

NIST Special Publication 1236

# Large Outdoor Fires and the Built Environment: Summary of Kick-Off Workshop

Sponsored by the International Association for Fire Safety Science (IAFSS)

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THE INTERNATIONAL ASSOCIATION  
FOR FIRE SAFETY SCIENCE

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Standards and Technology  
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**NIST Special Publication 1236**

# **Large Outdoor Fires and the Built Environment: Summary of Kick-Off Workshop**

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U.S. Department of Commerce  
*Wilbur L. Ross, Jr., Secretary*

National Institute of Standards and Technology  
*Walter Copan, NIST Director and Under Secretary of Commerce for Standards and Technology*

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## Abstract

The kickoff workshop of the new permanent working group, sponsored by the International Association for Fire Safety Science (IAFSS), entitled *Large Outdoor Fires and the Built Environment* was held from 3:00 pm to 4:30 pm on Sunday October 21, 2018. The workshop was held as a part of the 11<sup>th</sup> Asia-Oceania Symposium on Fire Science and Technology (AOSFST) in Taipei, Taiwan. The working group is co-led by Sara McAllister of the U.S. Forest Service (unable to come to Taiwan), Sayaka Suzuki of National Research Institute of Fire and Disaster, and Samuel L. Manzello of NIST's Engineering Laboratory. The IAFSS permanent working group consists of three subgroups, with subleaders appointed by Manzello, McAllister, and Suzuki, and these are prioritized into the following topics: Ignition Resistant Communities (IRC – led by Elsa Pastor, UPC, unable to come to Taiwan), Emergency Management and Evacuation (EME, led by Enrico Ronchi, Lund University, unable to come to Taiwan), and Large Outdoor Firefighting (LOFF, led by Raphaele Bianchi, CSIRO). The IRC subgroup is focused on developing the scientific basis for new standard testing methodologies indicative of large outdoor fire exposures, including the development of necessary testing methodologies to characterize wildland fuel treatments adjacent to communities. The EME subgroup is focused on developing the scientific basis for effective emergency management strategies for communities exposed to large outdoor fires. The LOFF subgroup is providing a review of various tactics that are used, as well as the various personal protective equipment (PPE), and suggest pathways for research community engagement, including environmental issues in suppressing these fires. The overall objectives are to bring the full depth of knowledge of the IAFSS community to work on these priority topics. At the kickoff workshop, detailed ideas were presented regarding the planned activities of the working group, especially the large workshop to be held at IAFSS 2020.

## Key words

Large Outdoor Fires; Urban Fires; Wildland-Urban Interface (WUI) Fires; Informal Settlement Fires; Wildland Fires

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## 1. Introduction

### 1.1. Workshop Objectives

Large outdoor fires present a risk to the built environment. One example are wildfires that spread into communities, referred to as Wildland-Urban Interface (WUI) fires. Other examples are large urban fires, including those that have occurred after earthquakes as well as informal settlement fires. Research into large outdoor fires lags behind other areas of fire safety science research. Common characteristics between fire spread in WUI fires and urban fires have not been fully exploited. For these reasons, the IAFSS has approved the formation of a new permanent working group entitled *Large Outdoor Fires and the Built Environment* [1]. This report details the first official workshop of this permanent working group. At the kickoff workshop, detailed ideas were presented regarding the planned activities of the working group, especially the large workshop to be held at IAFSS 2020 Symposium in Waterloo, Canada.

### 1.2. Program of the Workshop

Time*	Title	Speakers (in bold)
3:00-3:15	Introduction	<b>S. Manzello</b> , S. McAllister, <b>S. Suzuki</b>
3:15-3:25	Oceania view	R. Bianchi
3:25-3:35	Asia view	S. Suzuki
3:35-3:50	IRC	E. Pastor/ <b>S. Suzuki</b>
3:50-4:05	EME	E. Ronchi/ <b>S. Manzello</b>
4:05-4:20	LOFF	R. Bianchi
4:20-4:30	Discussion	All participants

\* Each presentation (other than discussion) includes 5 minutes Q & A time.

