http://www.businessinsider.com/photo-dc-10-plane-fights-wildfire-2013-8

Characterizing Large Airtanker Use in U.S. Fire Management

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“As wildfire fear rises, US tanker fleet incomplete”

“Forest Service faces another air tanker shortage this fire season”

“USFS air tanker numbers drop as fire hazard increases”

Where are airtankers used?

- We don’t know!
- Drop location data not routinely collected
- National-scale standardized dataset
- Incident-level information may be available
  - not a census
  - not a sample
- Aircraft sensors (OLMS) log flight parameters
- Must be manually matched to individual incidents

Methods

ROSS resource orders

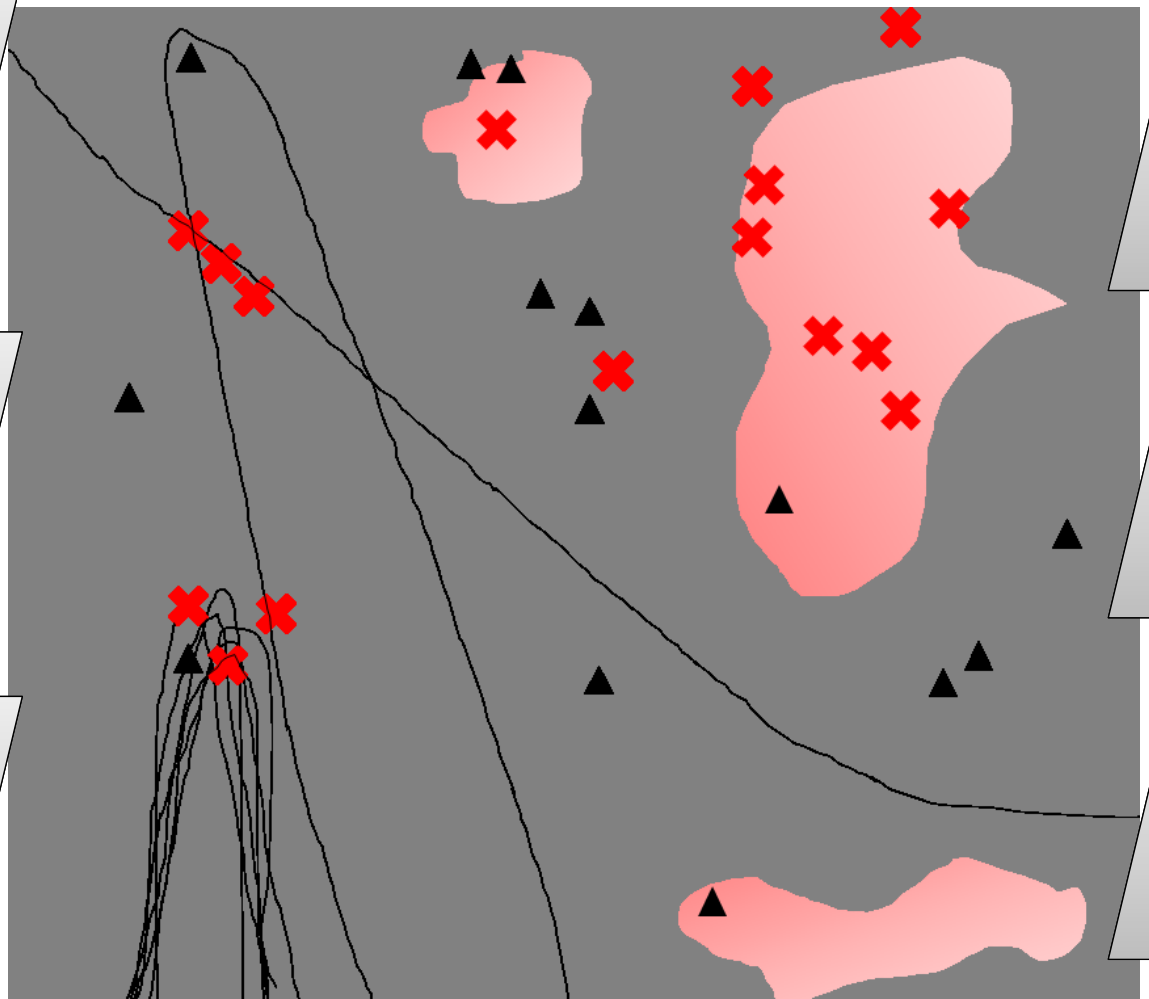
AFF flight tracking

ABS aviation billing system

fire location data

fire peri-meters

WFDSS



ICS 209

Firestat

ancillary data sources

Response and Containment

RESPONSE CATEGORIES:

Initial Attack (IA)

Extended Attack (EA)

