Duration and cost effectiveness of fuel treatments in the Alaska boreal region

Project Wrap Up

JFSP Research Project 14-5-01-27

Authors and Contributors

Stacy Drury – Senior Fire Ecologist, Pacific Southwest Research Station
Randi Jandt – Fire Ecologist, Alaska Fire Science Consortium
Joseph Little – Professor, Economics, UAF
Nathan Lojewski – Forestry Manager, Chugachmiut
William Putman, CF – Forestry Director, Tanana Chiefs Conference, inc.

Graduate Students:

Allen Molina
Brock Lane

Acknowledgements

Funding Support was provided by the Joint Fire Science Program
Research, logistic, and administrative support (Thank You!):

Alaska Fire Science Consortium
BLM Alaska Fire Service
USFS, USFWS, DoD
DNR-DOF and DMLW
TCC, Chugachmiut, Toghottlele Corp.
And to the many wildfire management professionals who provided assistance along the way.

A Quick Note

- Reducing a 100 page report to a 20 minute summary means that a lot of info had to be left out
- Entire report will be available at: JFS Project 14-5-01-27 website: Duration and cost effectiveness of fuel treatments in the Alaska boreal region
    - Any errors or omissions are my responsibility

What did we do?

Built on previous JFSP funded work to evaluate a set of fuel treatment locations.

- Field work at fuel treatment study sites conducted summer 2015
  - Fuel treatment lifecycle
- Fire behavior modelling of treatment sites using field data
  - Duration and continued effectiveness.
- Survey of homeowners fall 2016
  - Examine preferences for fuel treatments
- Expert elicitation with wildfire managers spring 2017
  - Resource order exercise
- Collection, coding, and analysis of suppression cost data for DOF

Treatment Locations

- Interior
  - Delta Bison Range
  - Nenana Ridge Demo
  - Tanacross
  - Toghotthele Demo
  - Fort Wainwright Demo
  - Dot Lake
- South Central (KPB)
  - Campbell Tract
  - Funny River
  - Hope Gate
  - North Bean

Highlights: Fuel Treatment Life Cycle

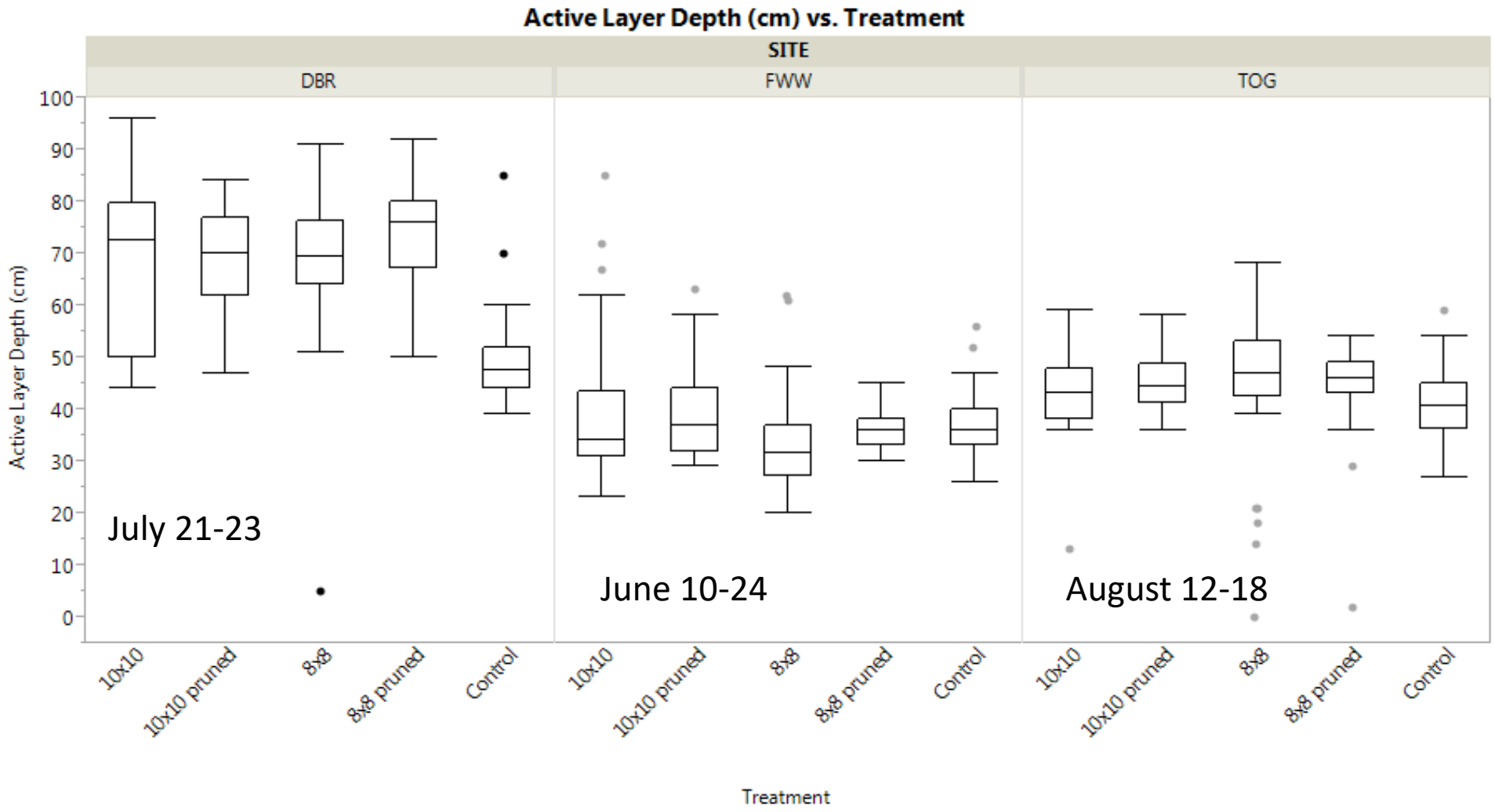
“Our data illustrate profound ecological and site impacts—both intended and unintended—can result from forest treatments in boreal forest.”

