



THE OHIO STATE UNIVERSITY

Social considerations for wildland fire
management...

What do people have to do with
wildland fire management?

Eric Toman, School of Environment and Natural Resources

Research collaborators/support

- Dr. Sarah McCaffrey – U.S. Rocky Mountain Research Station
- Dr. Bruce Shindler – Emeritus Professor, Oregon State University



Humans and Fire

- Substantial knowledge about fire as an ecological process
- Substantial management experience (prevention, suppression, and using fire)
- Why do we need to think about social considerations when making fire management decisions?



Josh Edelson/AFP/Getty Images



MI DNR

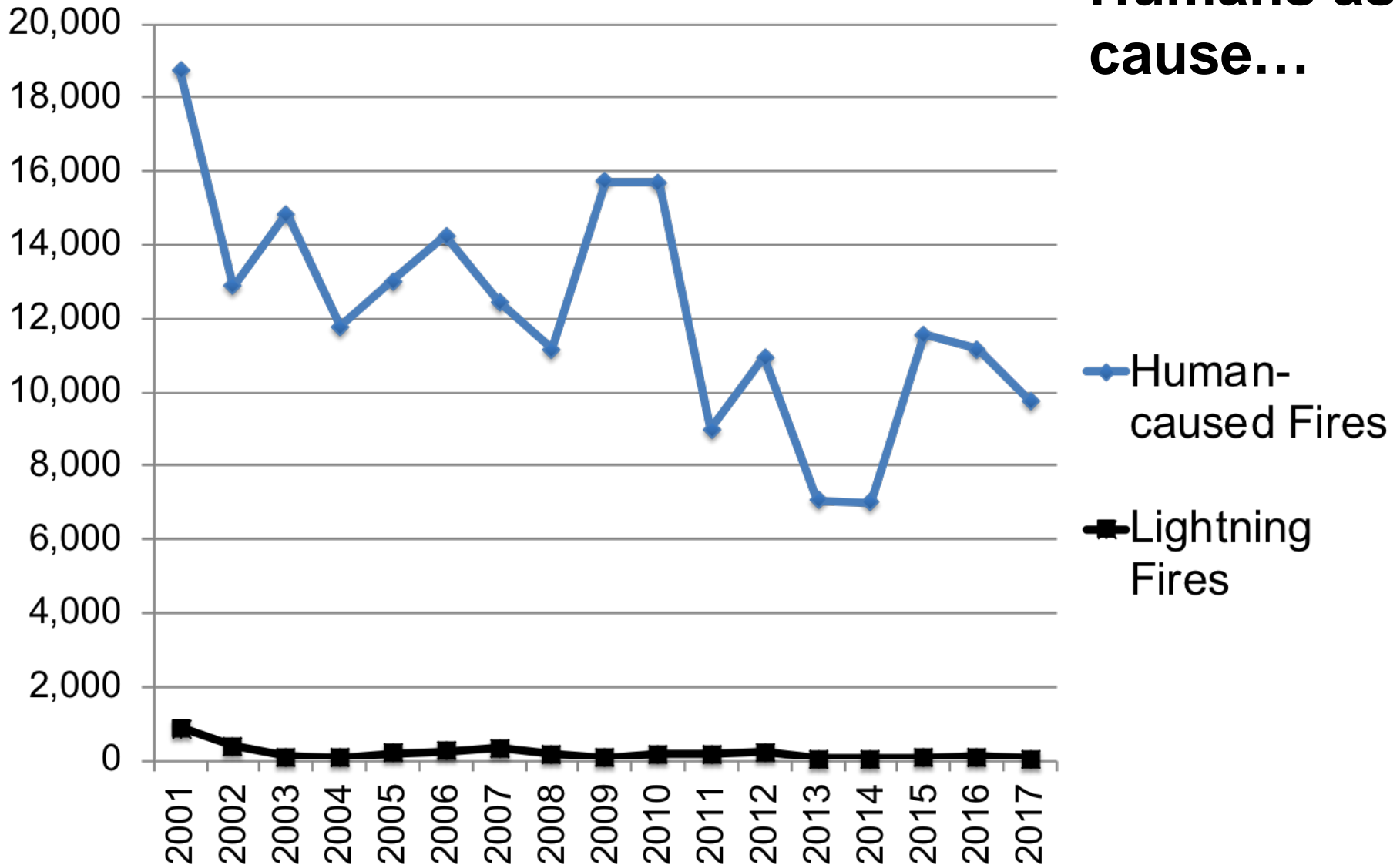


MI DNR

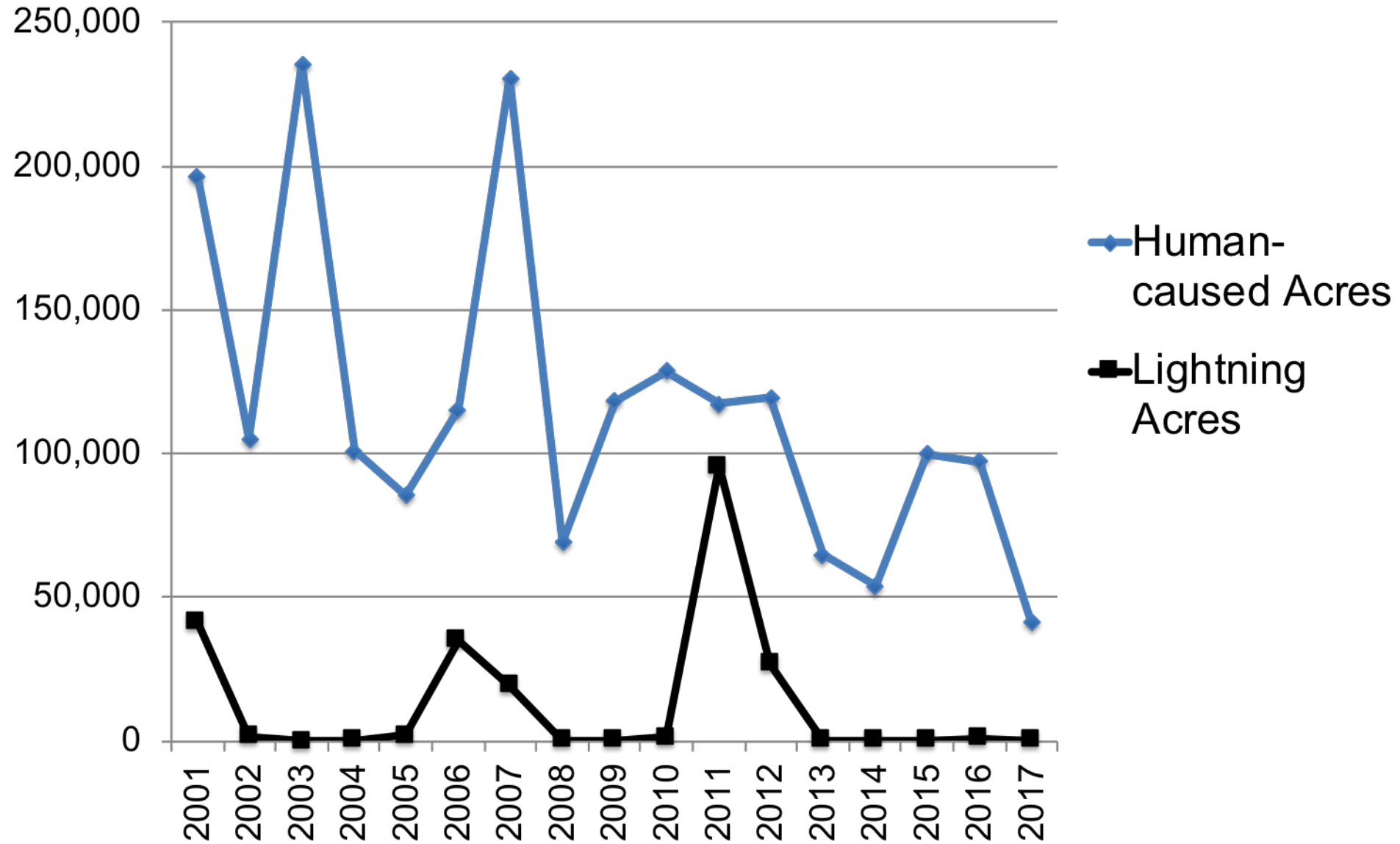
T & N

Eastern Area # of Fires

Humans as cause...



Eastern Area Acres Burned



Data from: https://www.nifc.gov/fireInfo/fireInfo_stats_lightng-human.html

Humans and Fire

- Coupled human and natural systems
 - Integrated systems with interactions between people and natural components
 - Reciprocal effects
- Often studied but not well understood
 - Silos – disciplinary, science and management
- Humans and fire
 - Humans impacted by fires
 - Humans as cause of fire
 - Complex...
 - Land use and development patterns
 - Policies – ESA
 - Management – timber, wildlife, recreation
 - Current and historical legacies...