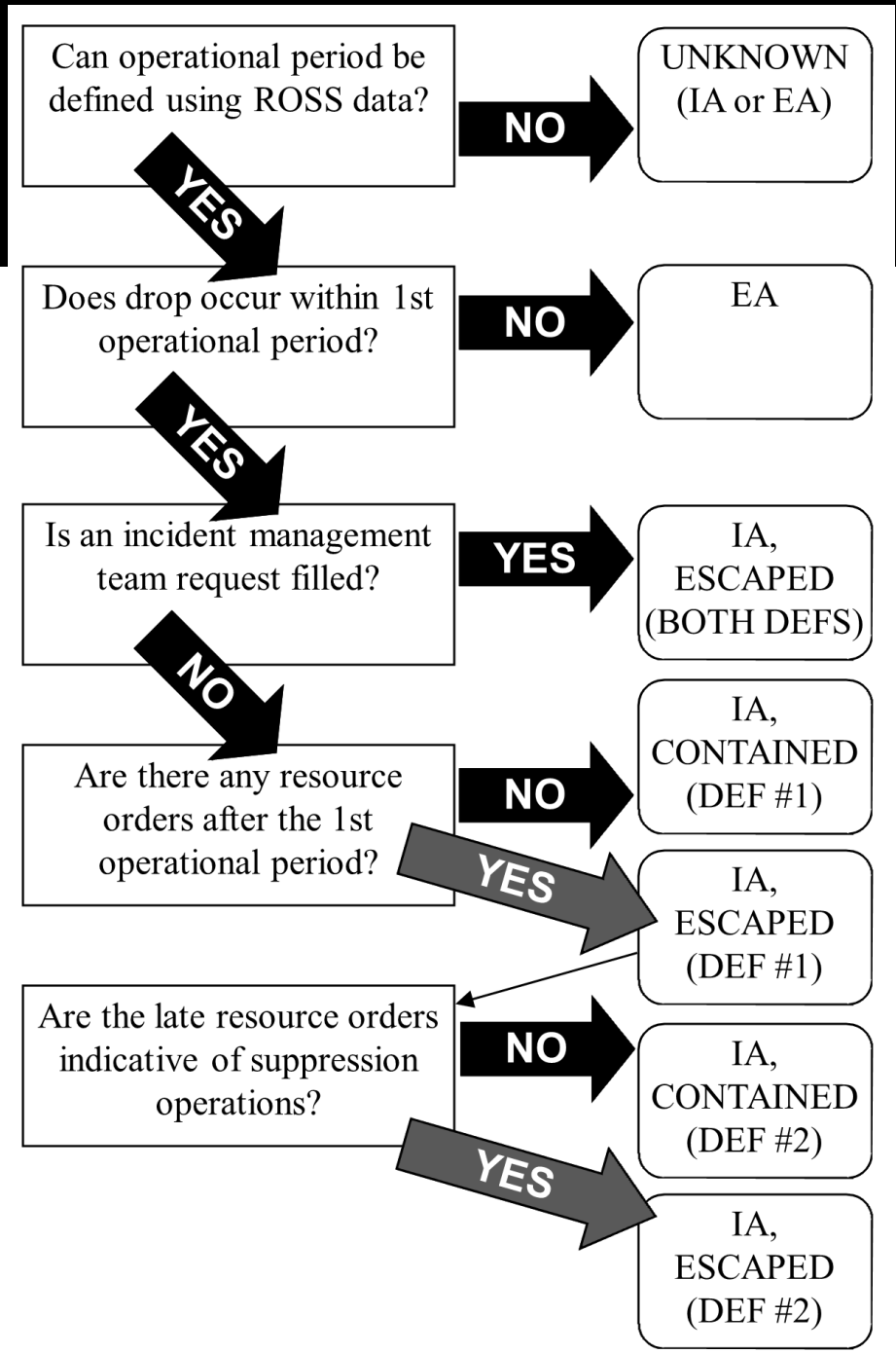
CONTAINMENT CATEGORIES:

Escaped

Contained

ESCAPED FIRES:

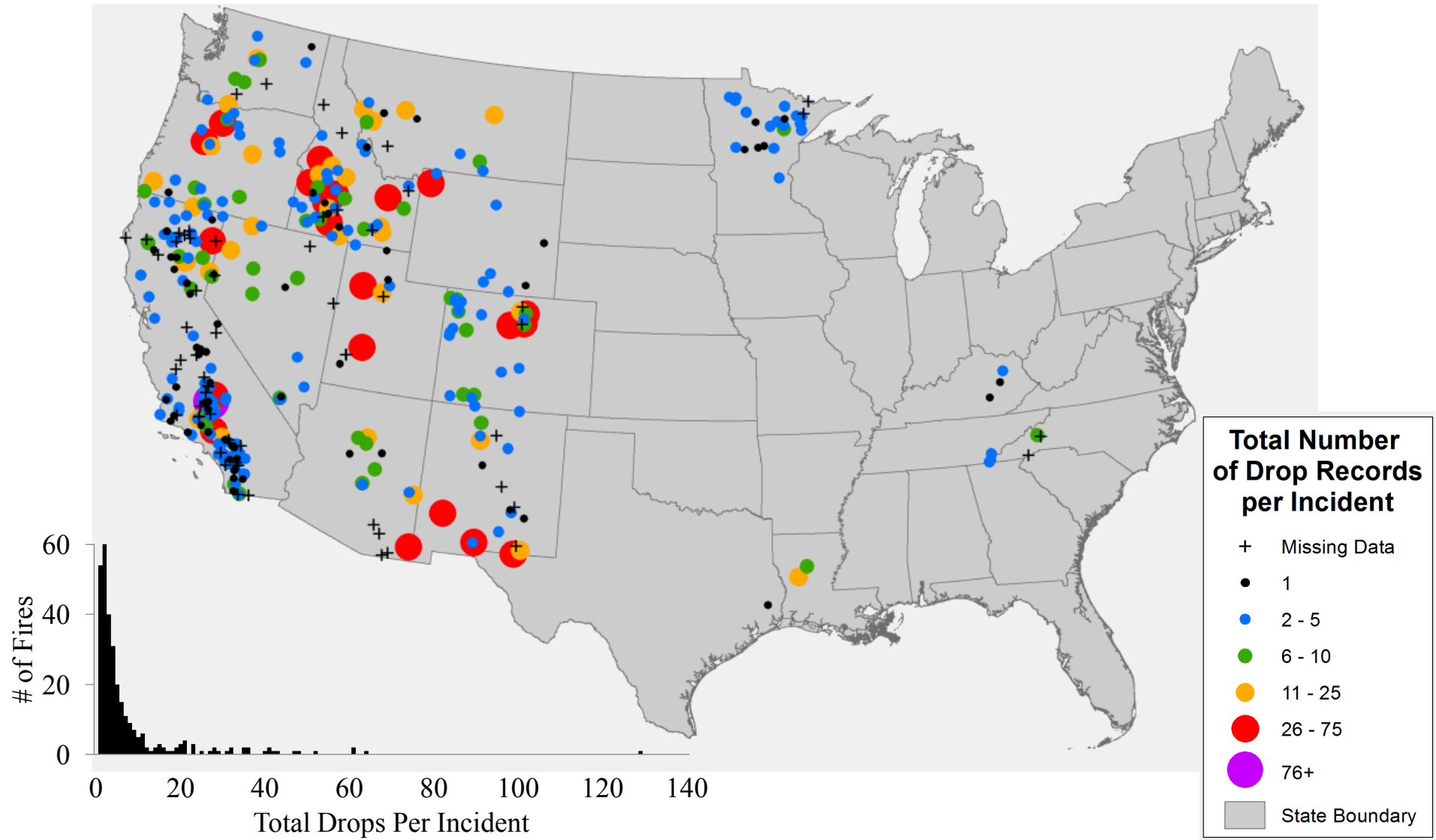
- Type 1, Type 2 or NIMO team
- resource orders after the 1st operational period, indicative of suppression