- Overstory cover in thinned interior black spruce sites after 14 years remained 12-24% of pre-treatment densities
  - Example: Tanacross 6% cover V. 43% in reference location
- Canopy fuel loading (crown mass and crown bulk) did not show significant increases over 14 years.
  - Example: Nenana Ridge crown bulk density in shaded fuel break was 16-30% of reference control after 8 years

Highlights: Fuel Treatment Life Cycle

- Ground cover and substrate change
  - Interior sites reduction of live feather moss of 24-41%
- Unintended tree damage and loss after initial treatments
  - Example: windthrow at Tanacross location due to wind event
- Active Layer changes
  - Depth of active layer correlated with treatment type

Active Layer Changes at Three Sites



Highlights: Fire Behavior Modelling

- Fuel treatment field data incorporated into Behave Plus 6
  - Modeled at 70th (average) and 90th (drier) percentile conditions
- Interior Fuel Models
  - SB 1, SH 5, TU 4
- Southcentral Fuel Models
  - GS 1, GS 3, TU 1, TU 5
- Treatment duration of up to 14 years.

Highlights: Fire Behavior Modelling

- Interior Alaska Black Spruce Stands
  - Fuels treatment as much as 14 years post-treatment continued to mitigate fire behavior potentials
    - continued reduction in flame length, fire line intensity, and rates of spread in comparison to untreated controls
    - Shearbladed sites showed the lowest flame length, fire line intensity, and rate of spread
  - Interesting note (at demonstration sites): **the greatest reduction in modeled flame lengths and rates of spread were found in the units thinned to 8 x 8 spacing with the lower branches pruned from below**

Highlights: Fire Behavior Modelling

- White Spruce and Mixed Forest Stands
  - Greater variability in modelled fire behavior due to increased changes in vegetation
  - Shaded fuel breaks tended to be more effective for avoiding canopy fires in white spruce hardwood stands by reducing flame lengths and rates of spread relative to the reference controls
  - Interesting note (Tanacross): downed trees from wind event and recovery of shrubs and hardwood regeneration led to an increase in fire behavior on treated site when compared against reference control.