### 1.3. List of Registered Participants (Alphabetical Order by Surname)

Beline Alianto (Universitas Indonesia, Indonesia)  
 Raphaelle Bianchi (Commonwealth Scientific and Industrial Research Organization, Australia)  
 Thomas Cleary (National Institute of Standards and Technology, USA)  
 Bogdan Dlugogorski (Murdoch University, Australia)  
 Chow Chan Foon (CPG Consultants Pte Ltd, Singapore)  
 Xinyan Huang (Hong Kong Polytechnic University, China)  
 Shiori Imai (Central Nippon Highway Engineering Tokyo Company Limited, Japan)  
 Mineko Imanishi (Takenaka Corporation, Japan)  
 Yeo Swle Khiank (SP Group, Singapore)  
 Takeshi Kishino (Central Nippon Highway Engineering Tokyo Company Limited, Japan)  
 Yue Tsz Kit (Hong Kong Polytechnic University, China)  
 NG Soon Kuan (ASET Engineers Pte Ltd, Singapore)  
 Ya-Ting Liao (Case Western Reserve University, USA)  
 Samuel L. Manzello (National Institute of Standards and Technology, USA/Japan)  
 Chu Che Min (Hualien County Fire Department, Taiwan)  
 Yoshikazu Mineghishi (Takenaka Corporation, Japan)  
 Taku Nakayama (Central Nippon Highway Engineering Tokyo Company Limited, Japan)  
 Yulianto Nugroho (Universitas Indonesia, Indonesia)  
 Takumi Ota (Central Nippon Highway Engineering Tokyo Company Limited, Japan)

Pither Palamba (Universitas Indonesia, Indonesia)  
Dennis Pau (University of Canterbury, New Zealand)  
Ling Chu Su (Arup, China)  
Peiyi Sun (Hong Kong Polytechnic University, China)  
Sayaka Suzuki (NRIFD, Japan)  
Wai Cheong Tam (National Institute of Standards and Technology, USA)  
Kuang-Chung Tsai (National Kaohsiung University of Science and Technology, Taiwan)  
Will Tsai (Fire Force, New Zealand)  
Richard Walls (Stellenbosch University, South Africa)  
Yu Wang (University of Edinburgh, UK)  
Chia Lung (Farian) Wu (University of Edinburgh, UK)  
Jiann Yang (National Institute of Standards and Technology, USA)  
Masahiko Yokota (Central Nippon Highway Engineering Tokyo Company Limited, Japan)

## 2. Summary and Next Steps

A total of 32 global experts participated, representing Australia, China, Indonesia, Japan, New Zealand, Singapore, South Africa, Taiwan, United Kingdom, and USA. The workshop began with an introductory presentation delivered by Samuel Manzello and Sayaka Suzuki on how this topic became a permanent working group with IAFSS sponsorship. After this, Raphaelle Blanchi placed the large outdoor fire and built environment problem in the context of the Oceania region. Sayaka Suzuki then placed the problem in the context of why it is also very important to Asia. All three of these presentations provided a solid foundation for the participants to then listen to the detailed subleader presentations.

The subleader presentations went into extreme detail to highlight what each of the three subgroups will undertake and their specific plans as part of the IAFSS 2020 symposium that will be held in Waterloo, Canada. As two of the three subleaders were unable to travel to Taiwan, these presentations were delivered by Sayaka Suzuki and Samuel Manzello. It was noted that the IRC subgroup has the largest number of registered participants, as this topic most closely aligns with the majority of the expertise within the current IAFSS community. As a result, it was stressed that more participation would be helpful in the EME and LOFF subgroups.

Some interesting discussion points worth mentioning here relate to important of mass notifications for large outdoor fires; this is an important topic that should be addressed. There also the mention of SMART firefighting technologies and how this will best integrated into the effort as part of the LOFF subgroup. Finally, participants suggested it would be good to have another workshop prior to IAFSS 2020 Symposium with Inteflam 2019 suggested as a possible venue.

## 3. Acknowledgments

The support of the organizing committee of the 11<sup>th</sup> AOSFST is greatly appreciated. In particular, the authors wish to acknowledge the help of Professor Kuang-Chung Tsai of National Kaohsiung University of Science and Technology, Taiwan for setting up the room location for the workshop. Professor Wan-Ki Chow of the Hong Kong Polytechnic University, China and the Taiwan chapter of the Society of Fire Protection Engineers (SFPE; Ms. Emma Liu) are also appreciated. SLM would also like to personally thank Professor

Patrick Van Hees of Lund University, IAFSS President and ISO TC92 Chairman, for his constant support of this effort.