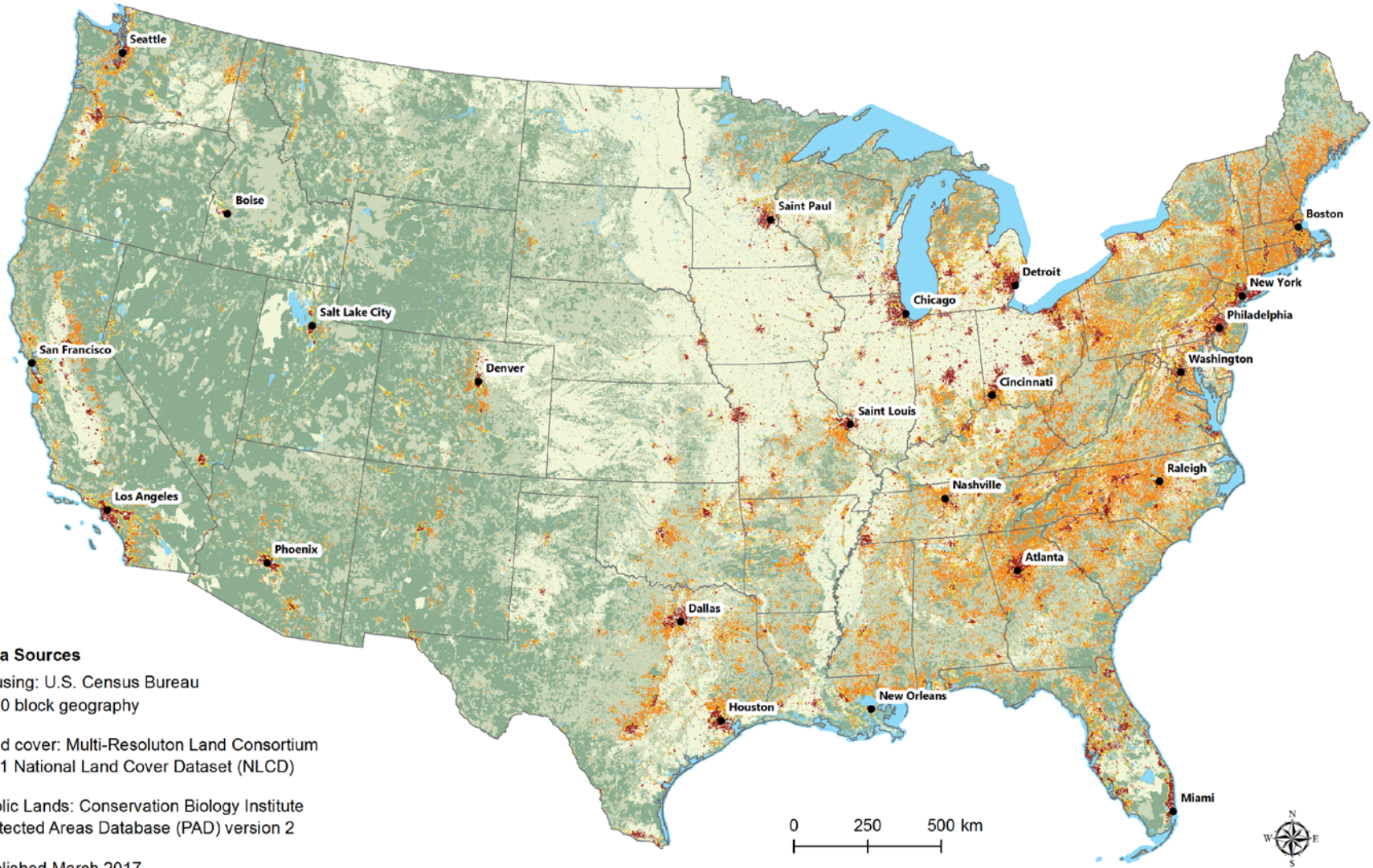
Wildland Fires



- Wildland Urban Interface
 - Where structures mix with wildland vegetation
- 11,000+ communities-at-risk
- 1990-2000: 60% of new housing starts in the WUI (Stewart et al. 2005)
- 38.5% of U.S. houses in WUI (Radeloff et al. 2005)



The 2010 Wildland-Urban Interface of the Conterminous United States



Data Sources

Housing: U.S. Census Bureau
2010 block geography

Land cover: Multi-Resolution Land Consortium
2011 National Land Cover Dataset (NLCD)

Public Lands: Conservation Biology Institute
Protected Areas Database (PAD) version 2

Published March 2017

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Wildland-Urban Interface (WUI)

- Interface
- Intermix

Non-WUI Vegetated

- No housing
- Very low housing density

Non-vegetated or Agriculture

- Low and very low housing density
- Medium and high housing density
- Water

Management Response

- Series of federal initiatives
 - The National Fire Plan (2000)
 - Ten-year Comprehensive Strategy (2001)
 - Healthy Forests Restoration Act (2003)
 - Cohesive Wildfire Management Strategy (2009)
- Two primary themes
 - Proactive fuels reduction
 - Engage local communities



Humans and Fire

- Evolving understanding of ecological role of fire
- Understanding of social component slower to evolve
 - Studied for more than 30 years
 - Majority of research completed in last 15 years

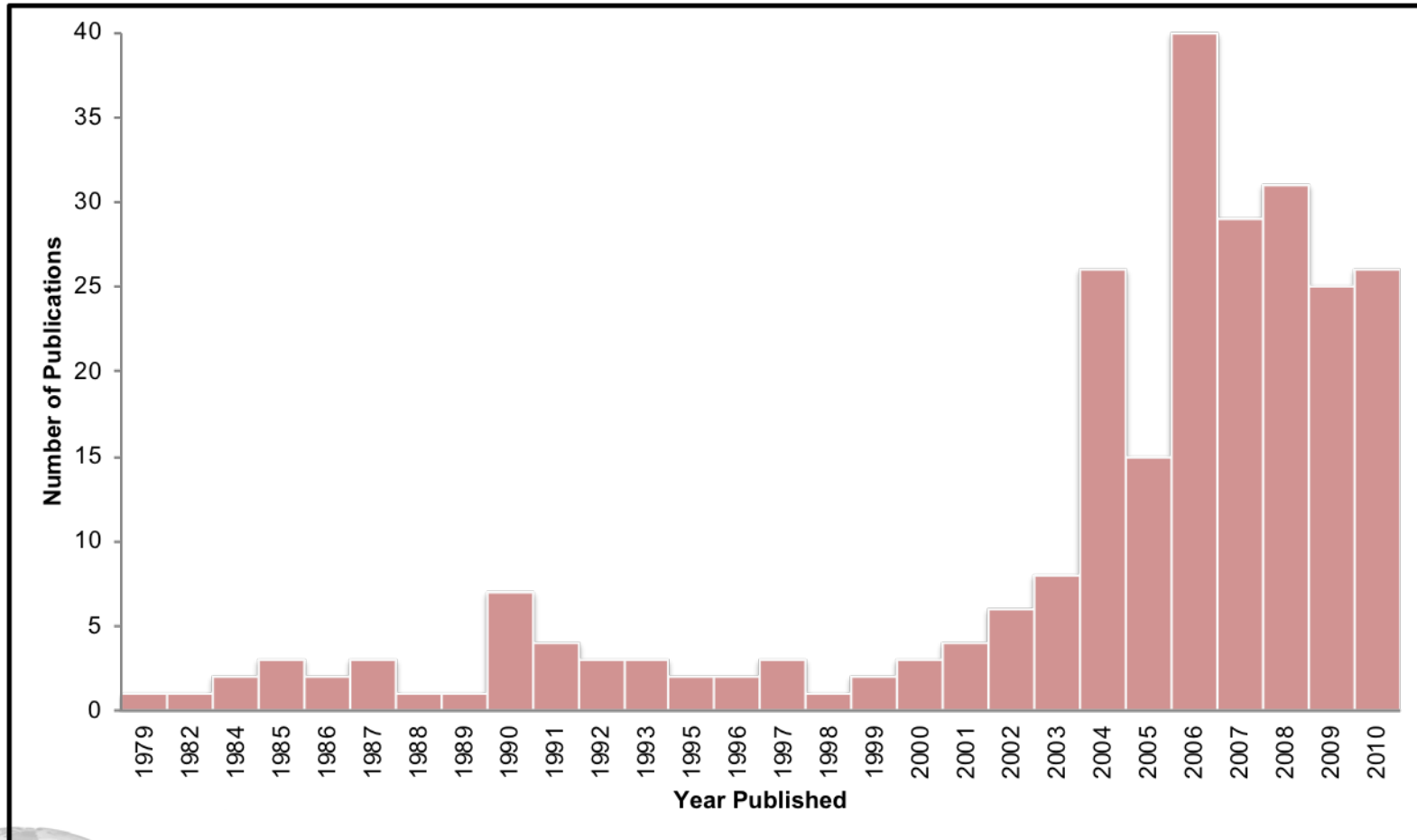


Wildfire Social Science Research

- Review of social science research on fire
- Substantial body of literature
 - 242 publications between 2000 and 2010 (peer or editor – reviewed)
 - 100+ authors

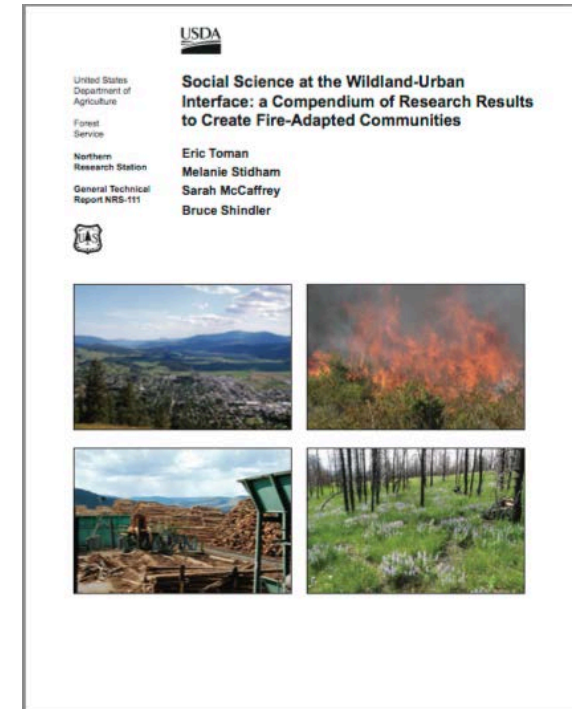
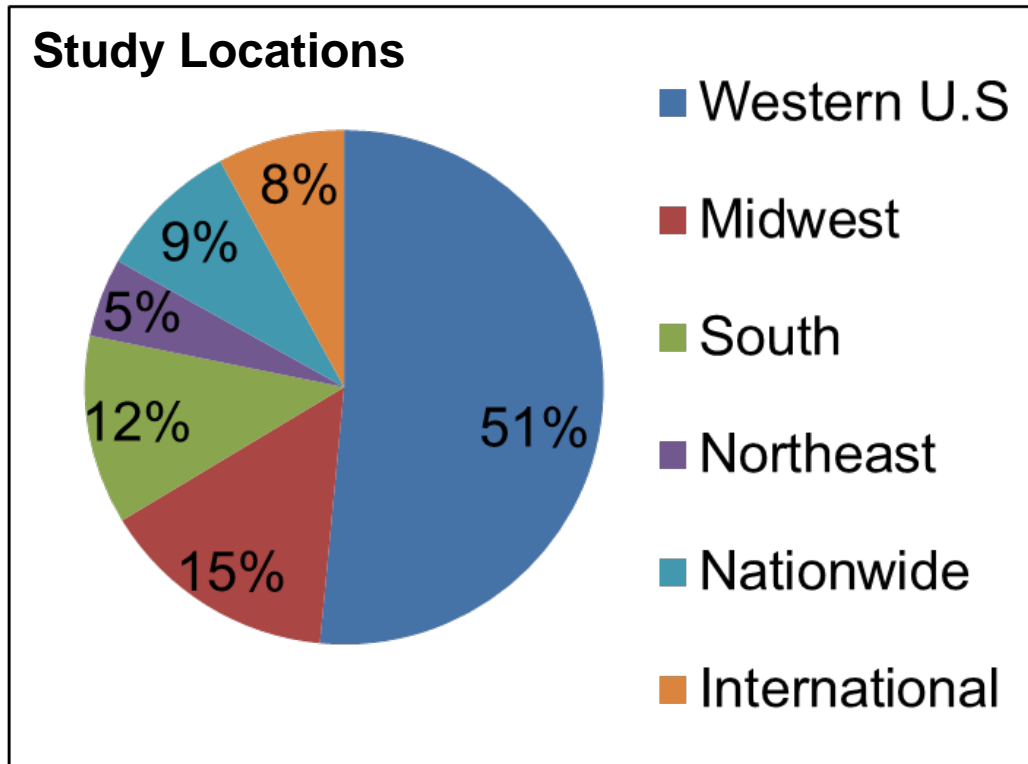


Wildfire Social Science Publications



Toman, Eric; Stidham, Melanie; McCaffrey, Sarah; Shindler, Bruce. 2013. Social science at the wildland-urban interface: a compendium of research results to create fire-adapted communities. Gen. Tech. Rep. NRS-111. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 75 p.

