NSSN
NSW Smart Sensing Network

NSSN GRAND CHALLENGES

BUSHFIRES

Smart Sensing for Improved Bushfire Prevention, Response and Recovery

Advanced smart sensing technologies can detect the earliest signs of fire, improve situational awareness for firefighters, and provide valuable data for post-fire recovery efforts. By combining world-class research across our network, the NSSN, its members and partners will develop technologies that enable more effective preparation, response and post-fire recovery efforts.

The 2019–2020 bushfires burned more than 5.3m hectares of land in New South Wales, ravaged 37% of the State's national parks, and destroyed more than 3,000 homes.

Estimates suggest the bushfires caused over $2 billion in insured losses across Australia, with the economic impact on tourism, hospitality, agriculture and forestry estimated to be around $3.6 billion. There may have been a further $2 billion in health costs, arising, in part, from respiratory illnesses caused by the smoke[1].

Residents of major Australian cities including Sydney and Canberra choked from bushfire smoke for prolonged periods. The hazardous air quality status in NSW threatened the wellbeing of millions of people, especially those suffering from respiratory conditions.

The unprecedented dry conditions in 2019, also led to the formation of an unusually large number of fire-generated thunderstorms (PyroCbs). The total number of such thunderstorms in south-eastern Australia increased from 60 at the end of 2018–19 to almost 90 at the end of 2019–20 – an increase of almost 50% in one bushfire season[2].

Bushfires and Smart Sensing

The increasing severity and impact of bushfires in Australia and around the world has resulted in calls for new approaches to bushfire preparation, response, and recovery.

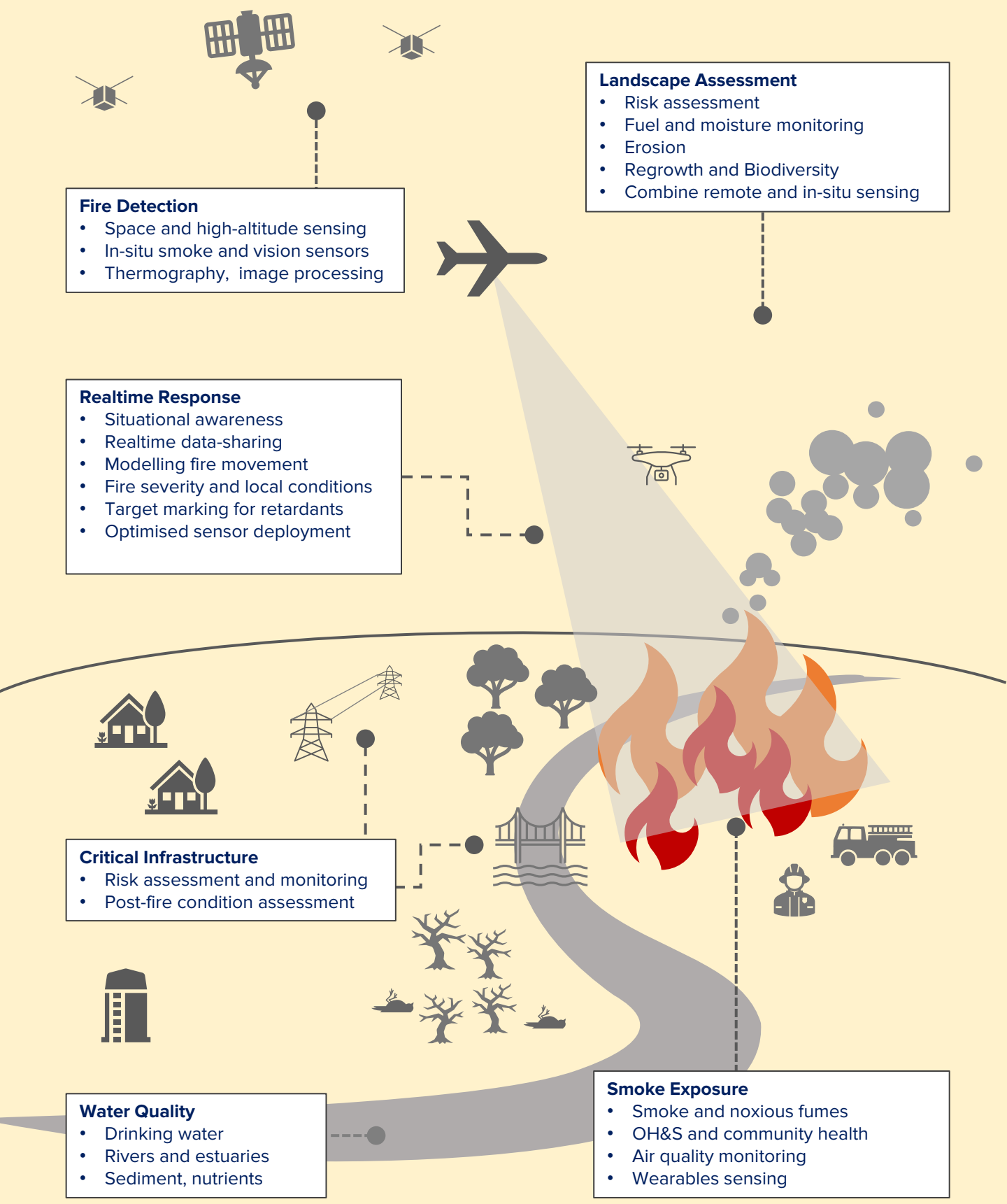
Of the 76 recommendations resulting from the 2020 NSW Bushfire Inquiry, many refer to or will benefit from smart sensing technology. Fire science, remote sensing, spatial technologies, data science and artificial intelligence are but some of technologies that will underpin future bushfire preparedness.

