

CALIFORNIA WILDFIRE DRINKING WATER IMPACTS



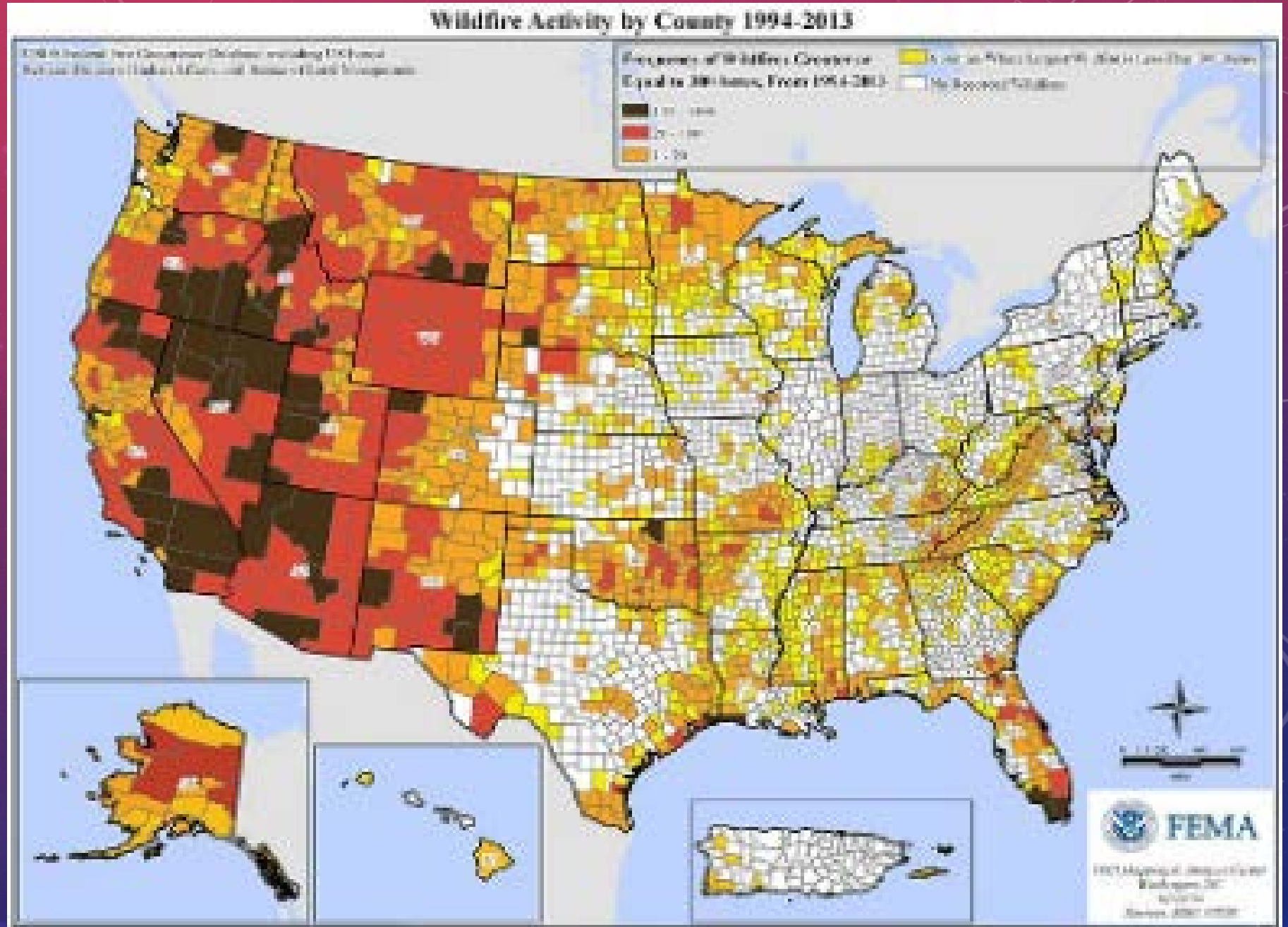
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USEPA REGION 9

WILDFIRES



- About two-thirds of western US municipalities rely on water from forested watersheds
- Wildfires can abruptly and adversely impact these watersheds
- These effects of wildfires are complex and long-lasting

