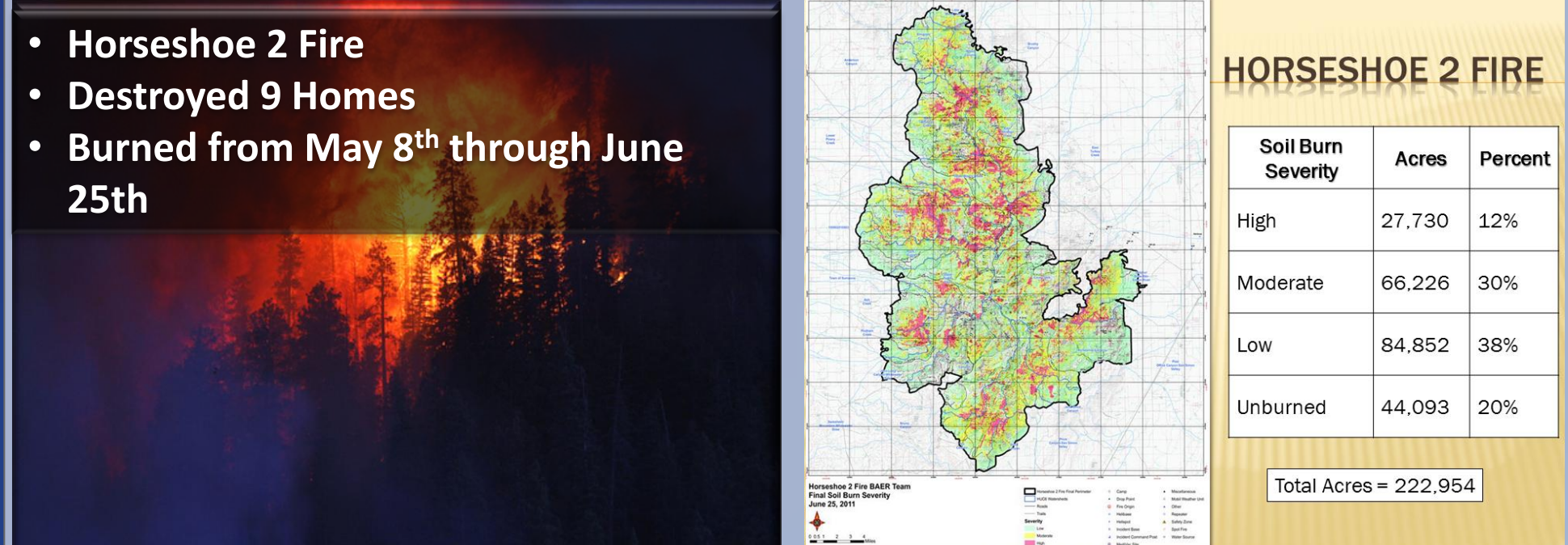
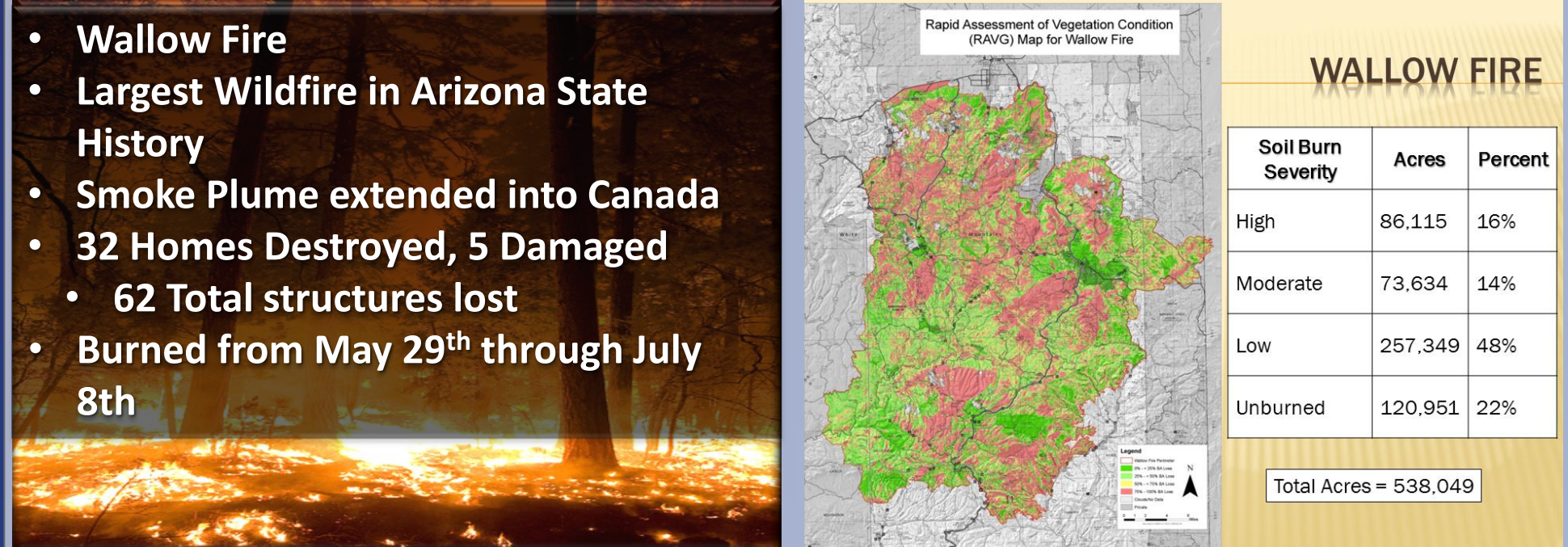