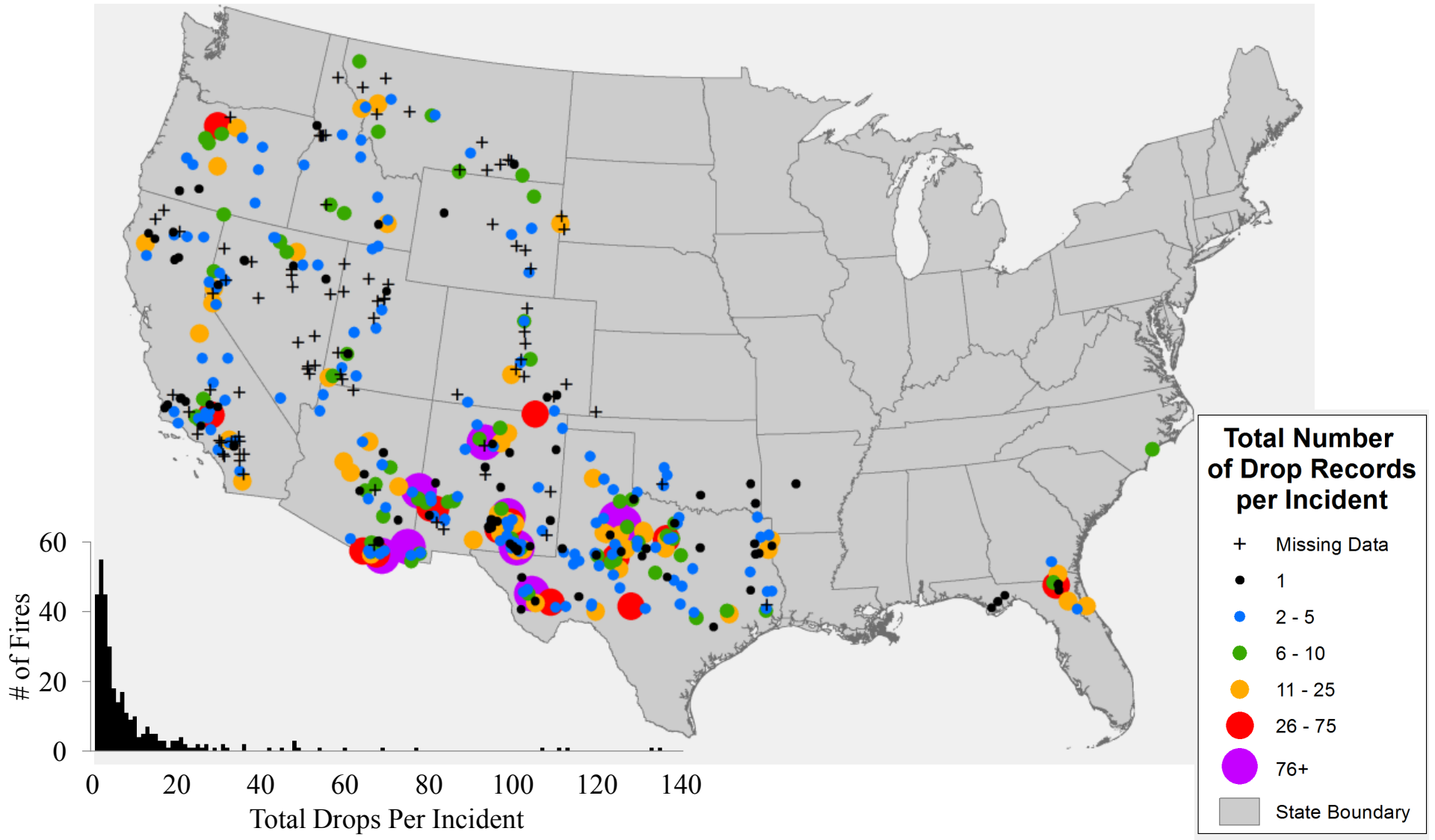
Drop Data Summary

	2010		2011		2012	
Total Drops	2448		3290		2281	
Unique Incidents	300		324		271	
Median Drops per Inc	4		4		4	
Mean Drops per Inc	8.0		9.8		8.2	
St Dev (Drops per Inc)	12.9		17.6		12.2	
Skewness	4.4		4.6		4.2	
Unknown Drops	40	1.6%	120	3.6%	32	1.4%
Misc. Drops	17	0.7%	12	0.4%	18	0.8%
Texas Drops	49	2.0%	900	27.4%	62	2.7%
Texas Incidents	2	0.7%	98	30.2%	2	0.7%