US WILDFIRE ACTIVITY (1994-2013)



CALIFORNIA WILDFIRES OCTOBER, DECEMBER 2017

9900 HOMES
AND STRUCTURES



JOSHI EDELSON WATERGATE IMAGES

WILDFIRE VICTIMS





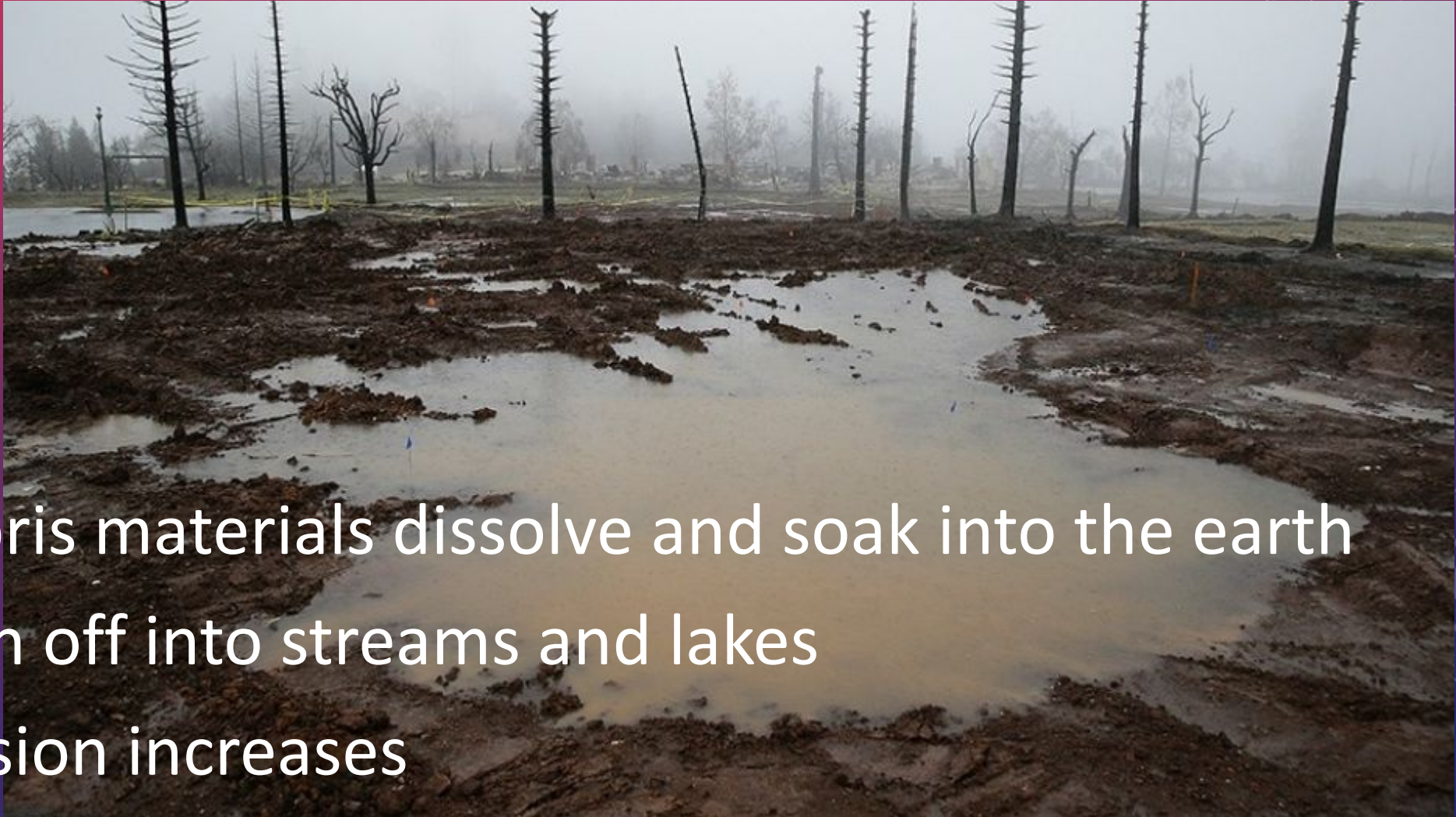
WHAT'S IN THE ASHES?