## References

- [1] Manzello, S.L., Bianchi, R., Gollner, M., Gorham, D., McAllister, S., Pastor, E., Planas, E., Reszka, P., and Suzuki, S., (2018) Summary of Workshop Large Outdoor Fires and the Built Environment, *Fire Safety Journal* 100: 76-92  
<https://doi.org/10.1016/j.firesaf.2018.07.002>

## **Appendix A: List of Presentations Delivered at the Workshop**

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## Working Group Structure

The working group consists of three subgroups focused:  
 Ignition Resistant Communities (IRC)  
 Emergency Management and Evacuation (EME)  
 Large Outdoor Firefighting (LOFF)

At some points each subgroup will cooperate each other as all related!



## IAFSS 2020 Plans

- We will have the **workshop**
- WG (sub-groups) efforts on Phase 1 will be presented
- We hope to get feedback from you! (which we call a part of Phase 2)

If you would like to join WG, please sign up from the link below;

<https://goo.gl/forms/OTMW2SbWi7mmHYiv1>



## Kick-off Program

Time: October 21st 2018 3:00 to 4:30 PM  
 Location: Room 403

Time*	Title	Speaker
3:00-3:15	Introduction	S. Manzello, S. McAllister, S. Suzuki
3:15-3:25	Oceania view	R. Bianchi
3:25-3:35	Asia view	S. Suzuki
3:35-3:50	IRC	E. Pastor/S. Suzuki
3:50-4:05	EME	E. Ronchi/S. Manzello
4:05-4:20	LOFF	R. Bianchi
4:20-4:30	Discussion	All Participants

\*Each presentation (other than discussion) includes 5 minutes Q & A time



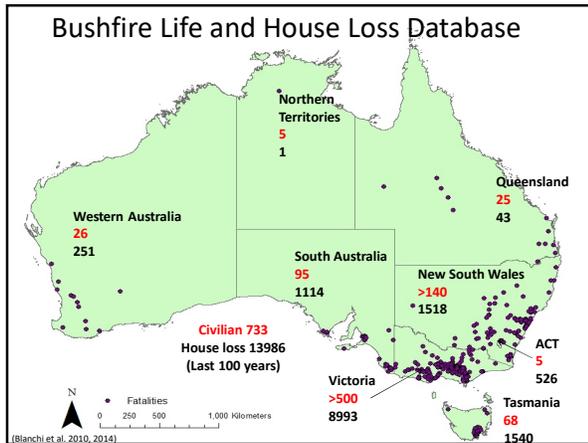
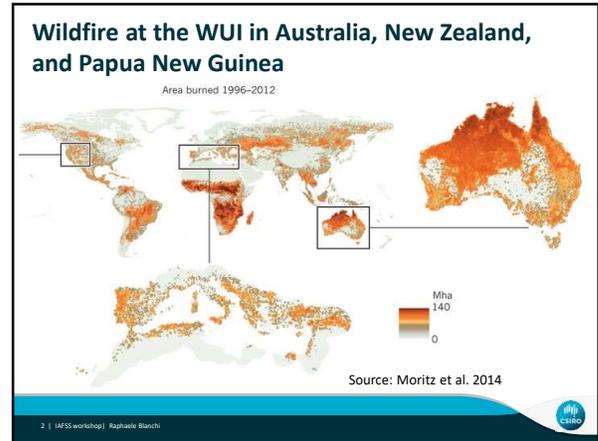
**Large Outdoor Fires and the Built Environment working group - Oceania view**

Raphaelae Bianchi (CSIRO)

LAND & WATER  
www.csiro.au

CSIRO

AOFST - WS



Fire	Burnt area	Number of house loss	Number of houses surveyed	Fatalities	State	Weather	Cost
Ash Wednesday (Australia)	210,000 ha	1511 VIC	1153 (in Victoria)	47 (Vic) 28 (SA)	VIC SA	FFDI 130	\$400M



(Ramsay et al. 1987)

Canberra (Australia)	Burnt area	Number of house loss	Number of houses surveyed	Fatalities	State	Weather	Cost
18/01/2003	160,000ha	519	226	4	ACT	FFDI 100	\$350 M