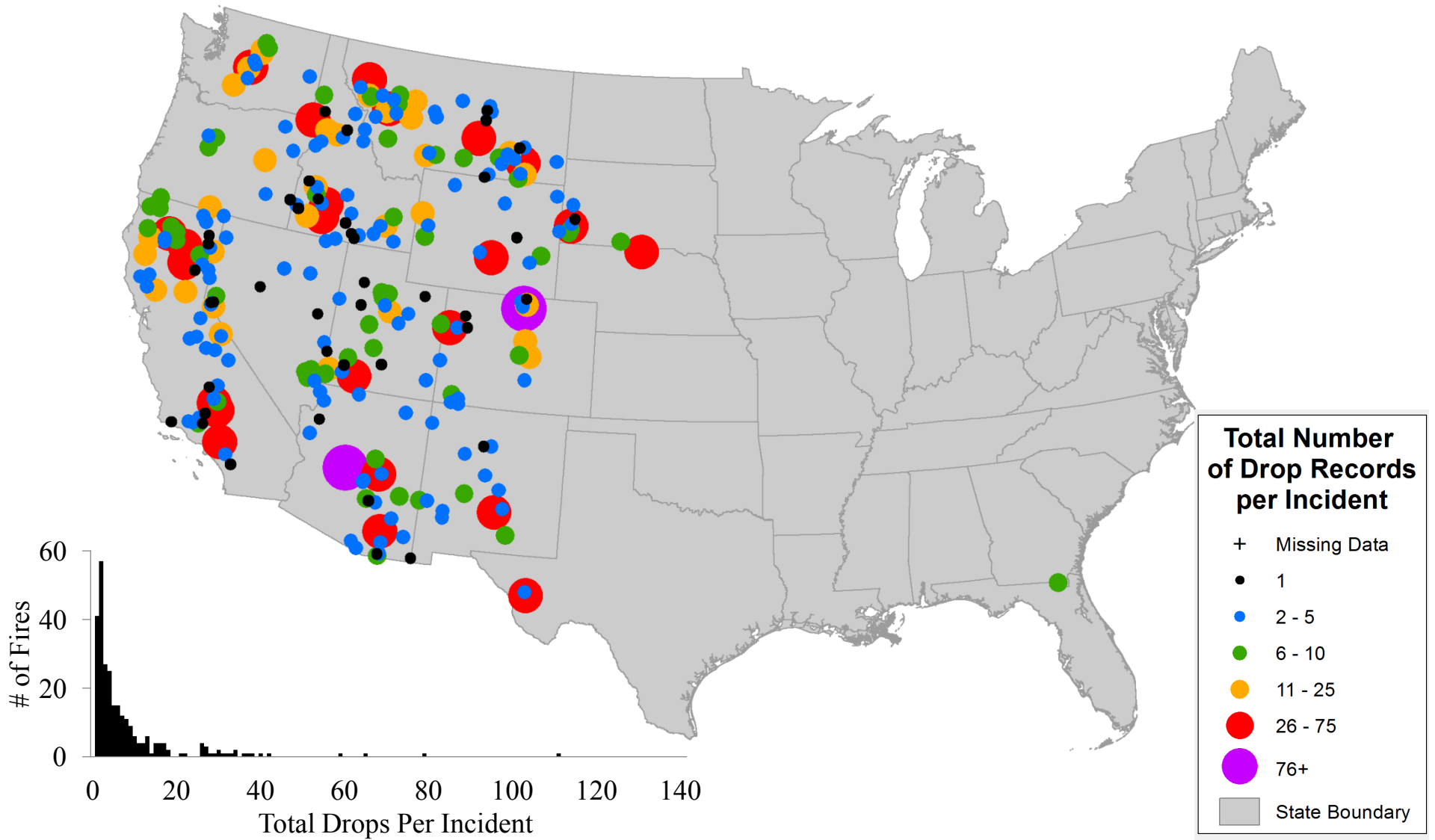
2010 graduated drop number by fire



2011 graduated drop number by fire



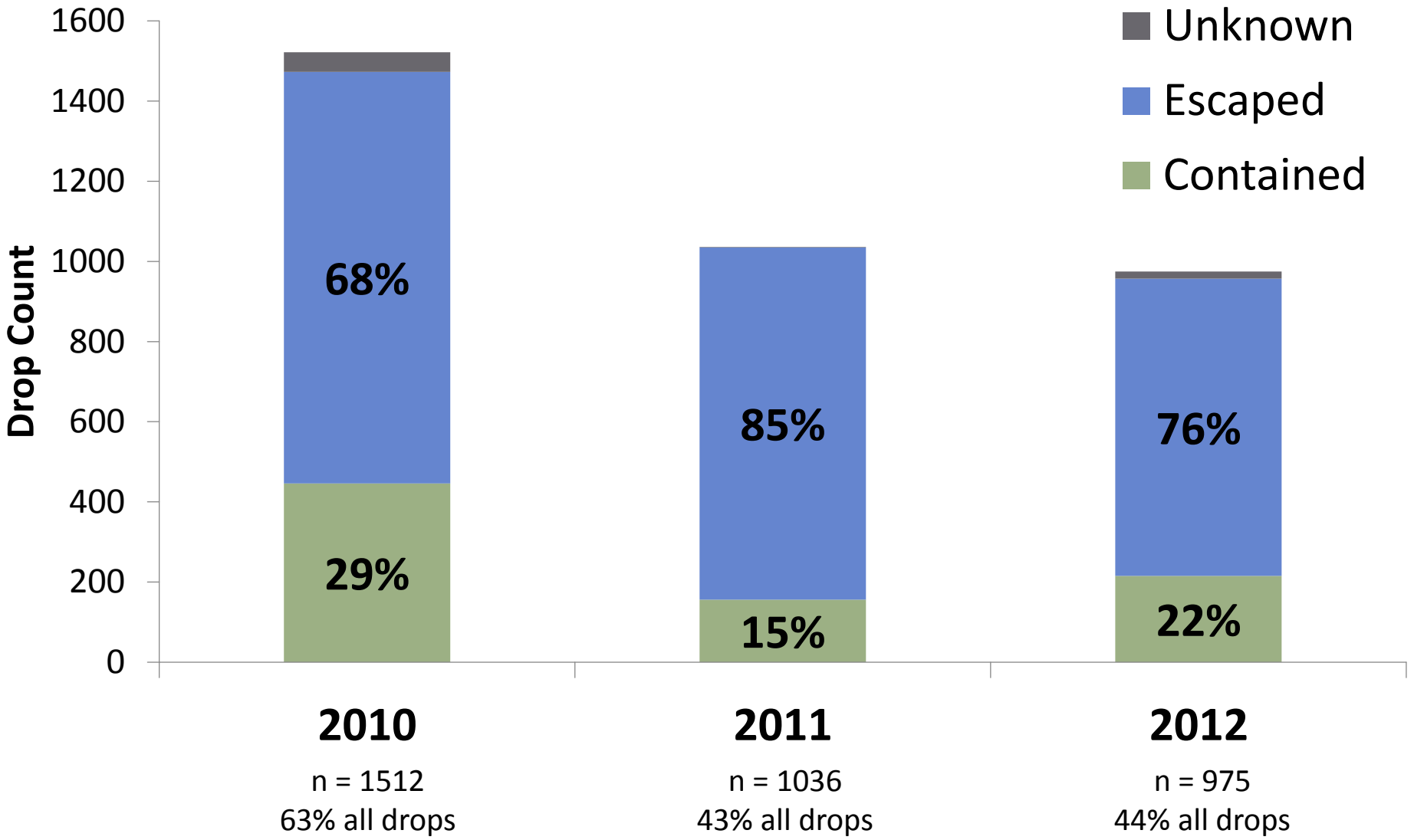
2012 graduated drop number by fire



Response and Containment Results

Response Category	Containment Category	Response by Drop # Drops (% Total)			Response by Fire # Fires (% Total)		
		2010	**2011**	**2012**	**2010**	**2011**	**2012**
IA	**Contain**	446 (19%)	156 (6%)	215 (10%)	127 (42%)	51 (22%)	69 (26%)
	Escape	1027 (43%)	879 (37%)	742 (34%)	101 (33%)	92 (40%)	92 (34%)
	Unknown	49 (2%)	1 (0%)	18 (1%)	21 (7%)	1 (<1%)	1 <1%
	Total	**63%**	**43%**	**45%**	**80%**	**63%**	**60%**
IA/EA	**Escape**	N/A	N/A	N/A	39 (13%)	41 (18%)	58 (21%)
EA	**N/A**	825 (34%)	1219 (51%)	1090 (49%)	15 (5%)	33 (15%)	37 (14%)
Unknown	**Unknown**	52 (2%)	143 (6.0%)	151 (6%)	2 (<1%)	10 (4%)	13 (5%)