Highlights: Homeowner Wildfire Risk Mitigation

- Discrete choice experiment
  - Evaluate attributes of wildfire risk reduction alternatives: costs, neighbor participation, presence of public fuel treatment, risk reduction to self and neighbors.
- Encourage homeowner wildfire risk mitigation activity
  - Will homeowners invest in private wildfire mitigation activity when fuel treatment nearby on public lands? Three treatment options: none, cleared fuel break, thinned treatment
  - Social dimensions of wildfire risk mitigations
  - Willingness to pay for risk reduction to neighbor

Impact of Public Fuel Treatments

When there was a thinned fuel treatment present willingness to pay for private wild fire risk mitigation

Overall: $1,457	FNSB: $1,290	KPB: $1,731

Cleared fuel breaks are estimated to reduced respondent willingness to pay for private wildfire risk reduction

-protect amenity values

-impacts on permafrost

Highlights: Homeowner Wildfire Risk Mitigation

- 10 year wildfire risk reduction (Self)
- 25% reduction
  - Interior $1,133
  - KPB $853
- 50% reduction
  - Interior $1,296
  - KPB $945

- 10 year wildfire risk reduction (neighbor)
- 25% reduction
  - Interior $667
  - KPB $453
- 50% reduction
  - Interior $689
  - KPB $544

Highlights: Expert Elicitation, Resource Ordering

- Used field data from Campbell Tract to create four fire scenarios
  - Fuel break present (10 MPH and 15 MPH)
  - No fuel break present (10 MPH and 15 MPH)
- Examine hypothetical resource orders under each scenario
- 51 Participants in the exercise reviewed two scenarios each
- Evaluate likelihood of observing an increase in the size of initial resource order size.
  - Controlling for scenario, whether expert indicated fuel order influenced their order