Multimedia briefing posted to our web page in April, 2011.



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.

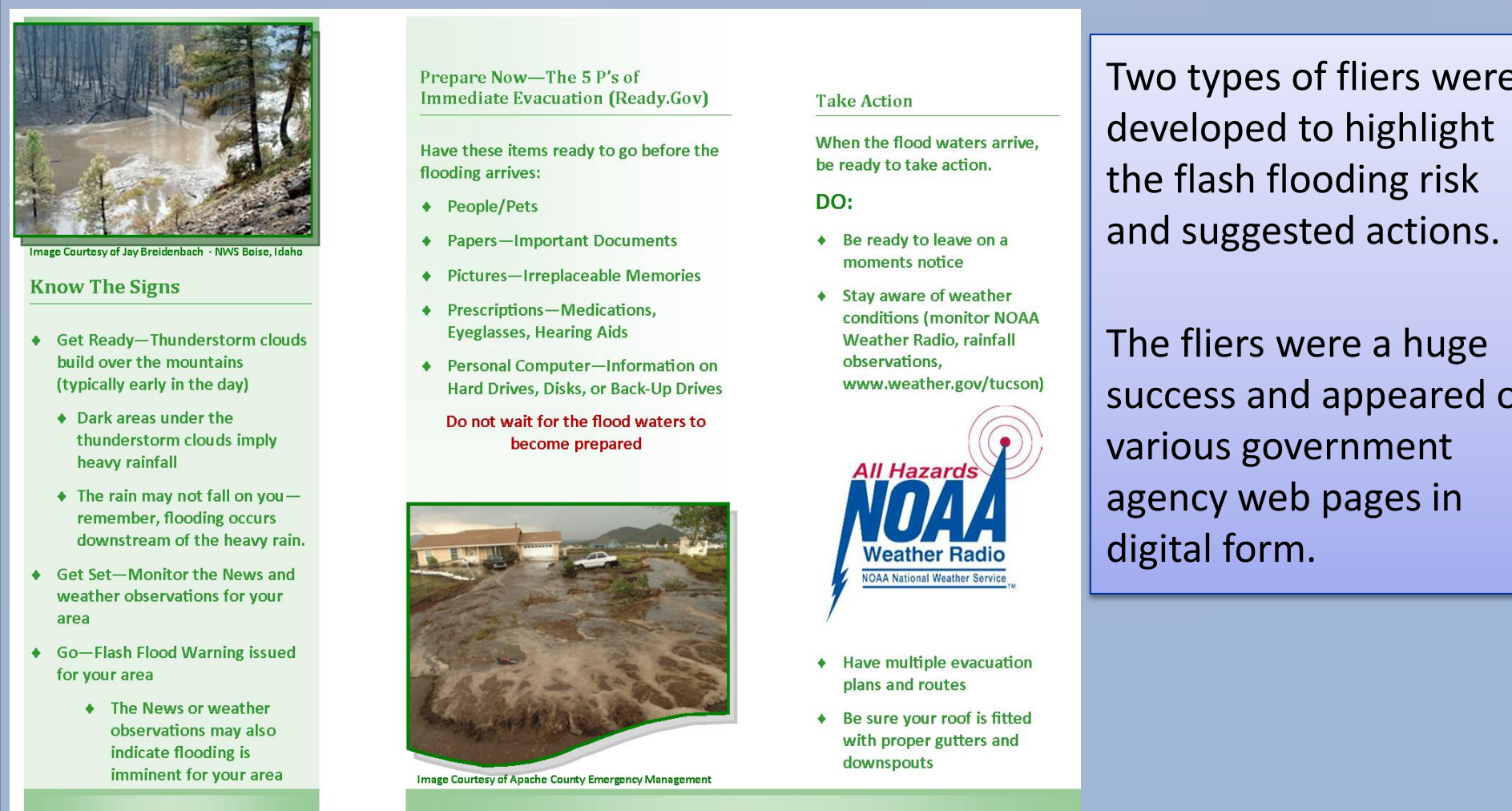
The Fires and Impacts on the Soil/Hydrology