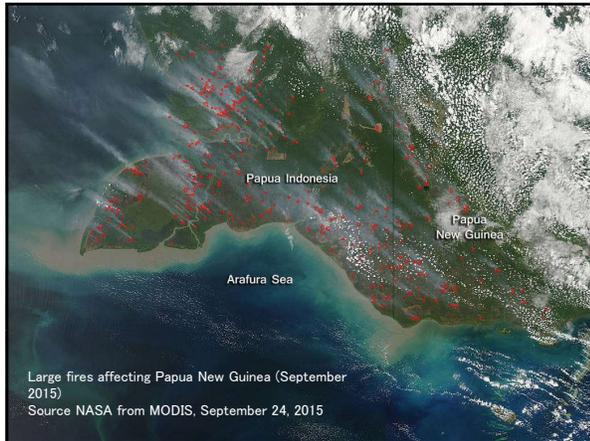
~80-90% of house destroyed in absence of direct radiant heat and flame from the fire front

(e.g. Leonard et al. 2005)

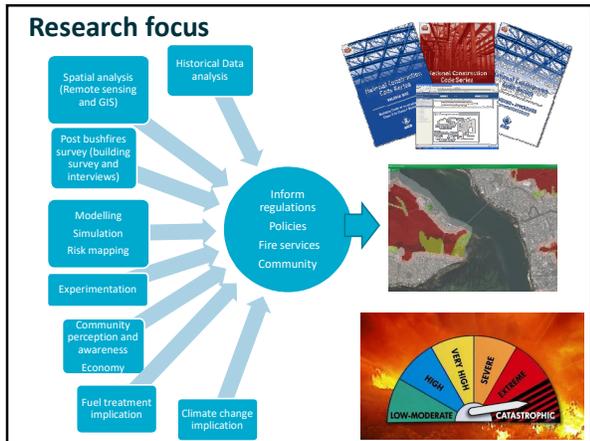


(e.g. Leonard et al. 2009)

Black Saturday (Australia)	Burnt area	Number of house loss	Number of houses surveyed	Fatalities	State	Weather	Cost
07/02/2009	390,000ha	2100	1100	173	VIC	FFDI 155	>\$4B



Port Hills Fire (New Zealand)	Kai Schwoebel	Number of house loss	Number of houses surveyed	Fatalities	Annual burnt area
13/02/2017		11	Inquest in progress	none	Fire season 15-16: 3500 ha Fire season 14-15: 3250 ha Fire season 13-14: 2000 ha Fire season 12-13: 4400ha



# Thank you

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# LARGE OUTDOOR FIRES AND THE BUILT ENVIRONMENT

## -Asia view-

Sayaka Suzuki  
National Research Institute of Fire and Disaster, Japan  
sayakas@fri.go.jp

AOSFST@ Taipei, Taiwan October 21<sup>st</sup> 2018

## Where is Asia??

## Asia

- Asia is large
  - 44,579,000 m<sup>2</sup>
  - Large Continent & Islands
- Population
  - 4.4 billion people
  - Densely or barely populated
- Variety of climate
- Variety of developments
  - even within counties
  - codes & standards
- Variety of culture
  - Different construction

## How much is forest in Asia?

## Large outdoor Fires in Asia

1987 Black Dragon Fire @ China & Russia      2010 Mount Carmel Fires @ Israel

Peat fires @ Indonesia      2016 Urban Fires @ Japan

2017 Shanty Town Fires @ Philippine      2000 Gangwon Wildfire @ Korea

## Large Outdoor Fires in Asia

- **Forest fires, Wildland fires, Wildfires or Mountain fires**
  - A lot of forest, and wildland
- **Wildland-Urban Interface (WUI) fires**
  - WUI area does exist
- **Urban fires**
  - Some countries have really-densely-populated areas
  - **Lots of research going on in Asia**

**Disaster-related**

- Earthquake
  - Post-earthquake fires
- Tsunami
  - Tsunami fires
- Flood, Cyclone, Typhoon
  - Less common for fires...

Mainly in Japan, and Japanese researchers have worked on those issues.

## Forest & Peat Fires in Asia

- **Peat Fires** - mainly Indonesia & Russia in Asia
  - Long & Slow flame spread (smouldering)
    - Producing lots of CO<sub>2</sub>
  - Peat fire could cause another forest fires
- **Forest Fires**
  - 1987 Black Dragon Fire showed 'the difference of making effort on forest fires'
- **What we should do?**
  - **Early Detection is the key** – Airplane & Satellite
  - Mitigation
    - By understanding ignition & fire spreads
    - not only effective but also 'eco-friendly' or cost-effective
  - Haze issue
    - Causing health problem globally - for example from Indonesia to South-East Asia region

