

# The Influence of Incident Management Teams on Suppression Resource Use

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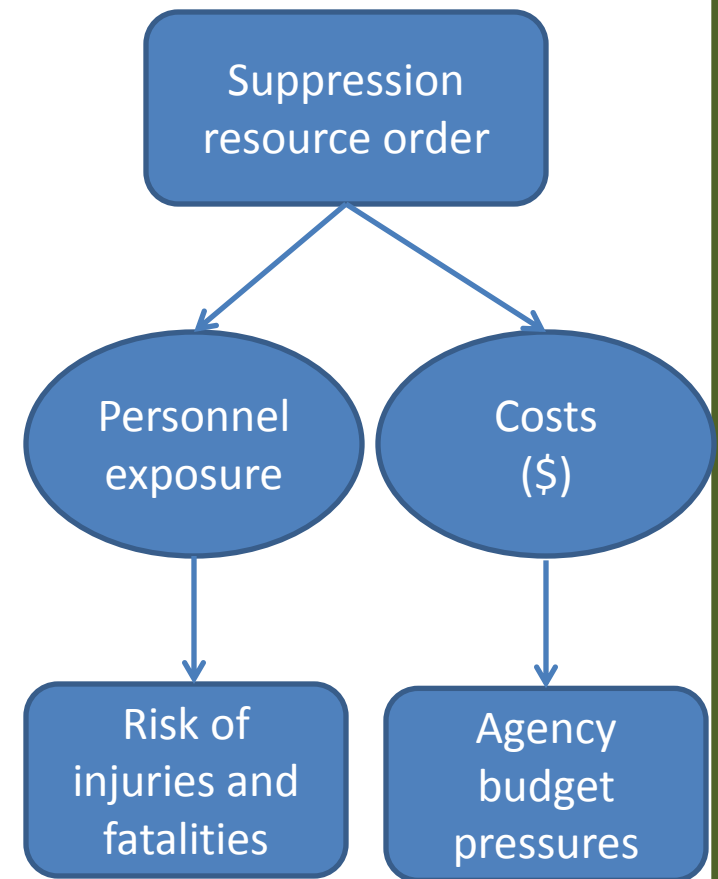
Large Fire Conference, Missoula, MT, May 22, 2014

# Two difficult problems of wildfire management

- High suppression costs threaten public agency budgets
  - Many human factors
  - Difficult to align incentives to constrain costs
- Exposure of personnel to risks
  - Engaging fire involves risk of injuries and fatalities (travel, exertion, accidents, burn-overs)

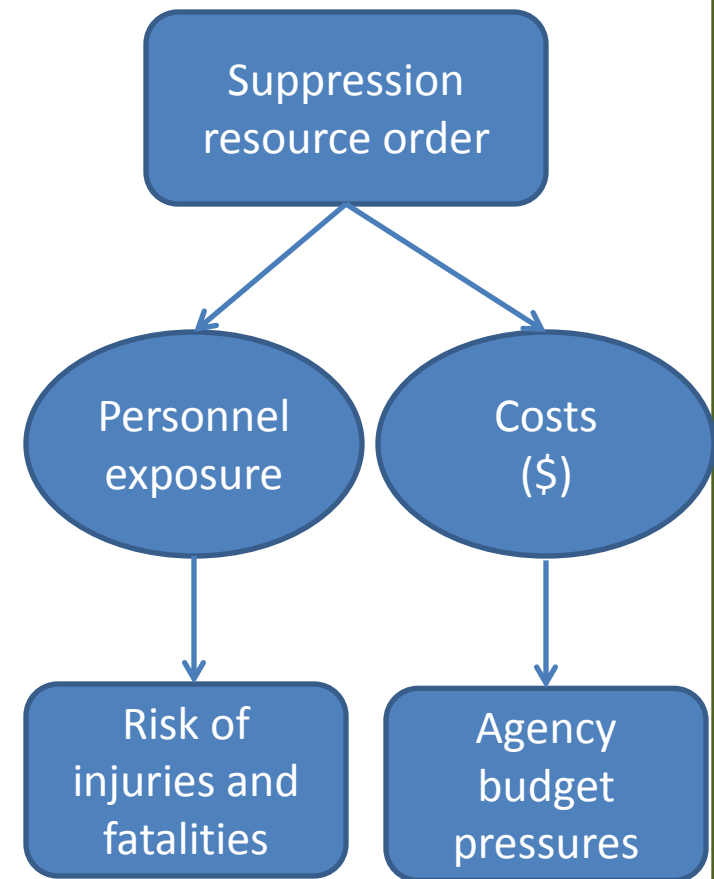
# Two difficult problems of wildfire management