Wildfire Social Science Publications



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<https://www.nrs.fs.fed.us/pubs/43435>

Themes

Theme	Article count
Homeowner/community mitigation before fire	84
Public acceptance of fuels treatments on public lands	83
Homeowner behaviors during fire and perceptions of fire management practices	41
Postfire response and recovery	32
Wildland fire policy and planning	69
Total articles in review	242*

* Some articles are included in more than one theme.

Homeowner/Community Pre-fire Mitigation

- Many residents in the WUI are (majority in most studies)
 - Aware of their fire risk, and
 - Are taking action to reduce the likelihood of fire on their properties
 - To be clear – doesn't mean they are doing EVERYTHING
- Findings consistent across locations
 - Studies in South, Northeast, Lake States, Rocky Mountains, Southern California, and Pacific Northwest

Homeowner/Community Pre-fire Mitigation

- Common behaviors
 - Access: improving visibility of address, widening driveway
 - Structural: fire resistant building materials, installing screens under porches and on vents, cleaning roofs and gutters
 - Landscape: reducing density of trees, pruning lower branches, planting fire resistant vegetation, maintaining irrigated green space near home



Homeowner/Community Pre-fire Mitigation

- Factors influencing action
 - Awareness of risk does not automatically lead to adoption of risk reduction behaviors
 - Why?



Homeowner/Community Pre-Fire Mitigation

Factors influencing adoption of risk mitigation actions

Personal/psychological factors	Situational factors
Trade-offs with other property values	Local ecological conditions
Social norms	Residency status
Perceived risk and effectiveness of mitigation options	Condition of adjacent properties
(Perceived) Ability to complete risk reduction behaviors	

Fuels Treatment Acceptability



- Most focus on prescribed fire and mechanical thinning on public lands
- Strong acceptance in WUI locations
 - ~80% in multiple studies accept some use of pf and thinning
- Some variation
 - Lower support in some locations (Toman et al. 2011)



Fuels Treatment Acceptability

- Limited research for alternative treatments
 - Managing unplanned ignitions (acceptance ranges from 33% to 60% depending on scenario - Kneeshaw et al. 2004, Winter 2002)
 - Grazing has strong acceptance particularly in rural areas (Brunson and Shindler 2004, Brunson 2008)
 - Herbicides generally unacceptable to majority (Monroe et al. 2006, Bowker et al. 2008, McCaffrey 2008a, Toman et al. 2011)



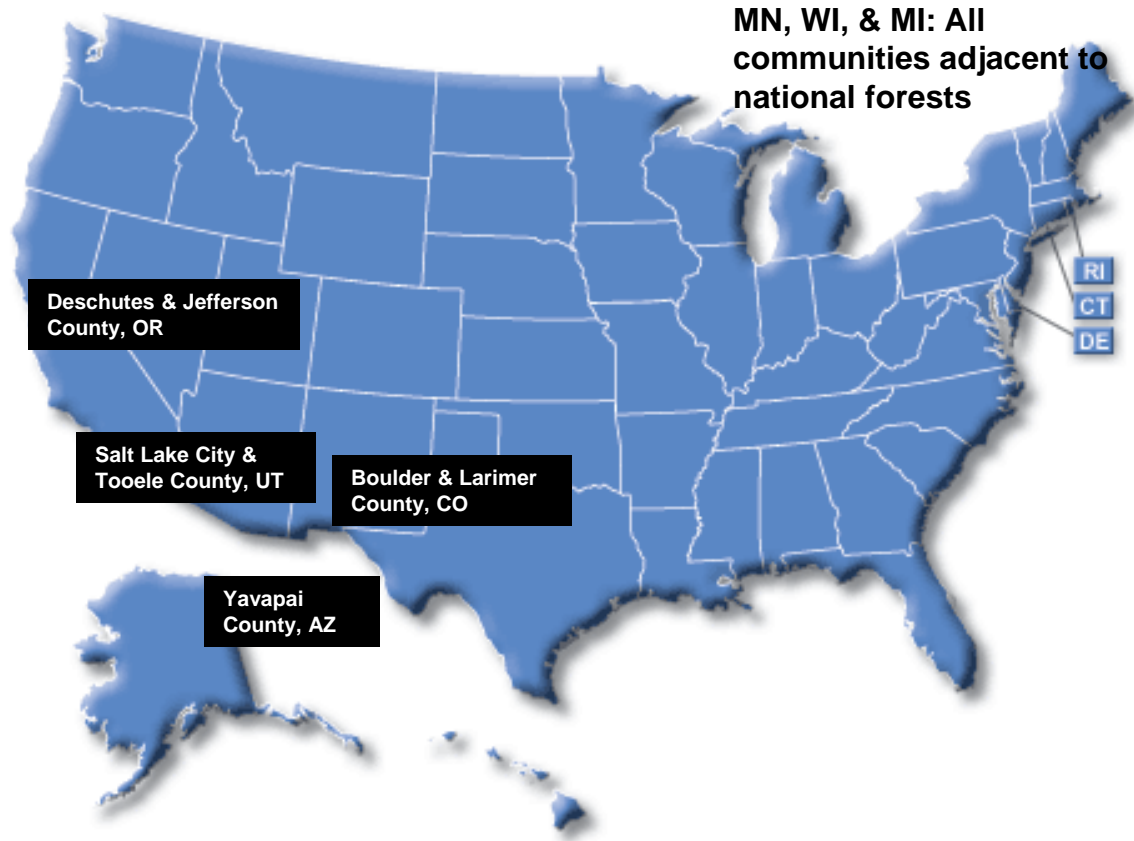
Fuels Treatment Acceptability

- Treatment acceptance most influenced by
 - Increased familiarity with the practice, and
 - Trust in implementing managers
- Expressed concerns include
 - Potential for escaped fires
 - Smoke
 - Erosion
 - Impacts to wildlife, water quality and aesthetics



Study Sites

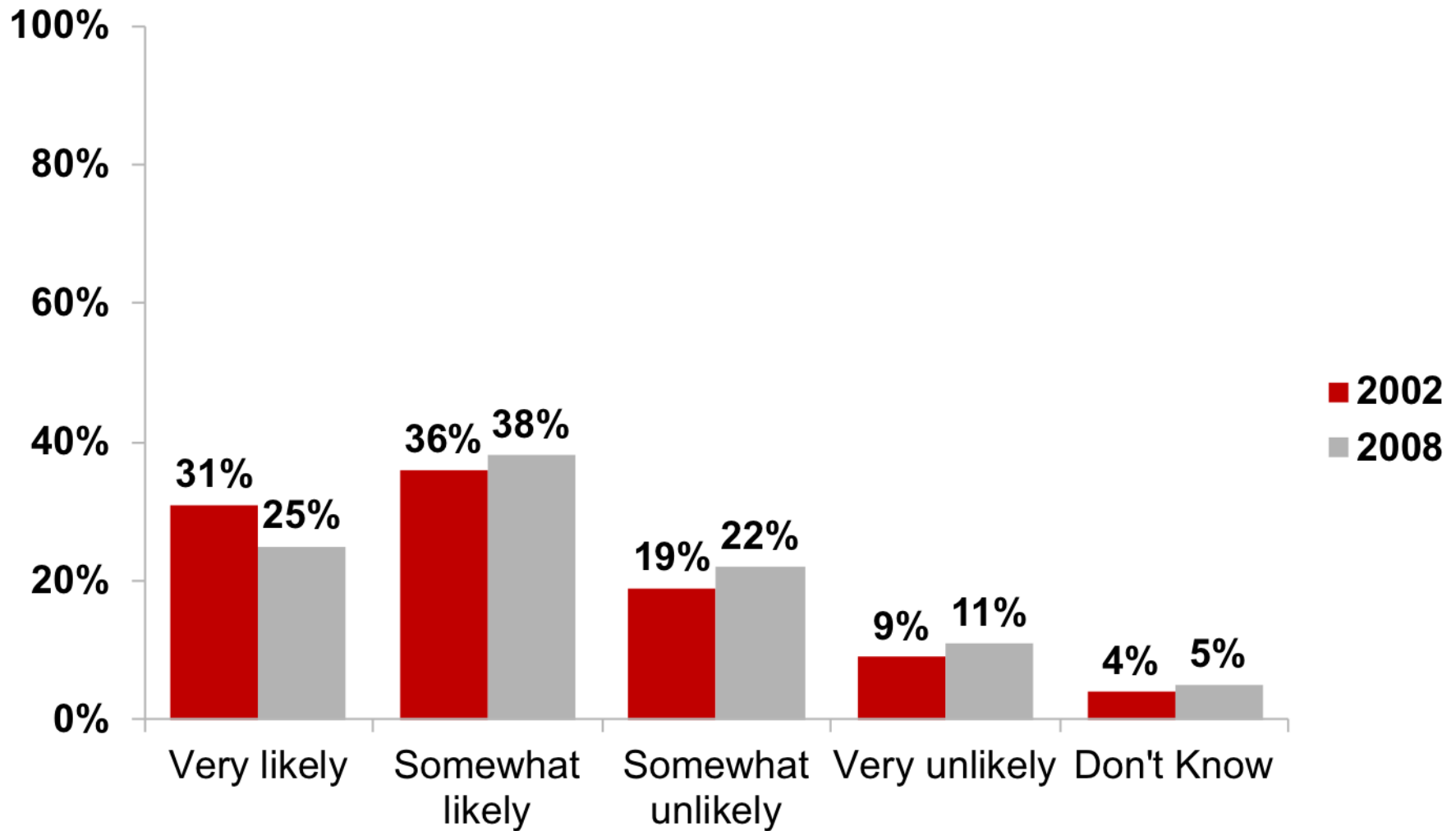
- Central Arizona Highlands
 - Colorado Front Range
 - Central Oregon
 - Utah Great Basin
- Communities adjacent to National Forests in:
- Michigan
 - Minnesota
 - Wisconsin