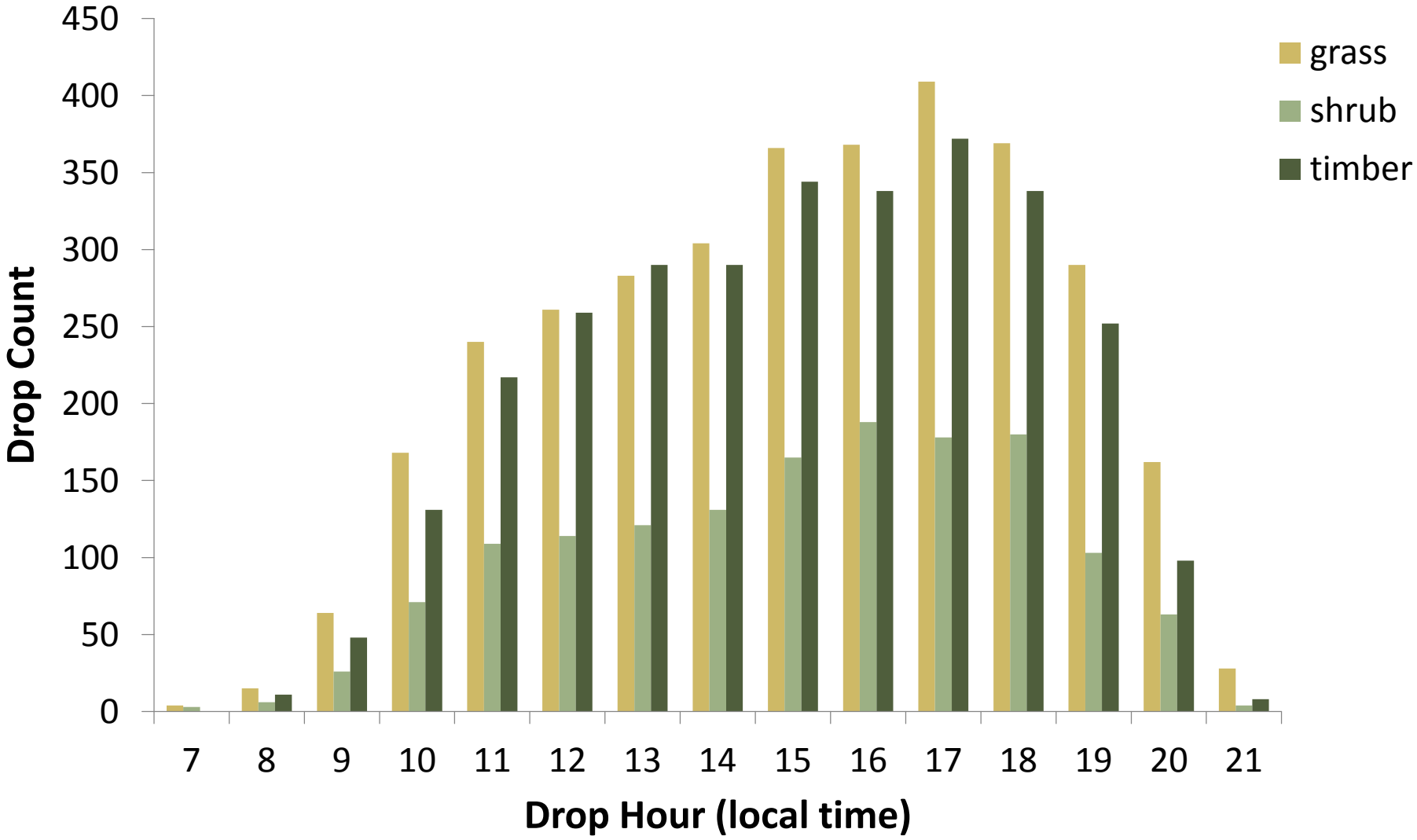
IA Containment Summary



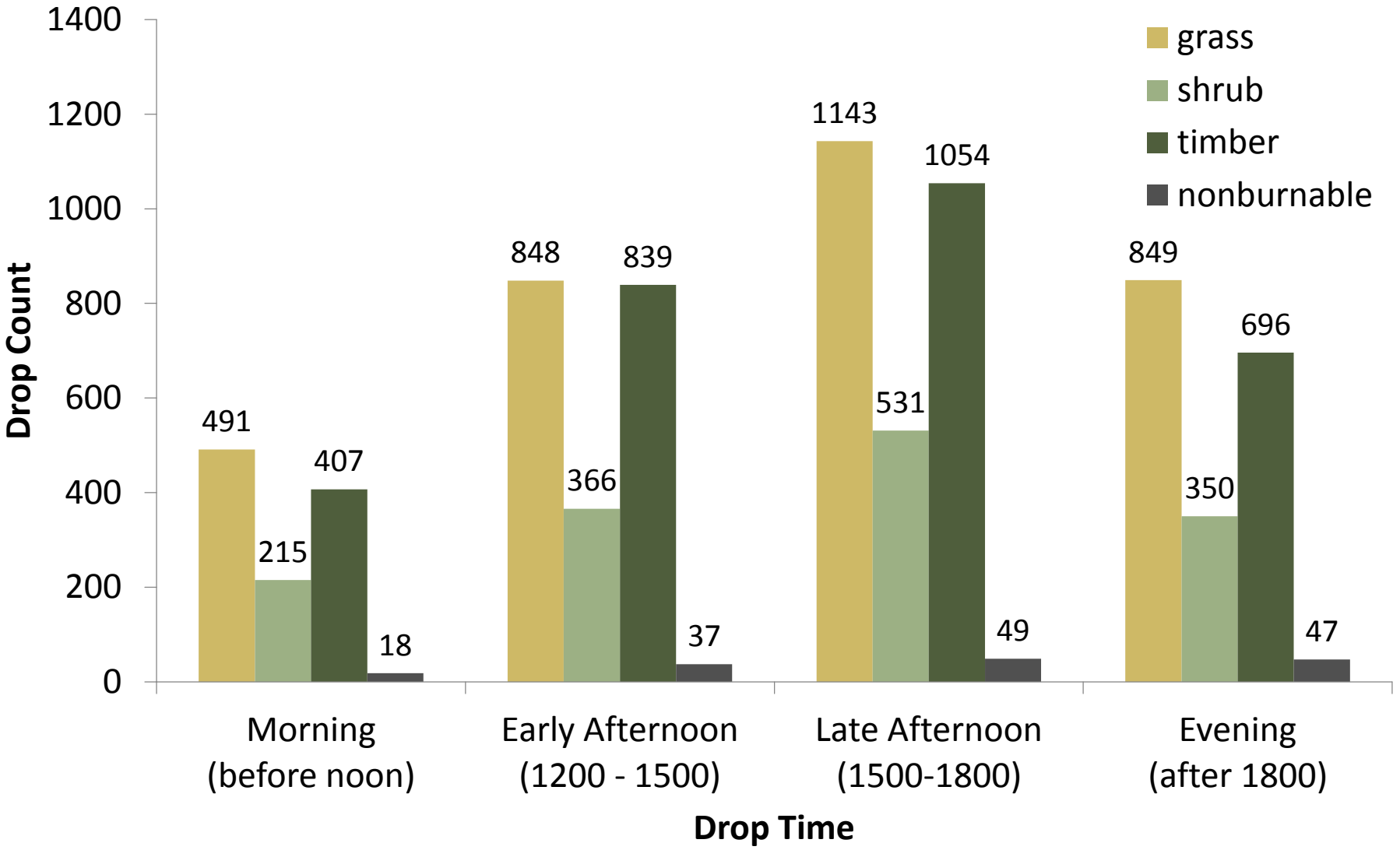
Conditions of effectiveness?

- Retardant delivery parameters
  - Continuous swath of chemical at a certain coverage level
  - Obstacles in path or light coverage can let fire just burn through
- Fuels
  - Needs to penetrate the canopy to affect ground fire spread
  - Broken or light fuels
- Slope
  - Tests have been done at airports
  - Flame length, fire behavior affected by slope
  - Also affects retardant delivery parameters
- Weather
  - High winds dissipate retardant and blow chemical off target
- Fire behavior
  - Target must be visible
  - Drop should be supported by ground personnel