## WUI fires in Asia

- **WUI area & fires?**
  - More problems as people have more interaction with forest/wildland
  - 2010 Russia **wildfires** – 150 structures and settlements
  - 2010 Mount Camel **Forest Fire** - several village & people evacuated
  - Korea designated the 'WUI' area
- Korea had 2 WUI fires in one day (2013)
- Japan's first two WUI fires happened in one day (2017)
  - Forest to residential fires & Residential to forest fires

## Urban fires in Asia

- Recent developments
  - **Co-existing New buildings & Old buildings**
    - New buildings follow (new) Codes & Standards
    - Old buildings – weaker to fire or any ignitions
    - Buildings under construction – weak to fire
    - Informal settlements exist in Asia
      - 2017 Shantytown fires in Philippines
- **Applying** new Codes & Standards to new buildings
  - Take times
  - Strengthening firefighter technology is also a key
- **Retrofitting** the codes and standards
  - Existing buildings
    - Weaker to fire (old, or just following old regulation, or not following at all)

## What is needed?

- **Statistics** – how we consider all different aspects in Asia into statistics?
  - Definition of 'Large fire'? Cost? burned area? Loss of life?
- **Urban Planning & Fire problem**
  - How we solve the fire problem while waiting to have better urban planning or better fire-resistance technology applied (that takes time)
- **Real-time simulation – important in WUI & Urban Fires**
  - Predict fire spread within communities
    - Applying firefighting resources
    - Firefighters may use those simulations
    - Adjustable to simultaneous fires

## Acknowledgement

- Kuibin Zhou (Nanjing Tech University, China)
- Yulianto Nugroho (University of Indonesia, Indonesia)

# IGNITION RESISTANT COMMUNITIES (IRC)

Sayaka Suzuki, Ph.D.  
National Research Institute of Fire and Disaster, Japan

Elsa Pastor, Ph.D.  
Universitat Politècnica de Catalunya, Spain

## Outline

Background  
*Why we work on Ignition Resistant Communities?*

Objectives  
*What we want to achieve?*

Discussion  
*What we are going to do by 2020?*

Call for participation

## Background

- Hardening structures is essential to decrease homes losses by outdoor fire exposures.
- Building codes and standards already exist, providing requirements to reduce risk of structural ignition.
- The devastating power of current large outdoor fire events is revealing weaknesses in our current knowledge



Mati (Greece) WUI fire, July 2018. Source: David Caballero

- Are levels of hardening adequately established?
- Are large outdoor fire exposures properly captured in codes and standards?
- Do we know what's coming/how much coming from wildfires and within communities?

## Objectives

To develop the scientific basis for **new standard testing methodologies** indicative of **large outdoor fire exposures**, including the development of necessary testing methodologies to characterize **wildland fuel treatments** adjacent to communities



Regulatory Framework and standards



Fire exposure/flame characterization

For both *exposure to structures & communities*  
*exposure from wildland*

Image Source: Valérie Gache, AFP, Greece WUI Fires 2018

## What's in codes & standards ?



Regulatory Framework and standards

Identify needs on codes & standards (both local & international) and any rules



- What is working/not working in current regulatory framework in large outdoor fire prone areas?
- What is missing in current codes and standards for large outdoor fires if not working?
- What is the difference of codes & standards among areas?

*Summary of worldwide regulatory framework*  
*Comparison among regulatory framework*

## What we know or not?



Fire exposure/flame characterization

Identify & quantify real fire exposures (heat flux, flame contact, firebrands) to the communities (from wildland and within communities)



- What kind of data do we have? From experiments & from actual fire
- What kind of data we don't have but we need?
- What we know from our own data?

*Summary of large outdoor fire exposures*  
*Summary of experiments & modellings for fuel treatments*  
*Set of parameterized large outdoor fire exposure scenarios*

## Discussion

13th IAFSS Symposium – Waterloo, Canada

What we are going to do by 2020

- Summary of worldwide regulatory framework
- Summary of large outdoor fire exposures
- Summary of experiments & modellings for fuel treatments

What we are looking for in 2020 workshop

- Finding the gap/the difference/the missing link in regulatory framework, between regulatory framework and real fire scenarios, in experimental/numerical/modelling work

*Any feedback is appreciated!*

## Call for participation



➤ 38 members from 14 different countries have signed in: Europe: (11), Asia (7), North America (17), Oceania (2), South America (1)

**We still need more people to cover all the worldwide LOF-prone areas and topics!**

Joint effort between standardization community and wildland-WUI fire research community