- 546 respondents
- 55% overall adjusted response rate

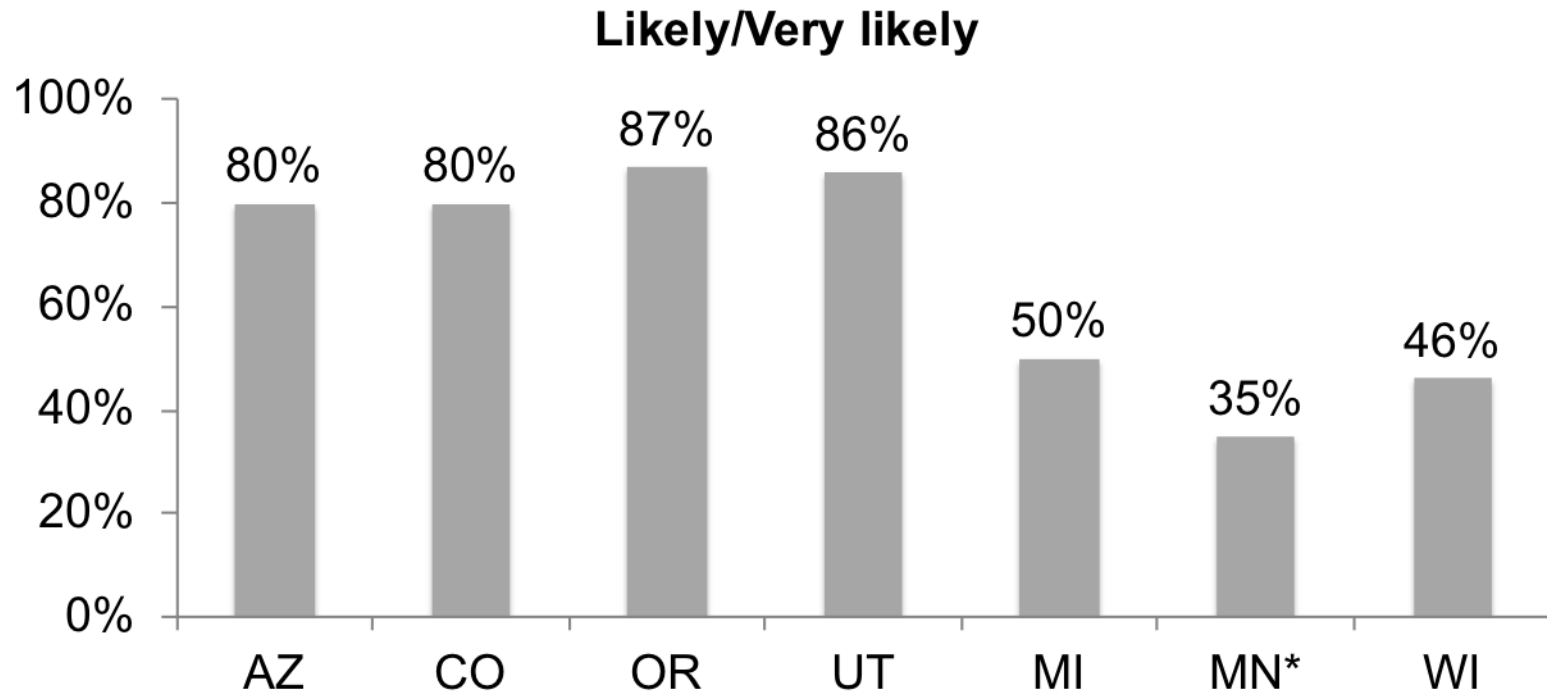


Perceived likelihood of wildfire in next 5 years



Likelihood of Wildfire

- Substantial differences between locations, decrease over time in MN
- 2008: Wildfire near home in the next 5 years is

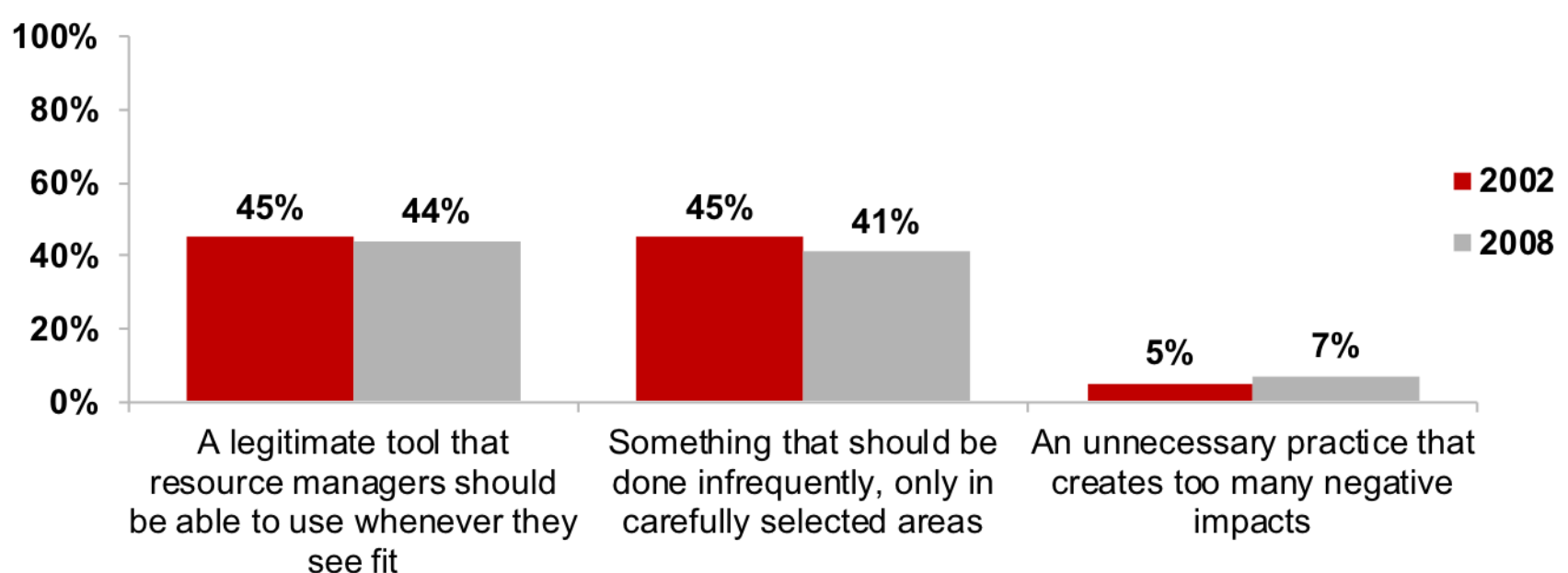


*Significantly different over time at $p < .05$

Acceptance of prescribed fire

- Acceptance of prescribed fire remained stable (slight decline in CO)

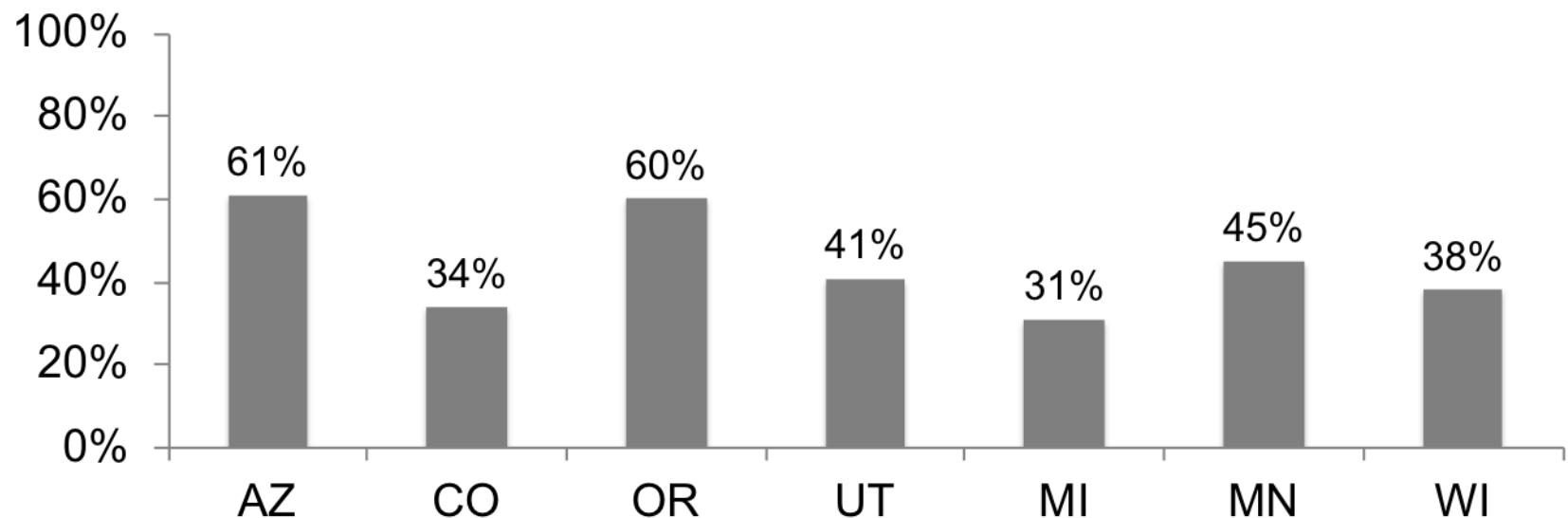
The use of prescribed fires on public forests and rangelands is:



Acceptance of prescribed fire

- Geographic differences: More participants in AZ and OR give managers full discretion