Raising Awareness – Building a Weather Ready Community

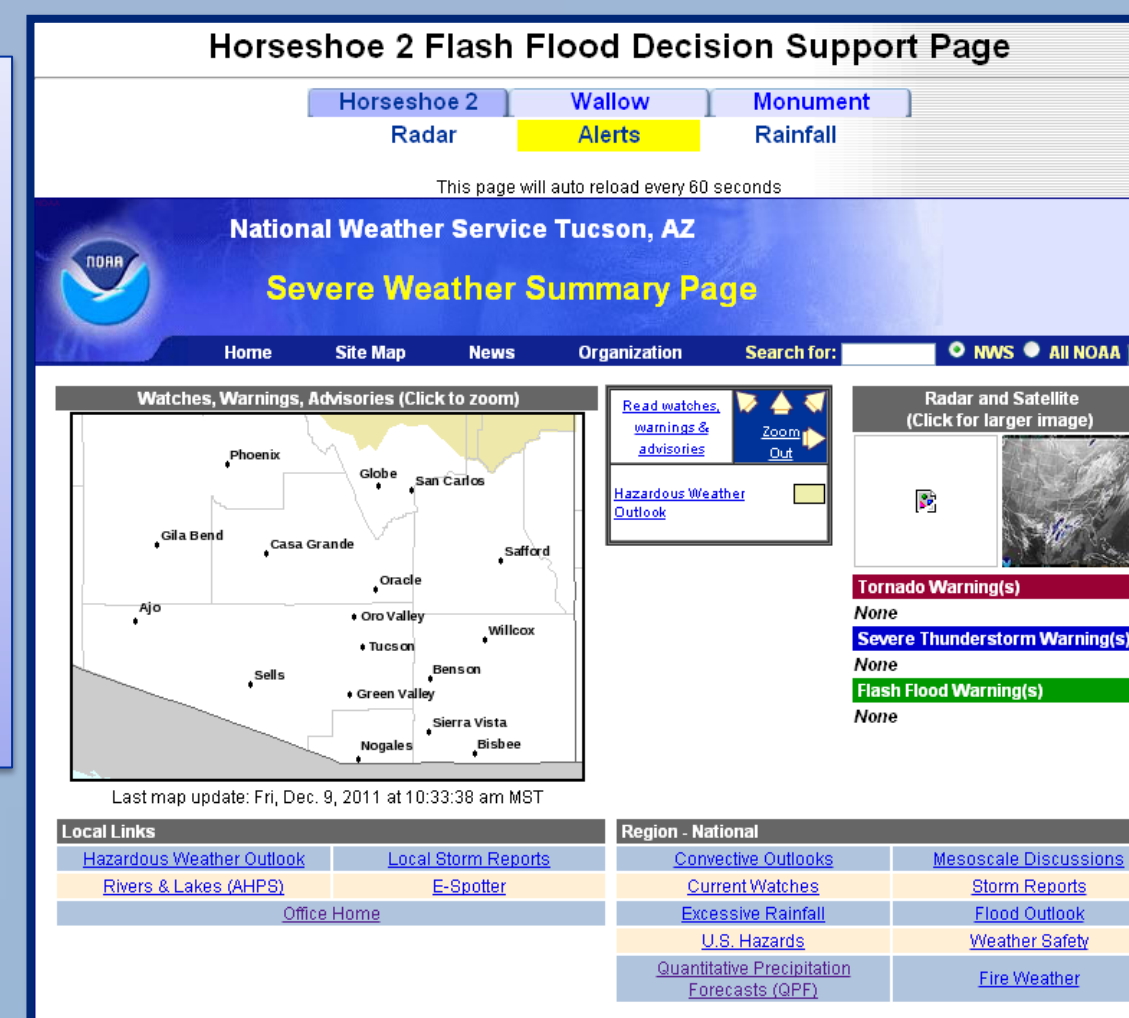


NWS Tucson staff participated in numerous community meetings in communities near the burn areas.



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

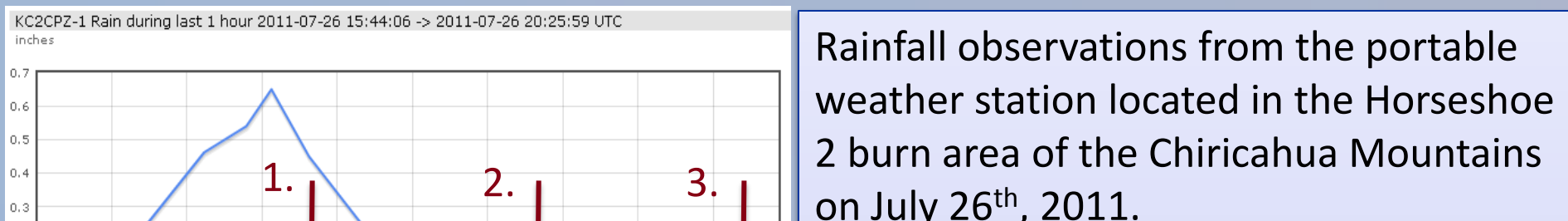
NWS Tucson also prepared numerous "Multi-Media" briefings regarding the fires, drought status, and monsoon precipitation outlook.