- Both problems stem from decisions to order suppression resources, and use them to engage fire
  - Resources cost money
  - Boots on the ground involves risk



# Two difficult problems of wildfire management

- Both problems stem from decisions to order suppression resources, and use them to engage fire
  - Resources cost money
  - Boots on the ground involves risk
- But you can't manage fire without resources



# Examining resource orders

- What factors drive decisions about resource orders?
- A few hypotheses:
  - Fire potential and characteristics
  - Socio-political influences
  - Individual management preferences and risk attitudes

# Examining resource orders

- We look at determinants of daily resource orders, and the role of individual teams in explaining orders
- Examine fireline production capacity
  - Calculate daily production capacity from line-producing resources (crews, engines, dozers, heli)
  - Observe how ordered production capacity varies with fire characteristics, between different IMTs
  - Regress production capacity on daily characteristics, IMT fixed effects

# Panel data of IMTs and resource orders

- IMTs: Identify unique incident management teams
  - Include Type 1 (T1), Type 2 (T2), Fire Use Mgmt (FUMT), Wildland Fire Mgmt (WFMT), and NIMO teams (90 teams)
- Incidents: Identify all incidents where one of the team types were assigned (299 fires, FY 2007 – FY 2011)
- Resources: Gather all resource orders from ROSS (federal resources only) for IMT assignment days (3,439 assignment days)

# Data summary

Panel data observations	
Number of incidents	299
Number of assignment days	3,439
Assignment days by team type	
T1	949
T2	2,183
NIMO	113
WFMT	26
FUMT	168
Avg. # assignments per team	4.74
Avg. # days per assignment	8.47

- Also include daily reported characteristics from ICS-209 forms: Growth potential, size, percent contained



# Data summary

- Measuring production capacity (dep. variable)
  - Calculate potential line production for all resources based on Broyles (2011)

DESCRIPTION	PRODUCTION CAPACITY (PC), CHAINS/DAY	
	<u>In timber fuels</u>	<u>In brush or grass fuels</u>
TYPE 1 CREW	52.3	61.6
TYPE 1 CREW – STRIKE TEAM	104.5	123.2
TYPE 2 CREW	28.0	32.7
TYPE 2 CREW – STRIKE TEAM	56.0	65.4
FIREFIGHTER – SINGLE RESOURCE	1.4	1.6
TYPE 1 HELICOPTER	36.0	36.0
TYPE 2 HELICOPTER	24.0	24.0
TYPE 3 HELICOPTER	12.0	12.0
ENGINE	21.0	21.0
ENGINE – STRIKE TEAM	105.0	105.0
DOZER	120.0	120.0
DOZER – STRIKE TEAM	240.0	240.0