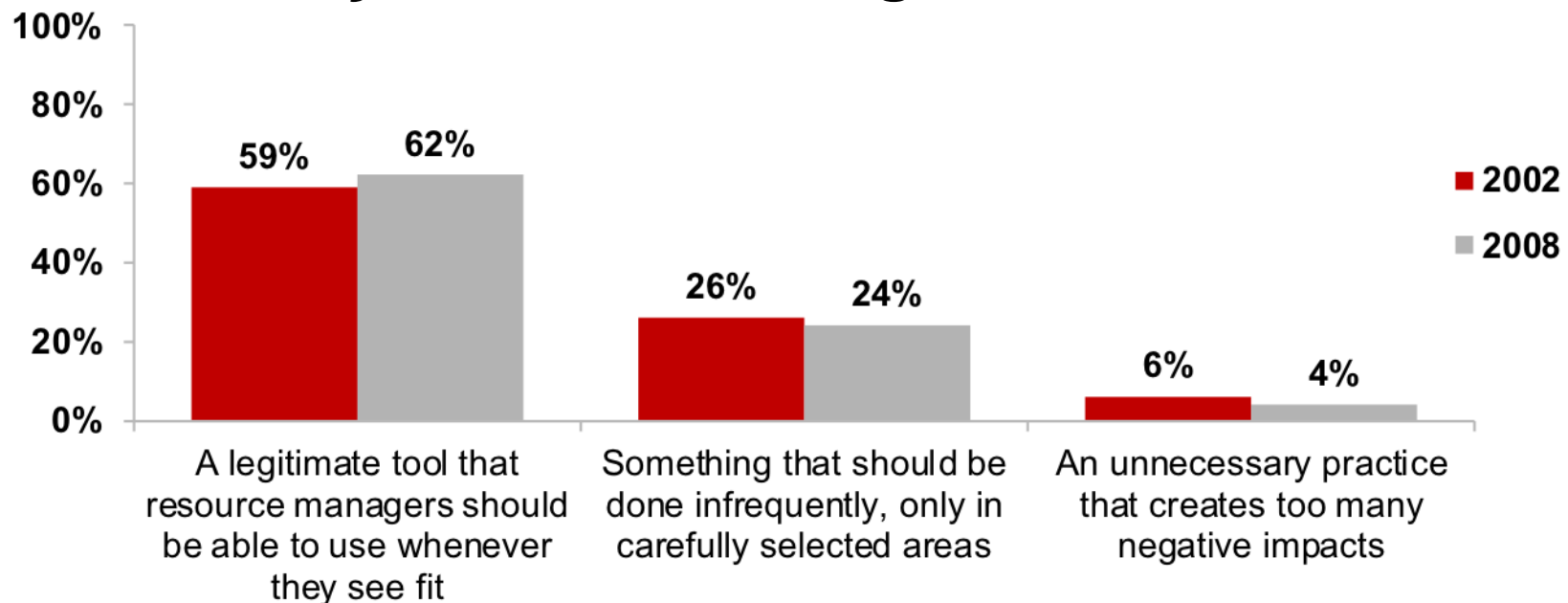
Prescribed fire is a legitimate tool that managers should be able to use wherever they see fit



Acceptance of mechanical treatments

- Generally give greater discretion to use mechanical methods
- Acceptance increased across study period

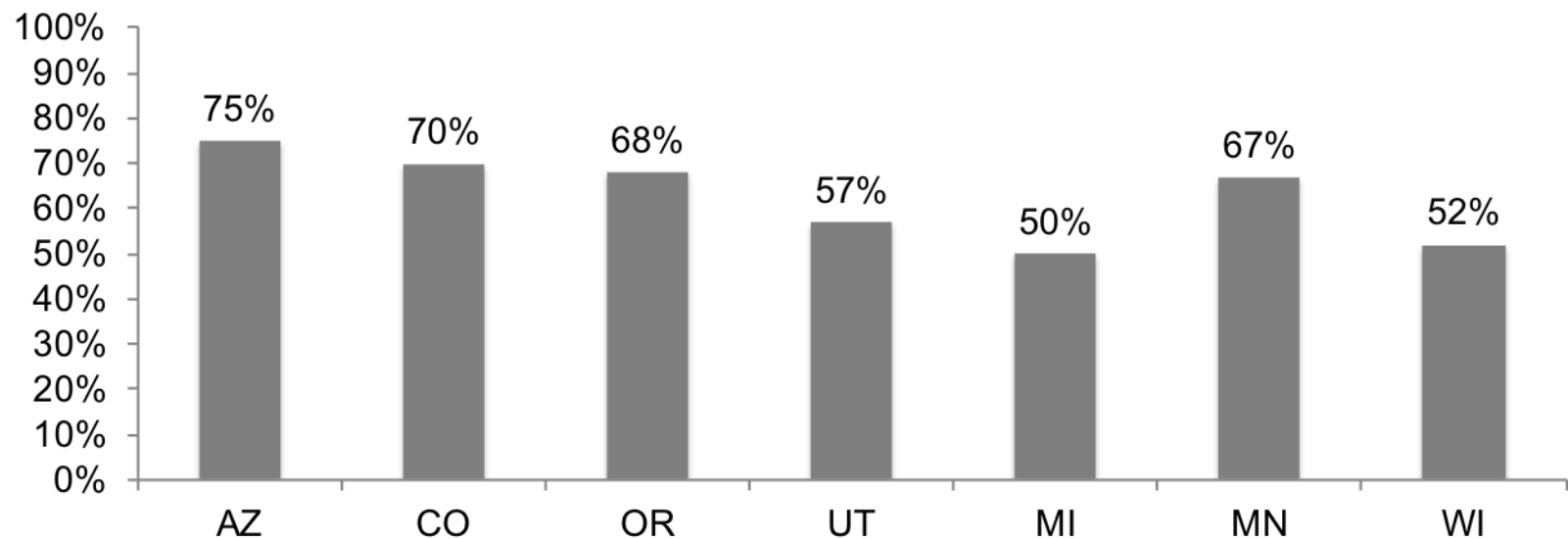
The use of mechanical vegetation removal is:



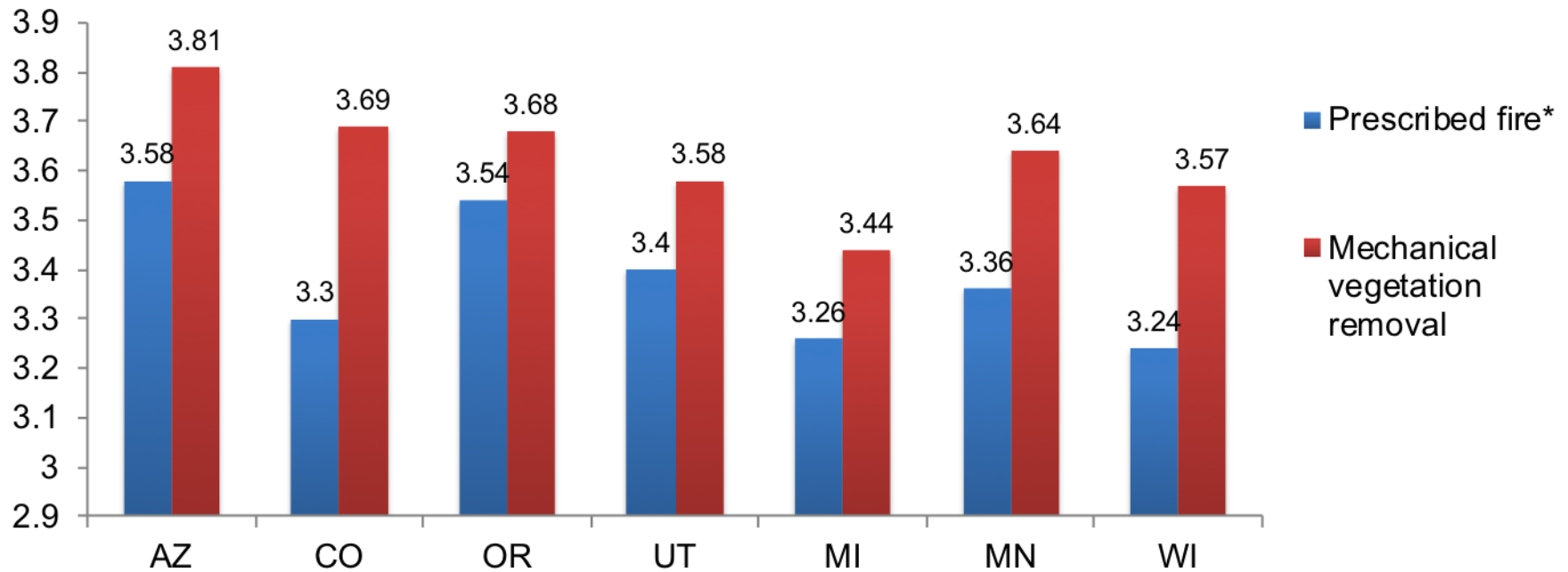
Acceptance of mechanical treatments

- Geographic variation: No significant differences between locations
- Majority give full discretion in each location

Mechanical vegetation removal is a legitimate tool that managers should be able to use wherever they see fit

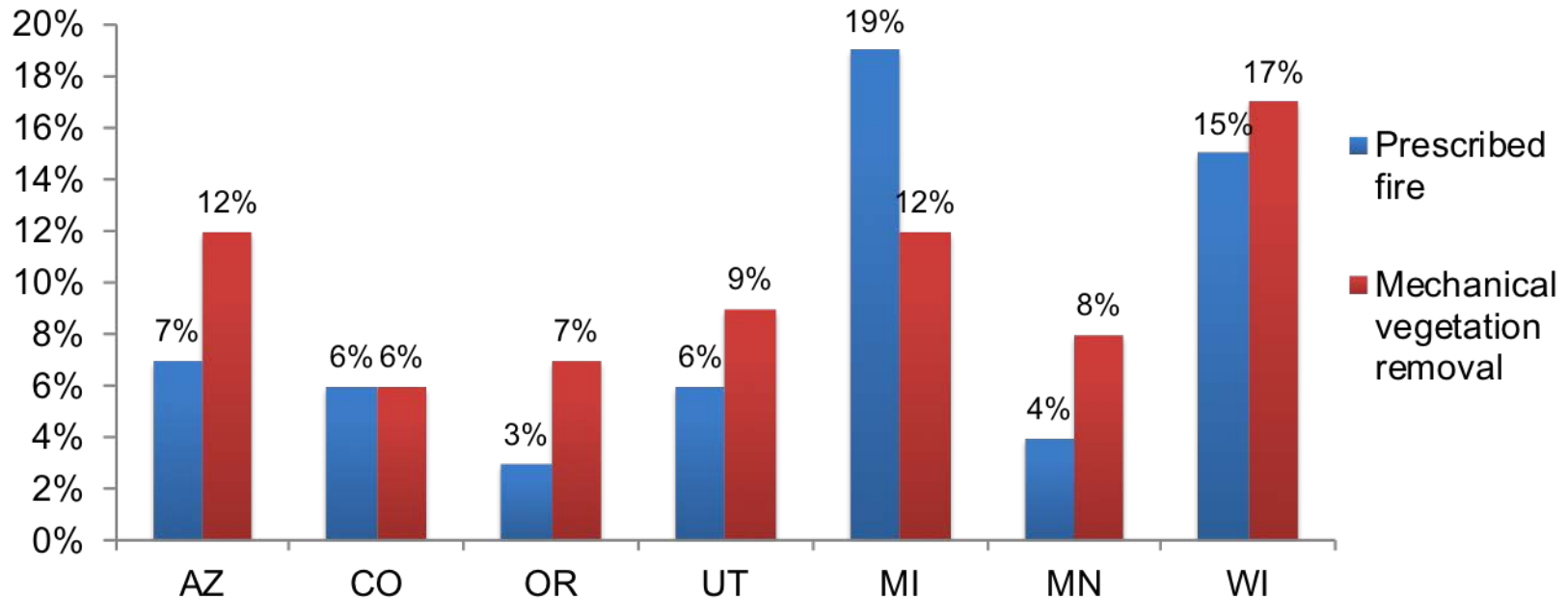


Mean acceptance of fuels treatments



- 1 (an unnecessary practice) – 4 (legitimate tool) with a “don’t know” option (“don’t know” excluded)
- Prescribed fire: mean acceptance significantly different between locations

I know too little to make a judgment



- Higher rates in Michigan and Wisconsin
- Not evident if just look at mean responses

Concerns with prescribed fire use

- Concern decreased on 6 of 8 items (across study period)
 - Increased levels of smoke (44-40*)
 - Loss of wildlife habitat (43-39*)
 - Increased soil erosion (49-39*)
 - Economic loss of useable timber (35-38 NS)
 - Reduced scenic quality (40-35 NS)
 - Damage to private property (47-32*)
 - Deteriorated public water supply (37-25*)
 - Decreased recreation opportunities (35-19*)

Data reflect percentage of respondents who rated concern as great/moderate on a four-point scale (none, slight, moderate, great).