AND WHERE MIGHT IT GO?



AND THEN THE RAINS COME....



- Fire debris materials dissolve and soak into the earth
- They run off into streams and lakes
- Soil erosion increases

WATER + BURNED MATERIALS = WHAT?

- From burned wildlands vegetation
 - Nutrients: nitrogen and phosphorous
 - Organic carbon and carbon combustion products (PAHs)
 - Agricultural chemicals (eg, simazine)
- From burned structures
 - Metals: lead, aluminum, mercury, arsenic
 - Organic carbon and carbon combustion products
- From ash
 - pH changes
 - Sediment and turbidity



POSSIBLE IMPACTS FOR DRINKING WATER

- Increased solids and turbidity from sediment (soil and ash)
- Increased organic carbon (TOC)
- Algal growth and species changes from nutrients
- Toxic metals and organics
- pH changes

CONSEQUENCES FOR DRINKING WATER TREATMENT

- Increased turbidity: increased filtration
- Increased algae: increased filtration, pH adjustment, taste & odor, and disinfection byproducts (DBPs)
- Increased organic carbon: increased coagulation, membrane fouling, DBPs, biological activity, chlorine demand
- Increased toxic materials: possible Maximum Contaminant Level violations

INFRASTRUCTURE DAMAGE

- Many small water systems (mostly mutuals and camps) were burned out in last year's fires
- Others lost power or power infrastructure
- Many storage tanks were damaged or destroyed
- Service connections, meters were generally lost as homes burned

DISTRIBUTION SYSTEM CONTAMINATION

- In the Fountaingrove area of Santa Rosa, the water distribution system depressurized during the fire
- During recovery, citizen reports of solvent smell in DW
- Testing showed many VOCs, especially benzene
- Benzene generally elevated all over, up to 900 ug/L in some areas

HOW DID BENZENE GET THERE?

- No evidence of on-site or historical sources
- Service lines were PVC and HDPE
- Believe caused by pyrolysis of PVC service connections to homes
- Hot anoxic gases, smoke pulled into system



WHAT HAPPENED NEXT?

- Bulk benzene flushed out
 - Levels lowered to ~1ug/L
- But benzene absorbed into PVC and pipe gaskets...
 - Only slowly leaching out
- Ongoing monitoring, flushing and replacement
- Close collaboration of CA DDW, City of Santa Rosa, EPA and FEMA

SURFACE WATER QUALITY MONITORING

- Monitoring may be useful for surface water sources of drinking water
- There is a general consensus on what should be monitored:
 - Turbidity/ total suspended solids
 - Total organic carbon
 - Total nitrogen (nitrate, ammonia)
 - Phosphorous
 - pH

WORTH MONITORING, IF INDICATED

- Metals (especially, lead and mercury)
- Arsenic
- Bromide (DBP precursor)
- Total trihalomethane (TTHM) formation potential
- Alkalinity
- Any constituents required for permits (zinc, chromium, copper, etc)

SAMPLING STRATEGIES

- Post-fire water quality can change over months or years, depending on rainfall and recovery
- Useful to have a baseline sample before first significant runoff
- Sample “first flush” (first storm-related increase in flows)
- Sample subsequent flushes from later storms
- If in snow country, sample during spring melt

SHORT-TERM MITIGATION STRATEGIES

- Removal of toxic materials and debris from burned structures and adjacent land
- Installation of wattles, hay bales and silt screens to control bulk sediment and ash flows into waterbodies
- Installation of artificial groundcover
- Reseeding



WATTLE INSTALLATION IN COFFEY PARK, SANTA ROSA



SURFACE WATER TREATMENT ISSUES

- Use water quality data from source monitoring
- May need to adjust coagulant addition, pH, pre-chlorination to address increased turbidity and TOC
- Algal blooms require additional attention to diurnal pH changes, taste and odor problems
- Filter runs may be shorter
- Membrane fouling likely to increase
- Disinfectant demand may increase

GROUNDWATER IMPACTS

- For most unconsolidated soils, little or no impacts expected for groundwater
- Natural filtration controls sediment/turbidity
- Nitrate, phosphate could slowly increase
- Some metals and organic contaminants from structures may migrate downward around immediate area
 - Lead, arsenic

QUESTIONS?



THE END