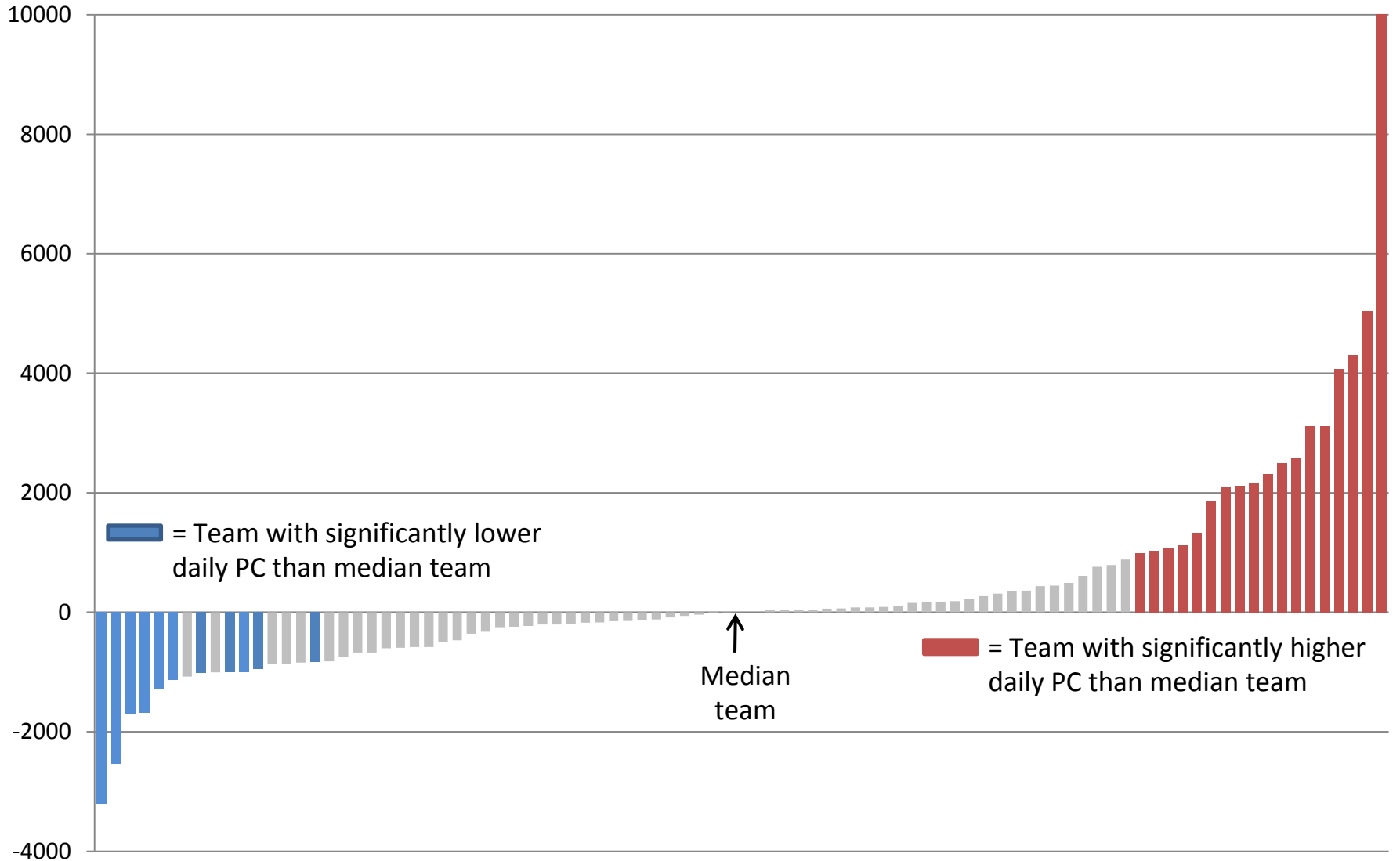
# Results – Reported fire characteristics

Variable	Coefficient (units = chains per day)
<b>Growth potential = Extreme</b>	<b>931.4</b>
<b>Growth potential = High</b>	<b>380.6</b>
Growth potential = Moderate	170.0
<b>% contained</b>	<b>5,956</b>
<b>% contained ^ 2</b>	<b>-5,419</b>
<b>Fire size</b>	<b>.013</b>
Rows in boldface indicate significance at 95% level.	

- Resource orders match assessment of fire behavior
- Very small effect of fire size
- Increasing orders as containment goes up, but drawdown of resources as fire nears containment

# Daily Production Capacity: Team Fixed Effects, excluding short assignments (fewer than 3 days)

Daily Production Capacity,  
in chains



# Results – Inherited resources and assignment length

Variable	Coefficient (units = chains per day)
<b>Inherited prod. cap.</b>	<b>.473</b>
Team assignment day	2.20
<b>Inherited x assign. day</b>	<b>-.065</b>
Rows in boldface indicate significance at 95% level.	

- Previous team's order has significant but very small persistence
- Persistence effect dissipates over time

# Results – Team type, assignment order, and duration effects

Variable	Coefficient (units = chains per day)
<b>Second team</b>	<b>-614.4</b>
<b>Third team</b>	<b>-961.5</b>
<b>Fourth team</b>	<b>-666.9</b>
Fifth team	-626.3
<b>Relative duration (0-1 scale)</b>	<b>-1,894</b>
<b>NIMO team type</b>	<b>-1,685</b>

Rows in boldface indicate significance at 95% level.

- Fewer resources ordered after the first team assignment
- Overall drawdown of resources over the course of the fire
- NIMO teams order fewer resources compared to T1 and T2 teams

# Summary

- The IMT assigned to a fire can have a big impact on resources ordered
  - Could be other unobserved factors associated with IMTs
  - Don't know what ordered resources are used for or how effective they are
- Timing and order of IMT assignment matters
  - Could matter during times of resource scarcity
- Need to better understand IMT expectations: Are they responding to expected conditions (rather than current)?

# Thank you!

- Questions?

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