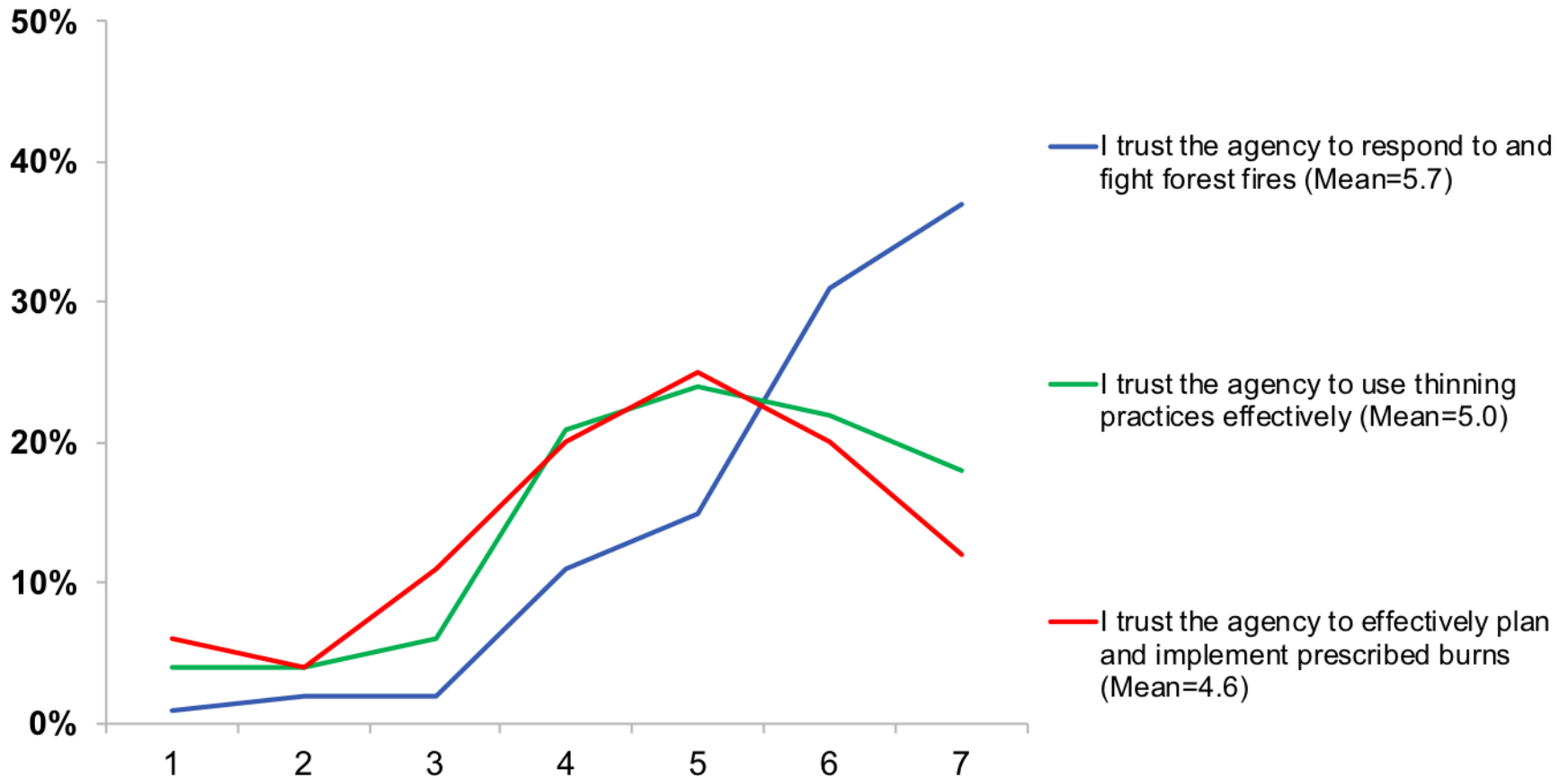
*Significantly different at $p < .05$

Concerns with prescribed fire use

Geographic variation

- Michigan residents indicated the highest level of concern for six of the eight items
 - *Increased smoke levels*
 - *Loss of wildlife habitat*
 - *Economic losses*
 - *Reduced scenic quality*
 - *Deteriorated water supply*
 - *Decreased recreation opportunities*

Trust in Agency Managers



7-point scale from Strongly Disagree to Strongly Agree with a Neutral midpoint.

Logistic Regression – Treatment Acceptance

Independent variables	Prescribed Fire β (significance)	Mechanical Vegetation Removal β (significance)
Sex	.245 (.845)	-.612 (.536)
Education	.532 (.052)	-.061 (.830)
Region	-1.482 (.111)	1.036 (.224)
Treatment specific confidence	1.428 (.004)	1.616 (.003)
Treatment outcomes^a	.376 (<.001)	.226 (.007)
Citizen-agency interactions ^b	.087 (.523)	-.118 (.374)
Chi-square	55.237 (<.001)	20.213 (.003)
Percentage calculated correctly	95.8	96.0
Nagelkerke R ²	.592	.314

Take home messages

- In general, results provide good news
 - Homeowners are taking action to reduce their risk and support fuels treatments on public lands
- Citizen acceptance is dynamic
 - Evidence in several locations of declining citizen – agency relationships
- Do these results reflect your experience?
 - How similar / different?



Take home messages

- Regional results
 - Some differences evident in the Lake States (particularly Michigan)
 - Suggests residents are less familiar with management agencies and practices
 - Opportunity to help shape responses



Take home messages

- To understand fire we need to understand humans
 - People help shape ecological systems
 - Fire management decisions are made by people (public and managers)
 - Decisions influenced by ecological and social factors



Thank you

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Lake States Fire Science Consortium

A JFSP KNOWLEDGE EXCHANGE CONSORTIUM

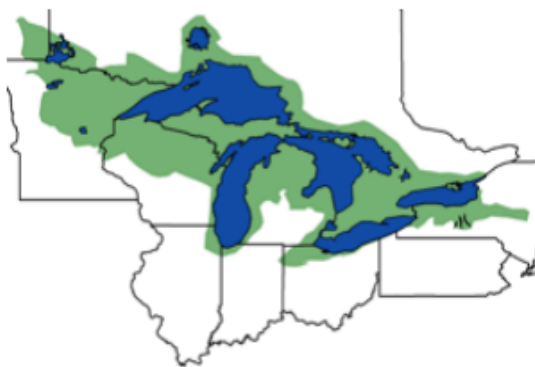


Navigation

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Display a menu

Welcome to the Lake States Fire Science Consortium



The Lake States Fire Science Consortium is a network of fire managers and scientists interested in the fire-dependent forest ecosystems of the Lake States region. [Learn more](#)

[Click here to join](#) and receive our announcements regarding Consortium activities and products.

Have a question about the Consortium? [Contact Us](#).

What's New with Fire Science in the Lake States

WORKSHOP

Fifth Annual Burning Issues Workshop and Michigan Prescribed Fire Council Annual Meeting

Burning Issues Workshop

February 5 & 6, 2019

On-line Learning

[View All Webinars](#)

[View all Past Workshops and Field Tour Archived webpages](#)

Upcoming Events

February 5:
Workshop - Burning Issues Workshop & MI RX Fire Council Annual Meeting

February 28: Webinar - The role of forest disturbance in habitat relationships and population ecology of Spruce Grouse.

March 28: Webinar -

Why do we see differences in Lake

States?

500 PEOPLE KILLED!

**FIVE MILLION DOLLARS WORTH
OF PROPERTY BURNED BY**

FOREST FIRES!

Lower Michigan and Ontario will never fully recover from the Fire Losses of July 1911. These FIRES DESTROYED LIVES and PROPERTY; BURNED HOMES and TOWNS; Caused FEAR and PANIC; Threw THOUSANDS of WORKMEN out of WAGES and out of FOOD; Created POVERTY and DISTRESS everywhere. What caused these fires?

Carelessness! MARK THE WORD! Carelessness!

CARELESSNESS IS RESPONSIBLE FOR FULLY 90 PER CENT OF ALL FOREST FIRES AND FOREST FIRE LOSSES. When CARELESSNESS becomes general it often results in DEATH. Who, then, is responsible? Would you like to feel that a fire STARTED by YOU or NEGLECTED by YOU had made a clean sweep of lives and property? Would you fire your friend's house knowing that his children were within? We are but children—often—helpless in the path of a raging forest fire.

What Can You Do? **BE CAREFUL!**

What Else? **PUT YOUR CAMP FIRE OUT!**

What Else? **HOLD THAT MATCH UNTIL IT IS OUT!**

What Else? **LOOK FORWARD TO WHAT MIGHT HAPPEN!**

If the property is NOT yours, **PLAY FAIR! BE FAIR!**
If the property IS yours, **PLAY SAFE! BE SAFE!**
THE TIME TO PUT THE FIRE OUT IS WHILE YOU CAN!
THE PREVENTION OF FOREST FIRES IS EVERY MAN'S DUTY.

For help, in case of fire, call upon the wardens of the

Northern Forest Protective Association

MUNISING, MICHIGAN



[http://geo.msu.edu/extra/
geogmich/fires.html](http://geo.msu.edu/extra/geogmich/fires.html)

ENVIRONMENT & NATURAL

Take home messages

- Citizen acceptance is dynamic
 - Evidence in several locations of declining relationships
 - Temporal linkages across fire event stages
- Build on existing strong base of understanding and support
 - Trust strongly linked to managers actions
 - Improved



During Fire Management Implications

- Effective communication and outreach is as important during a fire event as before and afterwards.
 - Communities that reported being well informed during a fire tended to experience less negative emotions during the fire and less postfire stress.
 - Uncertainty about what is happening has been cited as a primary source of stress during a fire event.