Portable Weather Station Observations and the Floods



Two weather stations were installed in the Horseshoe 2 fire burn area on the Chiricahua Mountains. Service Hydrologist, Erin Boyle, produced burn area background maps and amended the Flash Flood Guidance to increase situational awareness within WFO Tucson.

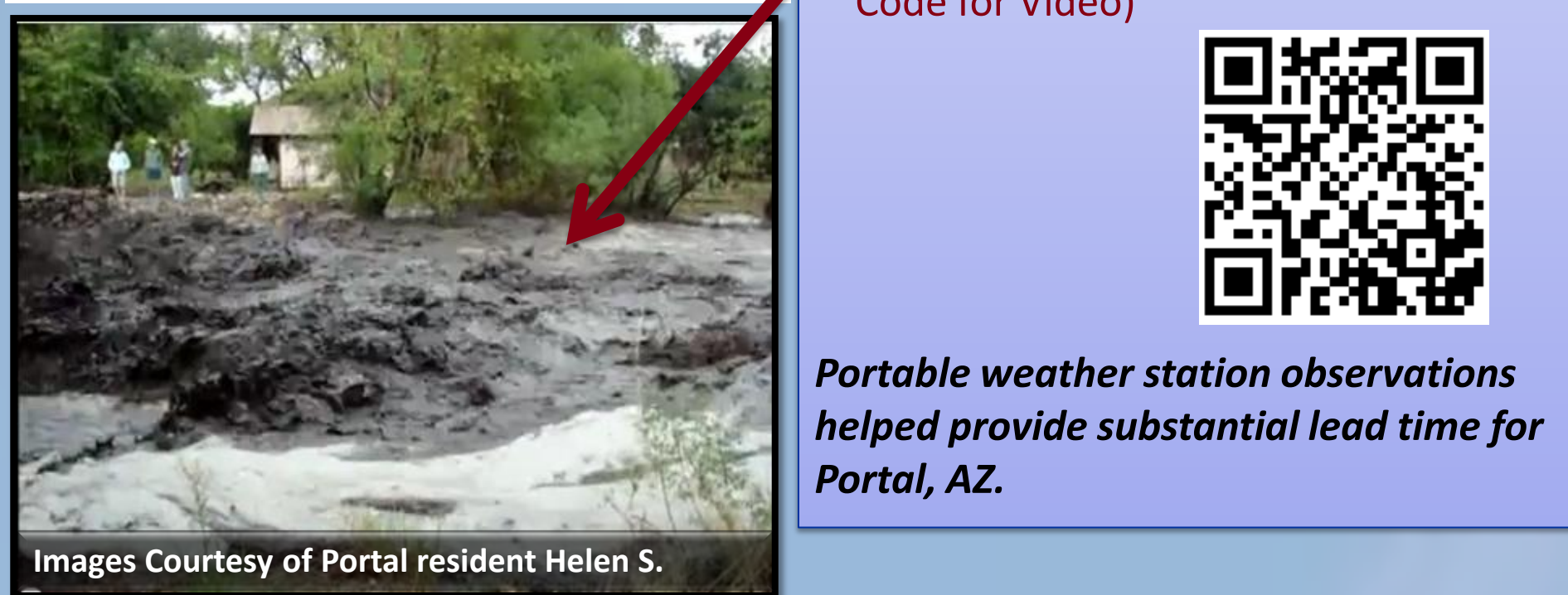


Rainfall observations from the portable weather station located in the Horseshoe 2 burn area of the Chiricahua Mountains on July 26th, 2011.

1. Initial Flash Flood Warning issued at 1720 UTC for Chiricahua Mts.
a. "AUTOMATED GAUGE REPORTS INDICATE THAT UP TO 1.00 INCH OF RAIN HAS OCCURRED IN THE BASINS THAT FEED INTO STREAMS RUNNING THROUGH PARADISE AND PORTAL."

2. 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.

Impacts/Conclusion

- 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 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

A special thanks goes to Nick Petro, WCM at NWS Raleigh, for pioneering the portable weather station idea and for helping NWS Tucson by providing instructions and invaluable insight.
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.

Contact Information:

John.Brost@noaa.gov (520) 670-5156 EXT 224
Ken.Drozd@noaa.gov (520) 670-5156 EXT 223
Erin.Boyle@noaa.gov (520) 670-5156 EXT 228

References

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