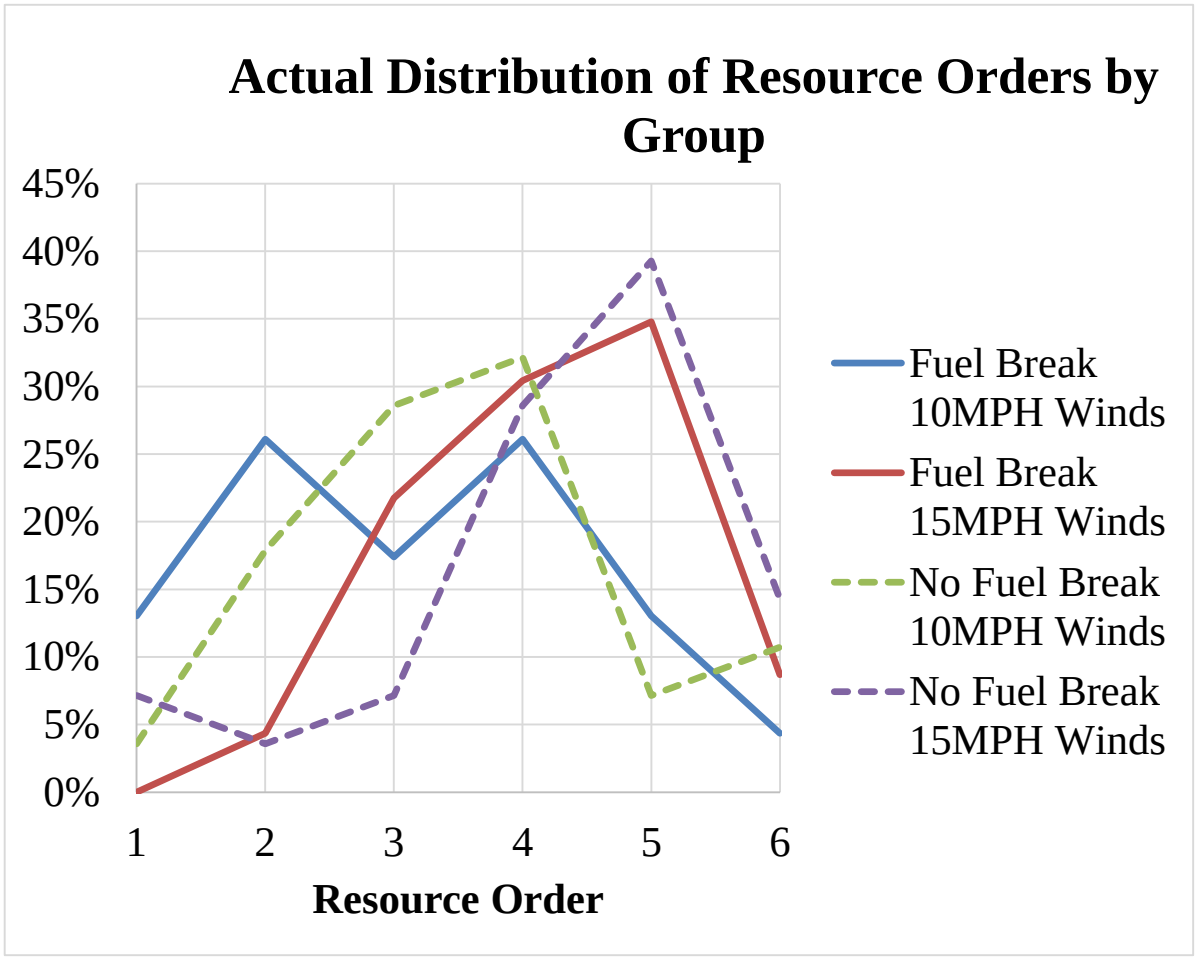
Resource Orders

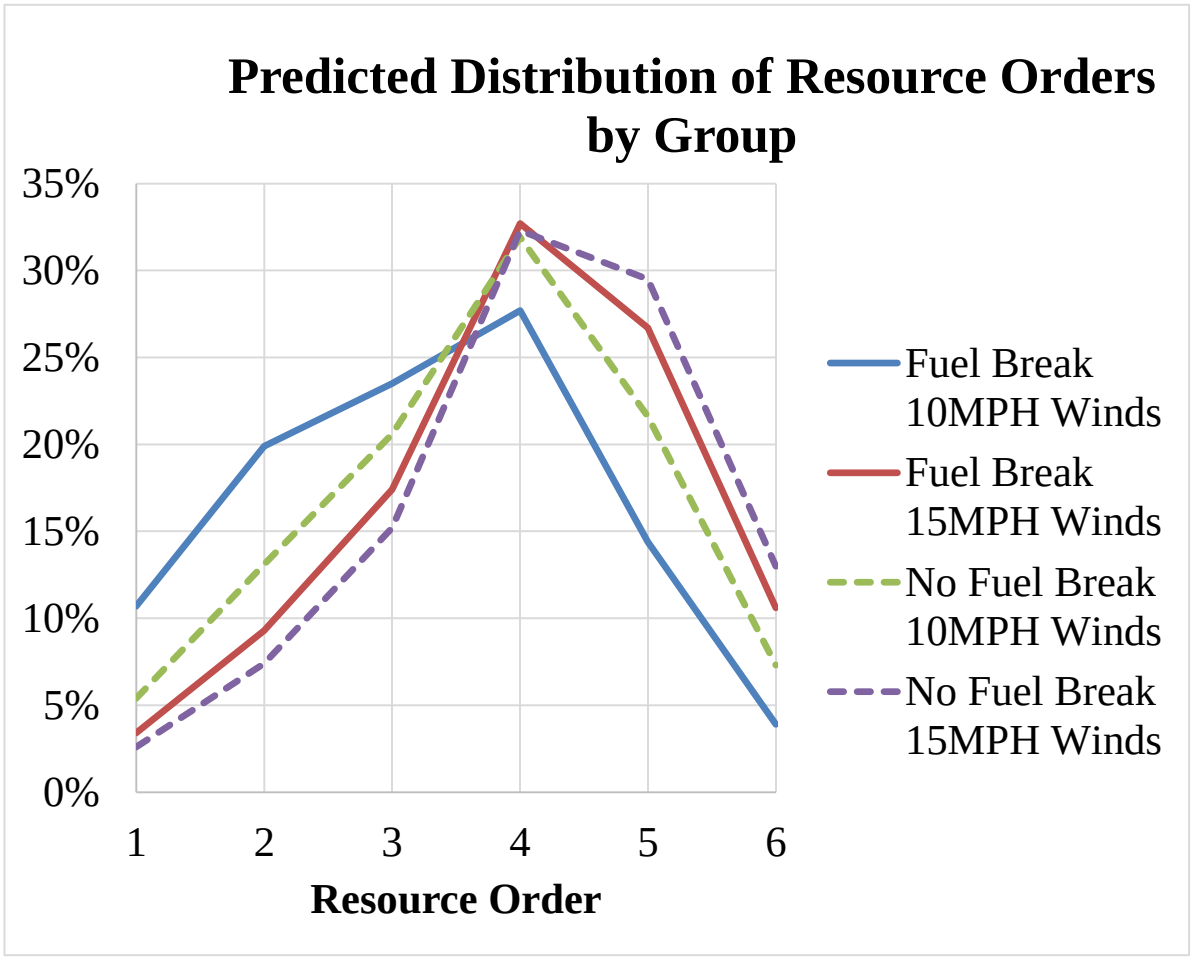
Order	Resources
1	10 water drops, 1 engine strike team (task force) and 1 hot shot crew.
2	10 water drops, 1 engine strike team (task force), 1 squad of state protection techs on ATV with drip torches, and 1 hot shot crew.
3	10 water drops, 2 engine strike teams (task forces), 2 hot shot crew, 1 terra torch, 1 bulldozer, and 5 retardant drops
4	10 water drops, 2 engine strike teams (task forces), 2 hot shot crews, 1 squad of state protection techs on ATV with drip torches, 10 retardant drops, 1 bulldozer and 1 helitack crew
5	20 water drops, 3 engine strike teams (task forces), 3 hot shot crews, 10 retardant drops, 2 bulldozer, 2 helitack crews, 2 type-1 structure protection engines, 1 terra torch
6	20 water drops, 4 engine strike teams (task forces), 4 hot shot crews, 10 retardant drops, 3 bulldozer, 3 helitack crews, and 4 Type-1 structure protection engines, 1 terra torch, 1 squad of state protection techs on ATV with drip torches, and an aerial firing module.