## Thanks for your attention!

If you have any questions specifically related to this sub-group,  
Please contact the sub-group leader,

**Elsa Pastor** *Universitat Politècnica de Catalunya*

 [elsa.pastor@upc.edu](mailto:elsa.pastor@upc.edu)

## Emergency Management and Evacuation Subgroup

Samuel L. Manzello<sup>1,2,3</sup> and Enrico Ronchi<sup>4</sup>

National Institute of Standards and Technology (NIST), USA<sup>1</sup>  
 Invited Guest Researcher  
 Building Research Institute (BRI), Japan<sup>2</sup>  
 National Research Institute of Fire and Disaster (NRIFD), Japan<sup>3</sup>  
[samuelm@nist.gov](mailto:samuelm@nist.gov)

Lund University, Sweden<sup>4</sup>  
[enrico.ronchi@brand.lth.se](mailto:enrico.ronchi@brand.lth.se)

Large Outdoor Fires and the Built Environment Working Group

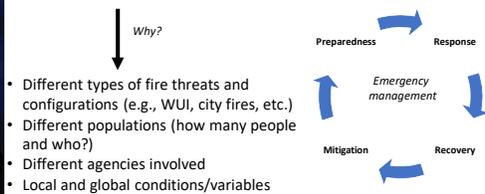
## Outline

- Background  
*Why an Emergency management and evacuation sub-group?*
- Objectives  
*What do we want to achieve?*
- Discussion  
*What we are going to do by 2020?*
- Call for participation

## Background

Why an Emergency management and evacuation sub-group?

National and international organizations may adopt different strategies for emergency management in case of large outdoor fires



## Background

Why an Emergency management and evacuation sub-group?

Mass fire evacuations involve thousands of people every year

[https://en.wikipedia.org/wiki/November\\_2016\\_Israel\\_fires](https://en.wikipedia.org/wiki/November_2016_Israel_fires)

Recent examples

- 2016 Fort McMurray wildfire, Canada (≈90,000 people)
- 2016 Haifa, Israel (>40,000 people)
- 2017 British Columbia, Canada (total of ≈35,000 people)
- ... and many more



Need to investigate **strategies around the world** for evacuation scenarios involving different resources, evacuation types, etc.

## Background

Why an Emergency management and evacuation sub-group?

- Limited knowledge on human behaviour in evacuation
- Scarce number of data-sets on human behaviour during evacuation emergencies
- Great variability in data-set types\*: qualitative vs quantitative (e.g., post-disaster analyses/interviews, behavioural intention questionnaires, Laboratory experiments on human behaviour, etc.)

\*Human Behaviour data → Need to assess what can be shared



Need to make collected data-sets more accessible

## Objectives

What do we want to do?

- Inventory of strategies and regulatory frameworks
  - Share and review strategies adopted around the world
  - Collect and categorize regulatory frameworks

<http://idahofirewise.org/>



- Inventory of tools
  - Tools exist for different scopes
  - Categorize and review existing tools currently used in EMEvac such as risk assessment tools, mapping tools, evacuation models (e.g. WUIVAC, DynaMIT, VISSIM, and others)

## Objectives

What do we want to do?

- Gaps, research roadmap and strategy/tool assessment

Identification of research roadmap

Analysis of existing tools

- How can we evaluate existing tools?
- Development of testing case studies

- What we know we do not know?
- What is missing in current codes/regulations?
- What data do we need?
- What tools we need to develop?



## Objectives

Why a research roadmap on Emergency Management and Evacuation?

FUTURE RESEARCH EFFORTS



What research areas should be prioritized?

Is existing knowledge sufficient? Is it fully implemented in the real world?

## Discussion

Possible final "products" (in red planned activities by IAFSS2020)

- Development of a standard template for the analysis of regulatory frameworks and summary of key regulatory frameworks available worldwide
- Development of a standard template for the analysis of emergency management tools (e.g. risk assessment tools, mapping tools, pedestrian models, traffic models, etc.) and summary of inventory of existing tools for aiding emergency management
- Summary of well-documented large outdoor fire real cases involving evacuation according to a standardized template
- Development of test case scenario(s) to evaluate the capabilities and limitations of existing tools to aid emergency management
- Enhancement of accessibility of existing and future evacuation data-sets
- Research roadmap

## Call for Participants

WE NEED YOUR HELP!