Postfire Management Implications

- Including citizens in on-the-ground recovery efforts can foster individual and community recovery.
 - Improves understanding of what happened
 - Provides tangible way to participate in the forest's recovery
- High levels of support for many postfire management activities, under appropriate conditions



Management Implications

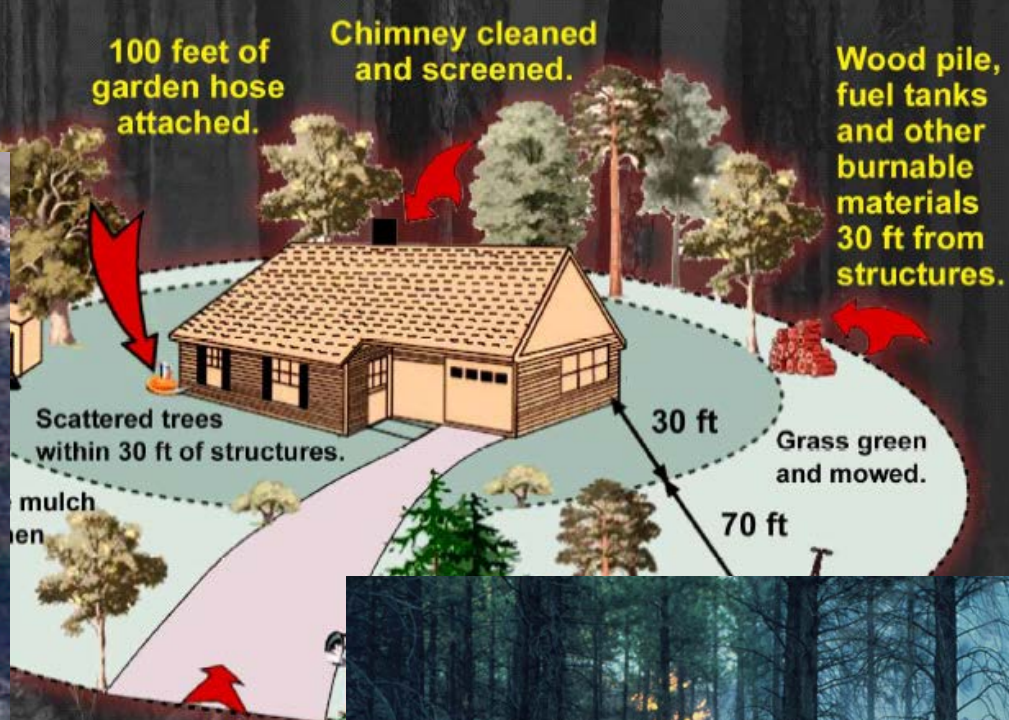
- Citizens' attitudes, confidence in agency managers, and acceptance of agency activities are linked across different phases of the event.
 - Pre-fire planning and events during a fire can influence all aspects of recovery, which in turn can influence future planning.







Are you Firewise?



Humans and Fire

- History of fire suppression
 - Core component of the missions of federal land management agencies in the U.S.
 - Humans were viewed as central to success
 - Primarily as a potential ignition source
 - Agency communication campaigns emphasized strict control of fire



Humans and Fire

- Growing recognition of ecological value of fire
 - 1972: First naturally ignited fire allowed to burn in Montana's Selway-Bitterroot Wilderness (Parsons & Landres, 1998)
- Fire suppression
 - Reduction in annual acres burned



- Increasing recognition of complexity of humans (Toman et al. 2006)
 - Influence fire occurrence and behavior (development and management)
 - Public acceptance of agency programs
 - Actions influence the risk of fire on private property



Wildland Fire Management

- Growing recognition of ecological value of fire
 - 1972: First naturally ignited fire allowed to burn in Montana's Selway-Bitterroot Wilderness (Parsons & Landres, 1998)
- Increasing recognition of complexity of human role (Toman et al. 2006)



During Fire Behaviors and Perceptions

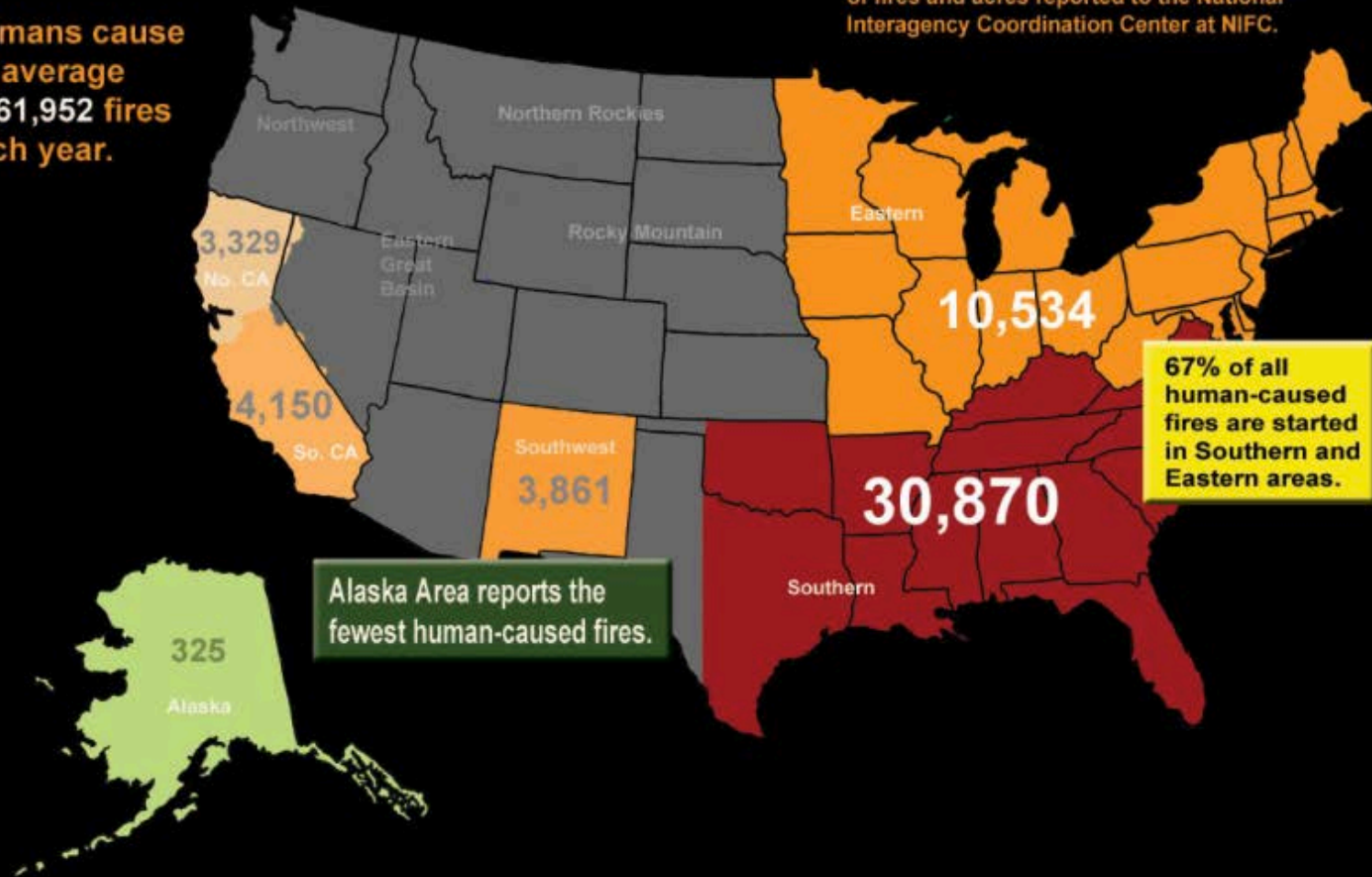
Evacuation Alternatives

	Shelter-in-place	Stay and defend or leave early
Behaviors in advance of fire	Prepare house and property to reduce risk of ignition	Prepare house and property to reduce risk of ignition, develop fire plan specifying when to leave, or how to defend
Behaviors during a fire event	Take shelter in home for duration of event	Leave early, or stay and actively defend property, taking shelter only during passage of actual flame front
Examples of where applied	In the US during tornados or chemical spills	In Australian bushfires

Human-caused Fires

All statistics are based on a 17-year average of fires and acres reported to the National Interagency Coordination Center at NIFC.

Humans cause an average of 61,952 fires each year.



National Interagency Fire Center:

https://www.nifc.gov/fireInfo/fireInfo_stats_human.html

and Acres Burned

Southern - 989,355

Nearly 37% of all acres burned by human-caused fires are in the Southern Area.

More than 2.7 million acres are burned each year by people who start wildfires.

Southwest - 331,300

Southern California
296,281

Rocky Mountain
215,787

Northwest
196,335

[View table of statistics for lightning-caused fires and acres.](#)

Updated 2/2/17

National Interagency Fire Center:
https://www.nifc.gov/fireInfo/fireInfo_stats_human.html

Wildland Fires



- Increasing fire activity
 - Average annual acres burned
 - 1960-99: 3,877,210
 - 1999-2008: 7,066,012
 - 2011: 8,711,367



Wildland Fires

- 2003: Cedar Fire in S. California
 - 2,400 structures burned
- 2011: more than 5,000 structures destroyed
 - Majority from series of fires in Texas
- Losses occurring despite record expenditures on fire suppression





Humans and wildland fire management: A review of social science findings aka...Wildland fire management: What do people have to do with it?

Eric Toman

School of Environment and Natural Resources
The Ohio State University



Outcomes of treatments

Prescribed fire would (majority agree):

- reduce fire risk
- help restore forest conditions
- reduce the cost of fighting fire
- improve wildlife conditions

Mechanized thinning would (majority agree):

- extraction of wood products
- reduce fire risk
- reduce the cost of fighting fire
- restoration of forest conditions
- improve wildlife conditions

Higher levels of agreement in AZ, CO, OR, UT, and MN

Logistic Regression

Variable	Acceptance of Prescribed Fire	Acceptance of Mechanized Thinning
	β (Sig.)	β (Sig.)
Education	.262 (.117)	-.133 (.431)
Regional Location (Western vs. Lake States)	-1.020 (.049) *	-.079 (.882)
Environmental / Economic Orientation	-.127 (.509)	-.038 (.844)
Trust in agency managers to implement specific treatment	.669 (<.001) **	.369 (.047) *
Treatment outcomes Index: 6-30 (Belief that treatment will result in positive outcomes)	.299 (<.001) **	.227 (<.001) **
Trust in agency information Index: 3-21 (Trust in agency information)	-.045 (.557)	-.046 (.605)
Agency interactions with local community Index: 6-24 (Ratings of citizen-agency interactions)	.009 (.888)	.079 (.172)
Agrees that agency incorporates public concerns	.024 (.948)	.222 (.591)
Chi-square	118.085 **	44.252 **
Percent correctly classified	93.5	94.9
Nagelkerke R²	0.575	0.316
Significance levels: *p ≤ .05; **p ≤ .001		

7 states



SCHOOL OF ENVIRONMENT & NATURAL RESOURCES

During Fire Behaviors and Perceptions

- Wildland fires are a social as well as ecological disturbance
 - Can have significant psychological, physical, and financial impacts
- Evacuations, though designed to protect, are socially disruptive
 - Evacuated residents express substantial anxiety over condition of home and a lack of control
 - Communication challenges – dispersed residents; tension between timing / quality of information



During Fire Behaviors and Perceptions

- Potential loss/damage to home, property, important documents, family keepsakes
 - Changes to landscape
- Some communities experience
 - Increased sense of community (“we’ re all in this together”)
 - Others with greater alienation (frustration over how fire was managed, blaming)



Postfire Recovery

- Postfire recovery linked to pre-fire planning and decisions and events that take place during a fire event
 - Postfire success influenced by pre fire relationships and during fire decisions



Thank You
B&B Complex
From Seattle Lake Resort

😊 TO THE FIRE FIGHTERS: 😊
Thank you for all your efforts!