Smart sensing is a broad group of technologies that will play an important role in future. it includes in-situ, mobile and remote sensors as well as the sensing platforms, data analysis, machine learning, data communication and data management needed to make sensed data both available and useful.

[1] https://naturaldisaster.royalcommission.gov.au/system/files/2020-08/Interim%20Observations%20-31%20August%202020_0.pdf

[2] https://www.dpc.nsw.gov.au/assets/dpc-nsw-gov-au/publications/NSW-Bushfire-Inquiry-1630/Final-Report-of-the-NSW-Bushfire-Inquiry.pdf

Smart Sensing Solutions for Bushfires



Fire Detection
- Space and high-altitude sensing
- In-situ smoke and vision sensors
- Thermography, image processing

Landscape Assessment
- Risk assessment
- Fuel and moisture monitoring
- Erosion
- Regrowth and Biodiversity
- Combine remote and in-situ sensing

Realtime Response
- Situational awareness
- Realtime data-sharing
- Modelling fire movement
- Fire severity and local conditions
- Target marking for retardants
- Optimised sensor deployment

Critical Infrastructure
- Risk assessment and monitoring
- Post-fire condition assessment

Water Quality
- Drinking water
- Rivers and estuaries
- Sediment, nutrients

Smoke Exposure
- Smoke and noxious fumes
- OH&S and community health
- Air quality monitoring
- Wearables sensing

NSSN Grand Challenge Bushfires

In line with its purpose of developing and applying smart sensing technologies for the benefit of Australia, the NSW Smart Sensing Network has established the *Bushfire Grand Challenge*.

The Bushfire Grand Challenge is a multi-year initiative with several components that will collectively advance the development and use of smart sensing for bushfire preparation, response, and recovery.

The components of the challenge are ***Bushfire Smart Sensing Innovation Roadmap 2030***, the ***Smart Sensing Research Program*** and ***Research Enablers.***

Bushfire Smart Sensing Innovation Roadmap 2030

The development and use of sensing and related technologies to support bushfire situational awareness, risk assessment and operations is a relatively new field of innovation with promising early results. We expect R&D activity to increase over the coming years as governments and industry recognise the value of these new capabilities.

With this as context, there is an opportunity to help both innovators and end-user organisations prioritise their efforts and increase the impact of smart sensing innovation in Australia.

The ***Bushfire Smart Sensing Innovation Roadmap 2030*** will provide a vision of capabilities required in 2030 and the intermediate steps to achieving that vision. The roadmap should serve as a common framework for crosssectoral collaboration and be used to guide investments in smart sensing innovation and technology. Formulating the roadmap will be a collaborative activity commencing with a workshop in October 2021.

Smart Sensing Research Program

The core of the Grand Challenge is the research projects. Identification of projects and initial framing will be co-designed in a workshop setting. Some examples of smart sensing project areas are shown here:

Combining remote and in-situ sensing to accurately **Assess and Monitor Fuel and Micro-Climates**

Landscape Recovery Mapping – plant regrowth, species diversity, erosion

Monitoring Personal and **Community Exposure** to smoke and toxic fumes

Monitoring Water Quality – ash, sediment, nutrients affecting drinking water, river and estuarine health

Fire Detection – remote and in-landscape sensing

"**Bushfire Digital Twin**" to enable real-time, shared, situational awareness

Tree Mapping and Assessment - prioritising dangerous trees that prevent access after fires

Critical **Infrastructure Condition Monitoring** and Assessment

Optimisng sensor placement and drone deployment to maximise information utility at lowest cost

Research Enablers

Supporting programs and resources form the third component of the Bushfire Grand Challenge.

Through the involvement of industry, government and philanthropic organisations the Bushfire Grand Challenge will help researchers use testing facilities, sensing platforms, data and other resources that may otherwise be difficult for innovators to access.

As with other NSSN Grand Challenges the NSSN Bushfire Grand Challenge also has access to the ***NSSN Grand Challenge Fund***. This fund complements other research and innovation funding programs and is targeted at collaborative research projects that increase the technology readiness of new smart sensing technologies.

Get Involved

We encourage operational agencies, other government organisations, industry and the research sector to participate in the NSSN Bushfire Grand Challenge.

To join us in solving the NSSN Bushfire Grand Challenge please contact Mr Peter Runcie at peter@natirar.com.au .

Proudly funded by

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