Assessment of Property Damage in Scenarios

	Fuel Break 10MPH	Fuel Break 15MPH	No Fuel Break 10MPH	No Fuel Break 15MPH	All Groups
Structures Lost					
None	65.2%	39.1%	60.7%	39.3%	51.0%
1-25	34.8%	56.5%	32.1%	46.4%	42.2%
26-100	0.0%	4.3%	7.1%	7.1%	4.9%
>100	0.0%	0.0%	0.0%	7.1%	2.0%

Distribution of Orders





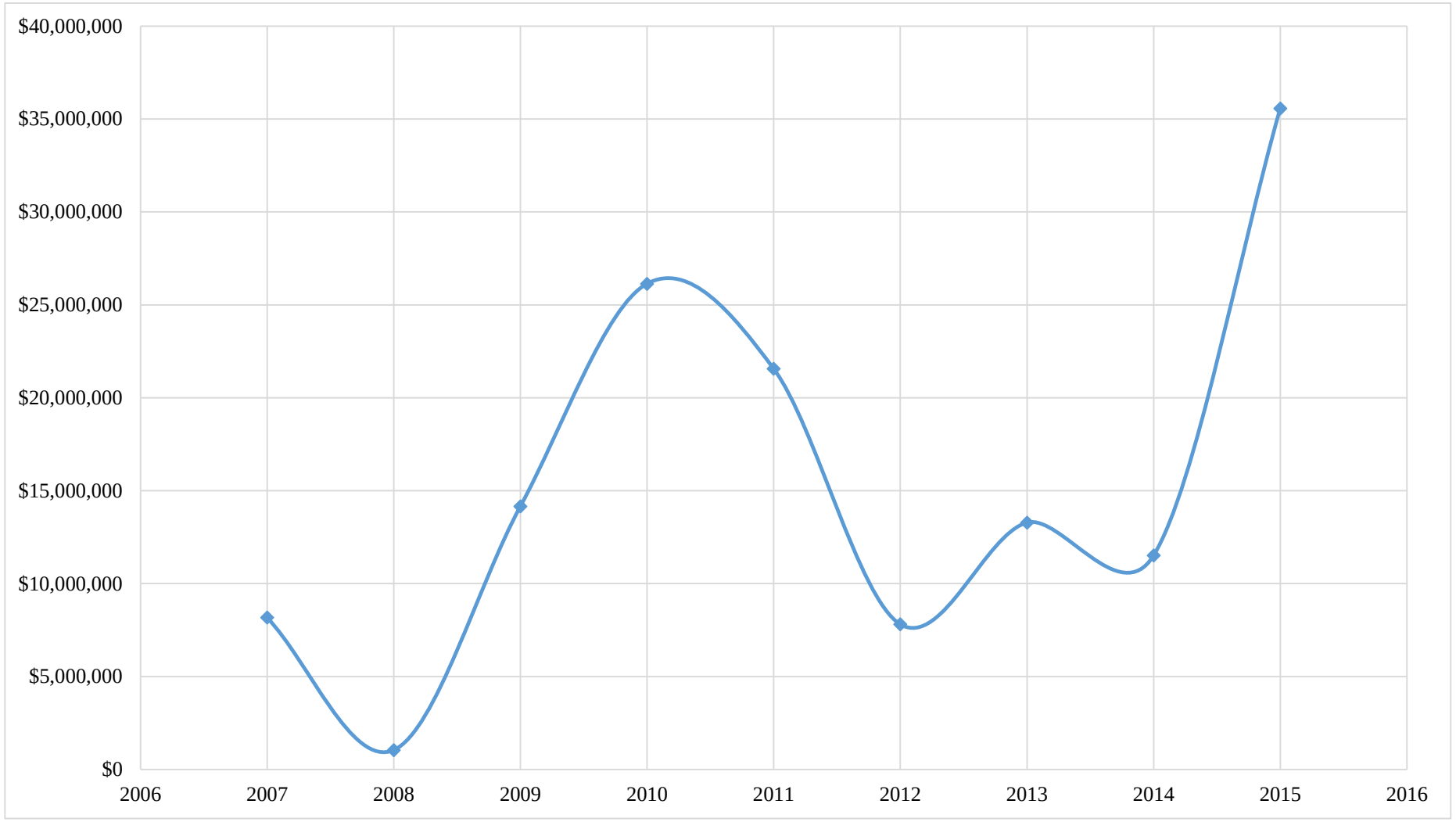
Highlights: DOF Wildfire Suppression Costs

- 266 fires greater than 50 acres 2007-2015
  - Broken out by management zone
- Cost data from DOF matched with fire information, conditions, presence of a fuel treatment,
- Modelled natural log of cost per acre, controlling for
  - Mgmt zone, year, precip, RH, fuels, topography, structures threatened
  - Could only identify 14 DOF fires with a fuel treatment within 5 km.
  - No statistically significant relationship between presence of fuel treatment and suppression cost per acre