TO THE U.S. FOREST SERVICE:
Everything that we love is gone... up in smoke.
The mismanagement of our forests has turned
our beautiful valley into an ASH HEAP!

TO BILL CLINTON & AL GORE:
Because of your environmental policies, the jobs are GONE,
the way of life is GONE, and now the beauty is GONE.
What's next? Shame on you!

Postfire recovery

- Interactive forms of communication are well received
 - Evidence that such activities can improve citizen – agency relationships (Toman et al. 2008)
- Multiple studies show high levels of support for many postfire management activities
 - Erosion control, hazard tree removal,
 - Mixed responses to harvesting burned trees (salvage logging) – responses linked with pre-fire beliefs/attitudes





Postfire Recovery

- Post-fire risk perceptions vary (Arvai et al. 2006, Cohn et al. 2008, McCaffrey 2004)
 - Some experience increased perception of risk and motivation to take action
 - Others may experience a “post-fire letdown” as and decide fire mitigation is not worth the costs



Wildland fire policy and planning

- Policies have evolved over time, typically following significant fire events
- Current fire policy takes a broad approach and includes
 - Suppression, proactive fuels reduction, restoring fire-adapted landscapes, and providing economic assistance to at-risk communities
- Increasing emphasis on collaborative efforts
- Substantial variability in implementation on-the-ground



Wildland Fire Policy and Planning

- Healthy Forest Restoration Act encourages WUI communities to develop Community Wildfire Protection Plans (CWPPs)

Factors contributing to successful development of CWPPs

Support and participation by land management agencies

A group facilitator

Community capacity

Ability to build on pre-existing groups and networks

Participants' commitment to value of collaborative process

Trust between parties

Galvanizing events

Recognition of shared values

The 2010 Wildland-Urban Interface of the Conterminous United States



Data Sources

Housing: U.S. Census Bureau
2010 block geography

Land cover: Multi-Resolution Land Consortium
2011 National Land Cover Dataset (NLCD)

Public Lands: Conservation Biology Institute
Protected Areas Database (PAD) version 2

Published March 2017

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Wildland-Urban Interface (WUI)

Yellow Interface
Orange Intermix

Non-WUI Vegetated

Dark Green No housing
Light Green Very low housing density

Non-vegetated or Agriculture

Light Yellow Low and very low housing density
Red Medium and high housing density
Blue Water

2000 Wildland Urban Interface



Copyright 2011

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WUI version 3 based on the 2000 Census,
the 1992-2001 NLCD Retrofit Change Product,
and the Protected Areas Database version 1.1

WUI

- Interface
- Intermix

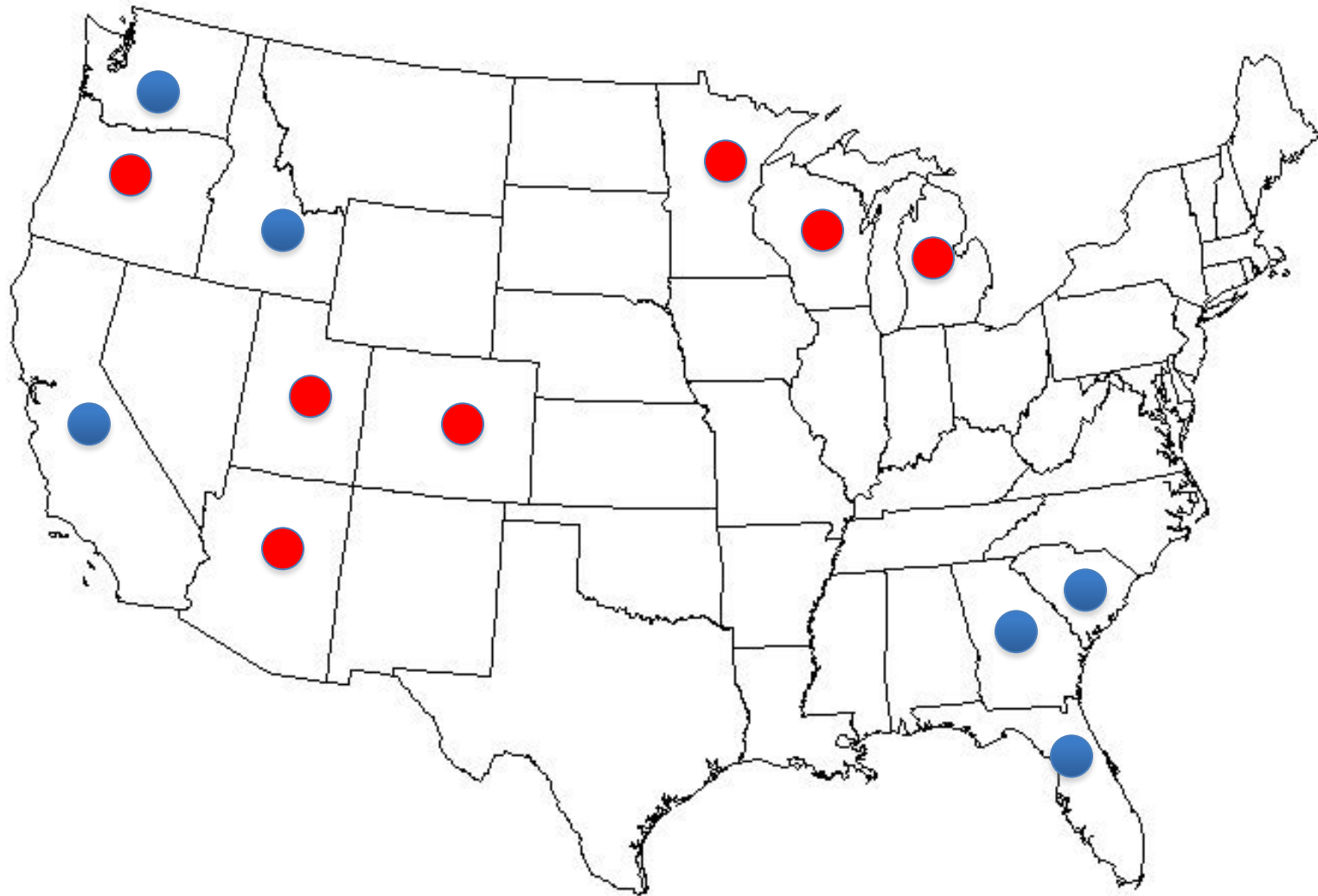
Non-WUI Vegetated

- No Housing
- Very Low Density Housing

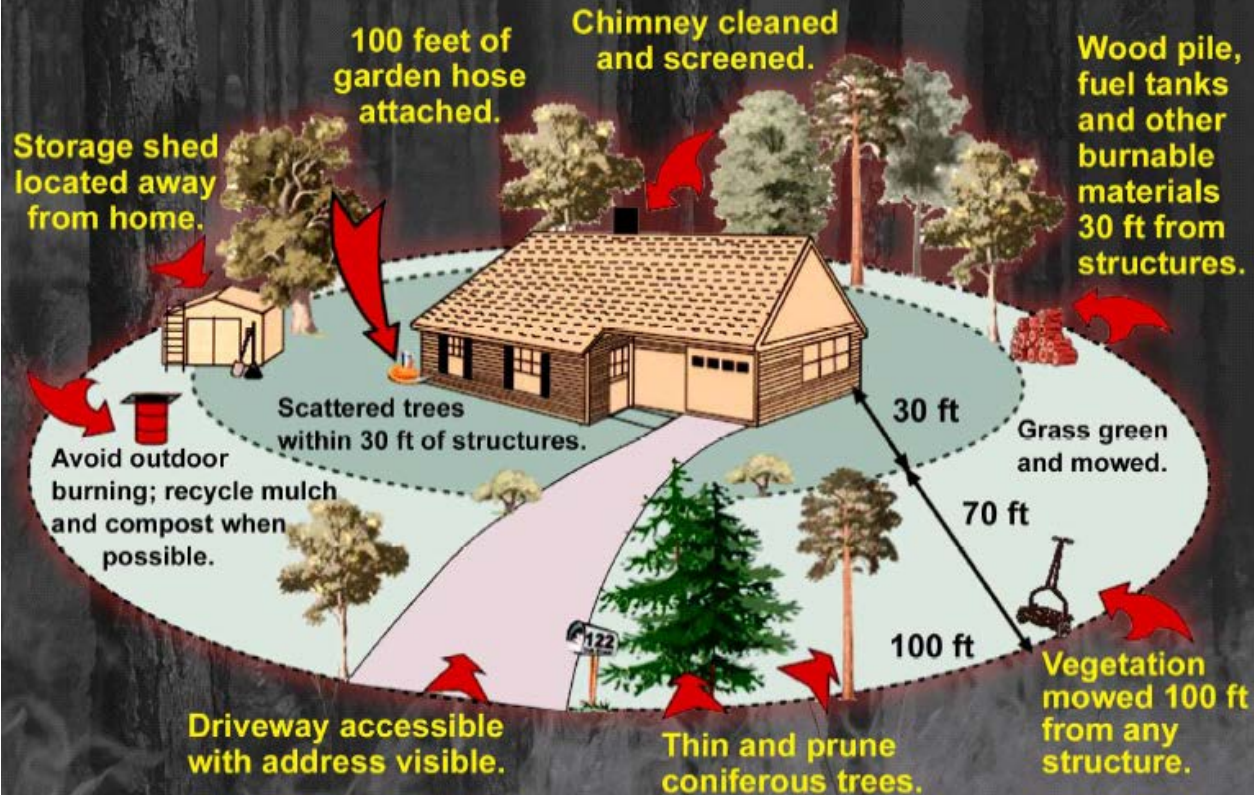
Non-Vegetated or Agriculture

- Medium and High Density Housing
- Low and Very Low Housing Density
- Water

Results from primary research



Are you Firewise?



- Peshtigo fire:
 - Oct. 8, 1871
 - ~1500 dead