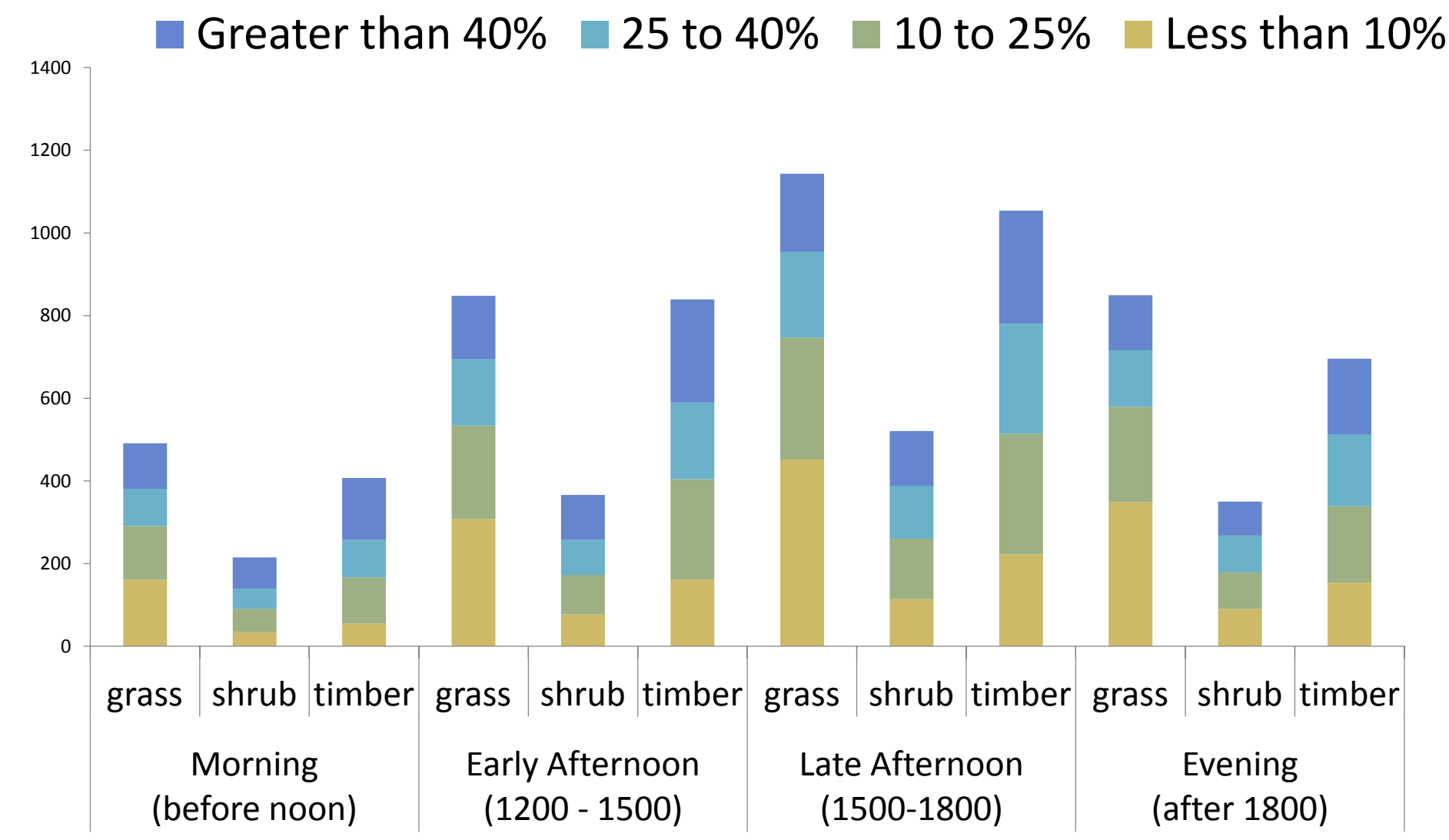
Drops by fuel type and drop hour



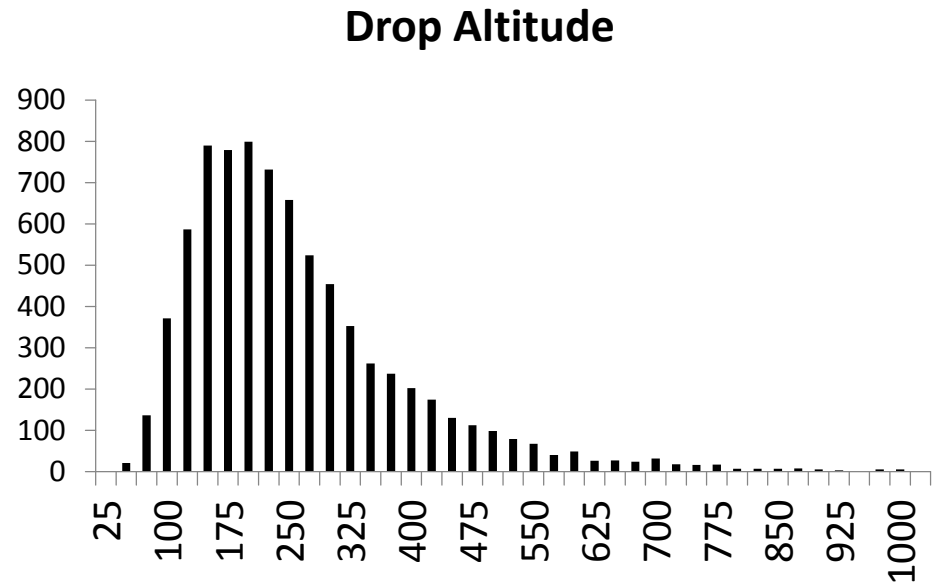
Drops by fuel type and time of day



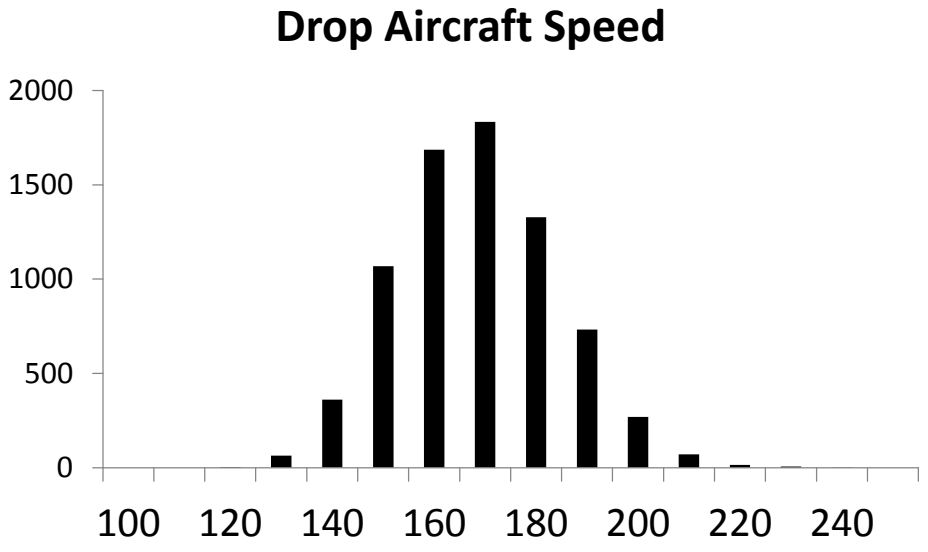
Drops by fuel type, time of day, and slope class



Flight speed and height (AGL) at drop



mean = 247 ft
median = 215 ft



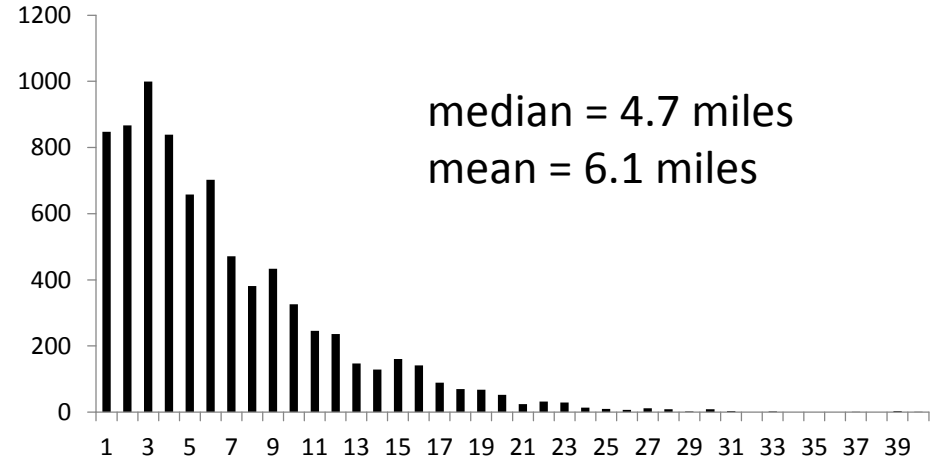
mean = 163 mph
median = 162 mph

General spatial summaries

	Number of Drops	Percent Total Drops
Intersect Retardant Avoidance Boundary	40	0.5%
< 250m from Retardant Avoidance Boundary	83	1.0%
Drops on Incidents with Teams	4059	50.6%
Intersect SILVIS WUI	313	3.9%
Intersect Wilderness	642	8.0%
Intersect IRA	920	11.5%
Intersect WSA	453	5.6%
Intersect Wilderness/IRA/WSA	1686	21.0%