Highlights: DOF Wildfire Suppression Costs

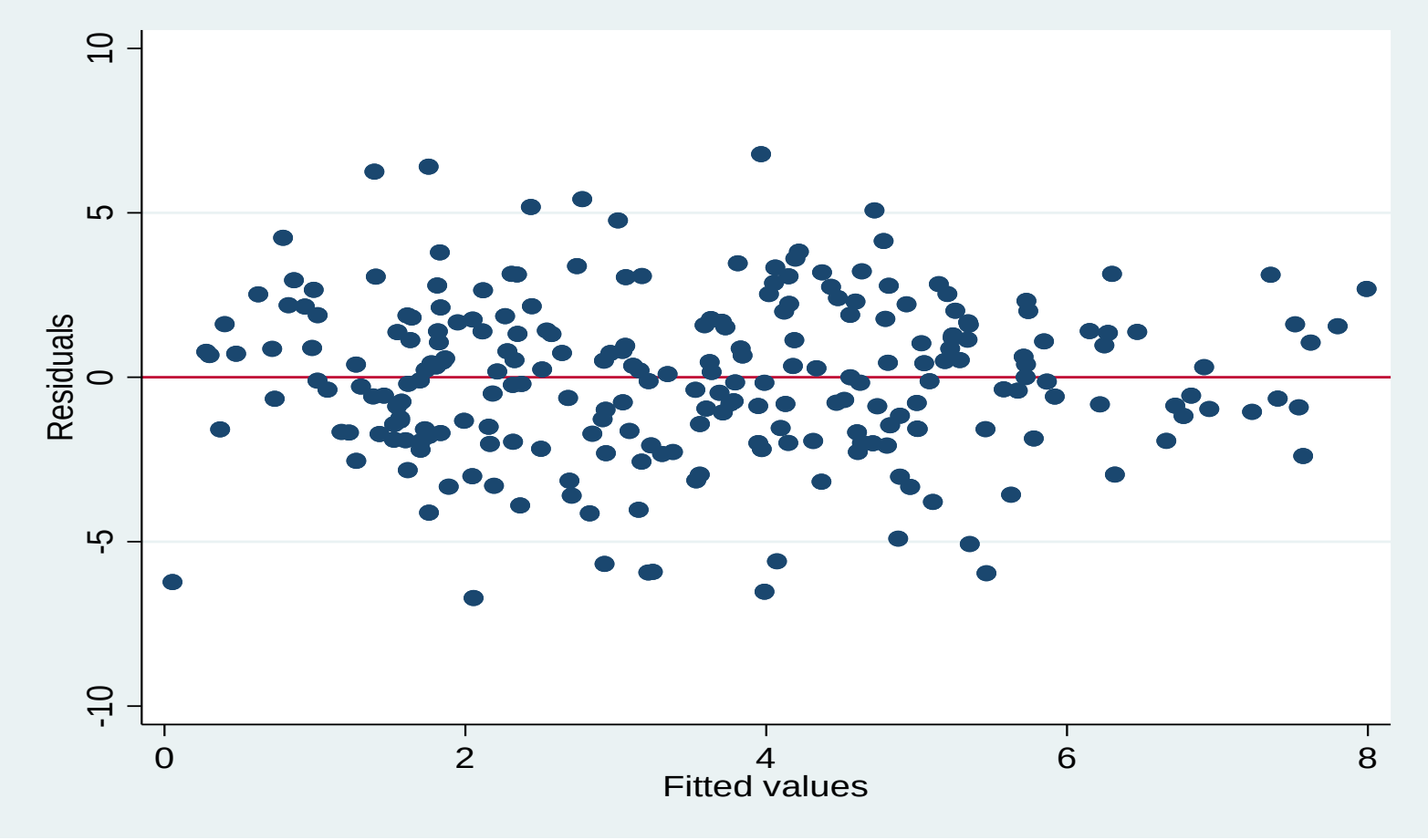
	Overhead & Crews	Aircraft	Engines	Supplies	Total
2007	$2,837,987	$1,512,572	$33,267	$2,716,610	**$7,100,436**
2008	$436,093	$226,385	$7,256	$268,568	**$938,302**
2009	$8,386,025	$815,573	$3,346	$3,541,937	**$12,746,881**
2010	$8,857,569	$4,395,789	$222,164	$10,470,355	**$23,945,877**
2011	$7,222,191	$3,785,072	$133,654	$9,266,704	**$20,407,621**
2012	$2,261,607	$914,861	$45,259	$4,329,408	**$7,551,134**
2013	$3,964,109	$2,246,714	$223,975	$6,605,000	**$13,039,797**
2014	$3,456,586	$2,447,778	$57,830	$5,531,961	**$11,494,155**
2015	$8,343,933	$7,741,475	$211,209	$19,270,150	**$35,566,768**

DOF Suppression Costs 2007-2015



Highlights: DOF Wildfire Suppression Costs

Residuals v. Fitted Values



Summary and Recommendations

- Fuels treatments do reduce fire behavior potentials especially under a range of weather conditions and lower wind speeds
- Fuels treatments should be planned and installed within a cohesive fire suppression plan or community wildfire protection plan
  - Plan for use in suppression efforts
  - Encourage WUI homeowners to pursue private wildfire risk mitigation
- Unintended effects of canopy removal Alaskan forests should also be considered
  - Preserve ecological benefits
  - Amenity benefits to homeowners
- Maintain existing fuels treatments on a 10 to 15 year schedule