The Emergency Management and Evacuation sub-group is intended as a multi-disciplinary group bridging expertise in a variety of areas

We include at the moment 22 members with expertise in engineering, psychology, sociology, modelling, and simulation... but we need more!

Current member countries

Australia, Canada, United Kingdom, Japan, Italy, USA, Poland, Sweden, New Zealand

If you are interested in this area and you want to share your expertise and experience within this IAFSS sub-group, just join us!



## Large Outdoor Fires and the Built Environment working group

### - Large Outdoor Firefighting – LOFF

Raphael Blanchi (CSIRO)

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www.csiro.au

CSIRO

AOFTS – Workshop 21/10

## Large Outdoor Firefighting – LOFF

- General aim

To develop the scientific basis for various **Firefighting** tactics that are used, as well as the various personal protective equipment (PPE), and suggest pathways for research **community engagement**, including **environmental and health** issues in suppressing these fires



## Protection of firefighters - PPE and crew protection system

**Background**

- Protection of firefighter is an important aspect of firefighter safety in a WUI fire where both the wildlands and the structures are involved
  - How to combine Wildfire and structure fire protection needs? What implication for PPE and protection of fire crew in vehicles?

**Objectives**

- Develop a framework for this new combined wildland/structure fire exposure, to assess PPE requirements, to assess the performance of crew vehicles
- Establish a network between fire researchers and fire managers for discussion and exchange

**How?**

- ✓ Develop a repository for inventories of PPE (both international and local Standards)
- ✓ Develop a repository for fire fighting vehicle crew protection systems
- ✓ Conceptualize a risk framework/ best practices that underpin the development of standards and test methods for firefighter protection

3 | Presentation title | Presenter name

CSIRO

## Protection of firefighters (cont'd) - Firefighting tactics

**Background**

- Various firefighting tactics are used globally to respond to large outdoor fires (wildfires or fires that have reached the WUI) depending on each country unique approach to fire-fighting.

**Objectives**

- What are the tactics used globally?
- Summary of knowledge and support for collaboration, exchange

**How?**

- ✓ Define a repository to develop inventories of various tactics that are used globally to respond to large outdoor fires
- ✓ Develop a framework for resources and strategies optimization for fire suppression in the WUI

4 | Presentation title | Presenter name

CSIRO

## Pathways for community engagement

**Background**

- Community engagement is an essential part of people safety in large outdoor fires
  - Why and how to engage community?

**Objectives**

- Provide scientific research on preparedness and mitigation measures
- Establish a multi-disciplinary network of researcher and practitioners to promote discussion on shared responsibility model and reflection on what is a fire-adapted community

**How?**

- ✓ Develop a framework and repository on preparedness and mitigation research
- ✓ Define community engagement pathways

5 | Presentation title | Presenter name

CSIRO

## Health and Environmental impacts

**Background**

- The impact of large outdoor fires smoke on the environment and health is an increasing concern
  - How to manage the risk on firefighters?

**Objectives**

- Better understanding of smoke contents and smoke dispersion to inform potential human exposure (for people at risk). Consider smoke impact for fire suppression strategies and mitigation measures (such as prescribed burning)
- Environmental effect of suppressing those fires

**How?**

- ✓ Develop a repository presenting a summary of knowledge on smoke exposure and health impact on fire fighters in different scenarios (urban fires, wildfires, WUI fires, prescribed burning).
- ✓ Develop a repository and review of smoke dispersion models for impact at the interface
- ✓ Inform government bodies, relevant bodies to define criteria for health impact

6 | Presentation title | Presenter name

CSIRO

## Discussion

- Discuss objectives and timeframes for phase 1 “collecting information”
- Define a framework to develop inventories and repositories of
  - PPE (both international and local Standards),
  - Fire fighting vehicle crew protection systems, and
  - various tactics that are used globally to respond to large outdoor fires
- Define repository for community engagement pathways
- Define repository to develop a summary of knowledge on smoke exposure and health impact on fire fighters

7 | Presentation title | Presenter name



## Call for participation

- Current participation

	Number people	Countries	
WG member	29	Europe, USA, China, Japan, Canada, Australia, UK, Korea	19 IAFSS members 10 non members
Keep me informed	26	USA, Denmark, Sweden, Malaysia, France, Japan, India, Australia	11 IAFSS members 15 non members

- IAFSS community, Research community
- Organisation in charge of risk/Fire services/practitioners

Collaborate with different disciplines to create integrate solutions and community behavioural change

8 | Presentation title | Presenter name



# Thank you

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