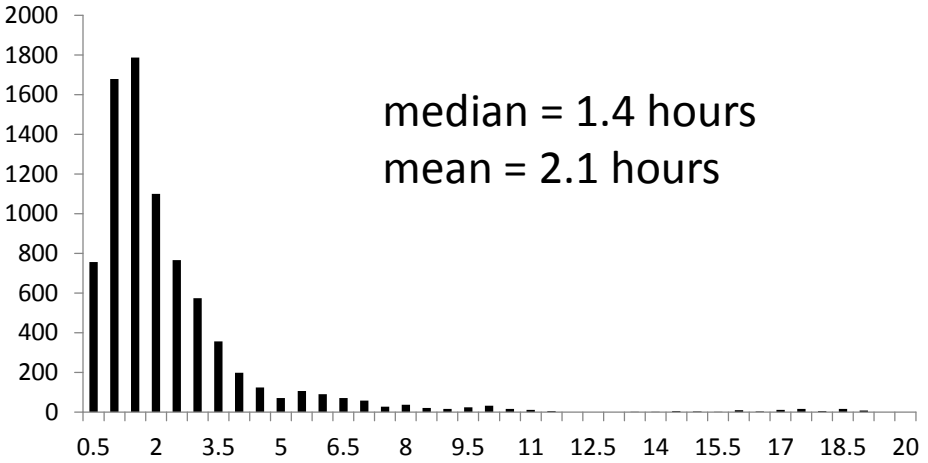
Measures of remoteness

Distance to Major Highway



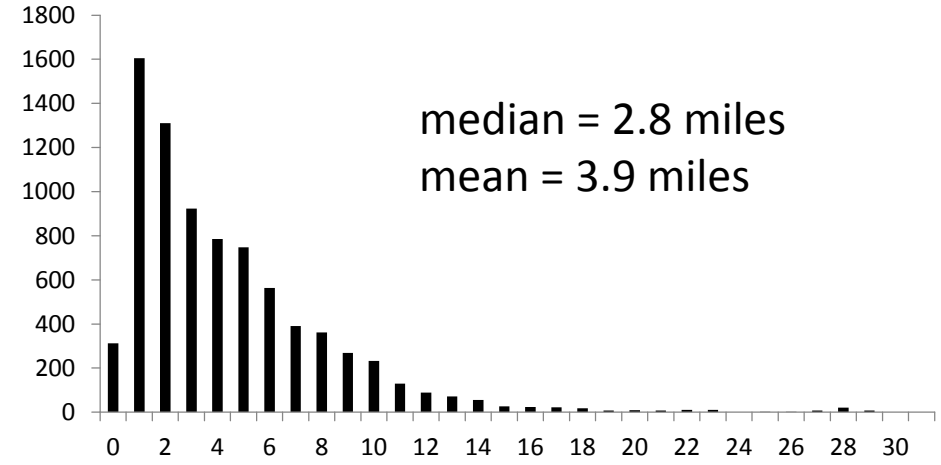
median = 4.7 miles
mean = 6.1 miles

Evacuation Travel Time



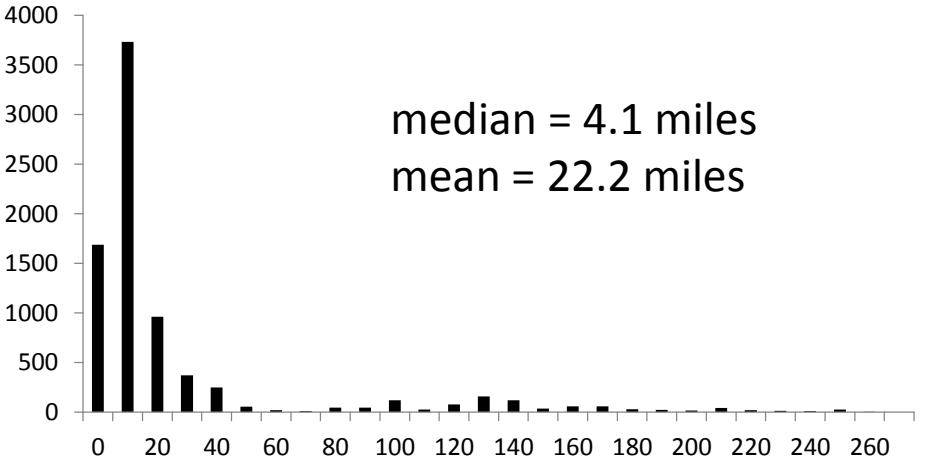
median = 1.4 hours
mean = 2.1 hours

Distance to WUI



median = 2.8 miles
mean = 3.9 miles

Distance to Wilderness, IRA, or WSA



median = 4.1 miles
mean = 22.2 miles

DC-10, San Miguelito Fire, CA

What we don't know …

- manual, time-consuming process gives us a picture of overall use …
- but can't say where, when, why, and how they are used
- given the investment in the program, answering basic questions of use should be easier

Year	Aviation cost	LAT and VLAT Cost	Total Suppression Cost	% Aviation	% LAT Aviation
2007	$35.5 M	$41.1 M	$1,373.9 M	25.9%	11.6%
2008	$36.7 M	$64.3 M	$1,458.8 M	25.2%	17.5%
2009	$28.7M	$56.3 M	$1,018.3 M	28.1%	19.7%
2010	$25.3 M	$54.9 M	$897.7 M	28.2%	21.7%
2011	$35.3 M	$67.7 M	$1,414.4 M	25.0%	19.2%
5-year total	$1,615.9 M	$284.3 M	$6,163.1 M	26.2%[A]	17.6%[A]

Data Woes

- GAO report issued in 2013 on fleet modernization efforts found that
  - USFS and DOI failed to effectively collaborate,
  - that there was insufficient data on aircraft use, performance and effectiveness
- Lot of data collected, but not standardized or synthesized
- Lack of data precludes answering many basic usage questions

Next steps …

- AFUE study ongoing
- Contracting changes will facilitate greater sample of drop data from next-gen aircraft
- Improvements to ROSS dispatch protocol to enforce business rules regarding airtanker orders
- Push for improvements in data collection protocol and standards to:
  - facilitate linking drops to incidents
  - move toward data on drop objectives and outcomes