



National Environmental Science Programme



Impacts of bushfire on freshwater fauna

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Acknowledgement of First Nations People and their Sovereignty and Contributions



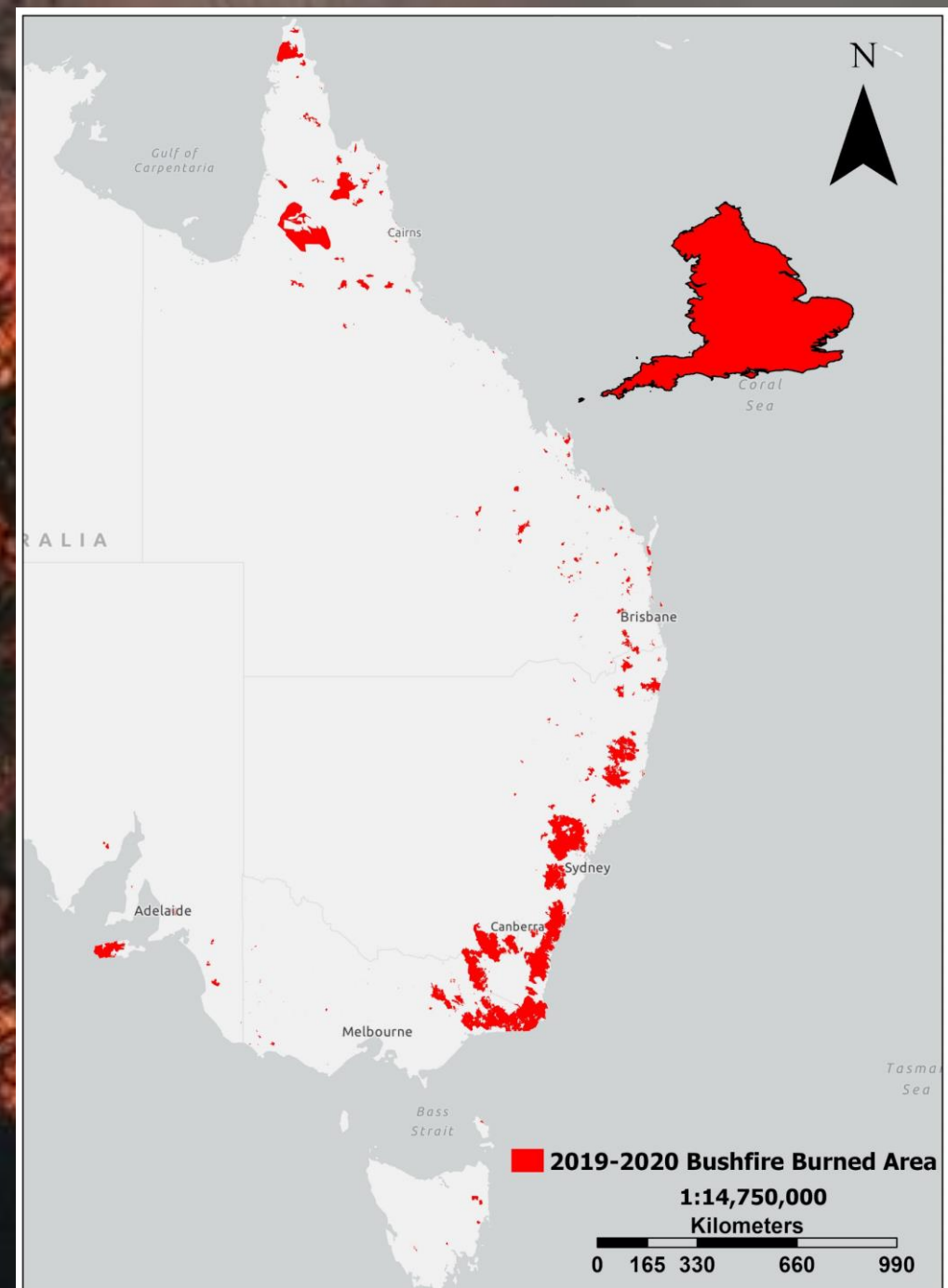
We acknowledge Aboriginal people as the First Peoples of Australia whose sovereignty was never ceded.

We acknowledge and respect their deep spiritual connection and enduring relationship to Country.

Our work is conducted on the Turrbal/Jaggara country of the Meanjin people.

Bushfires in Australia

Black Summer Bushfires
2019-2020



Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community



Loren Elliott/Reuters



Luis Ascui



<https://onetreeplanted.org/blogs/stories/australia-bushfires>



David Menzel



Douglas Gimesy/The Guardian



National Geographic

Australian Fresh Water Ecosystems

Habitat for >280 fish, 53 crayfish, 240 amphibian species

2019-2020 fires overlapped with 100% of the known range of some critically endangered fish and crayfish species

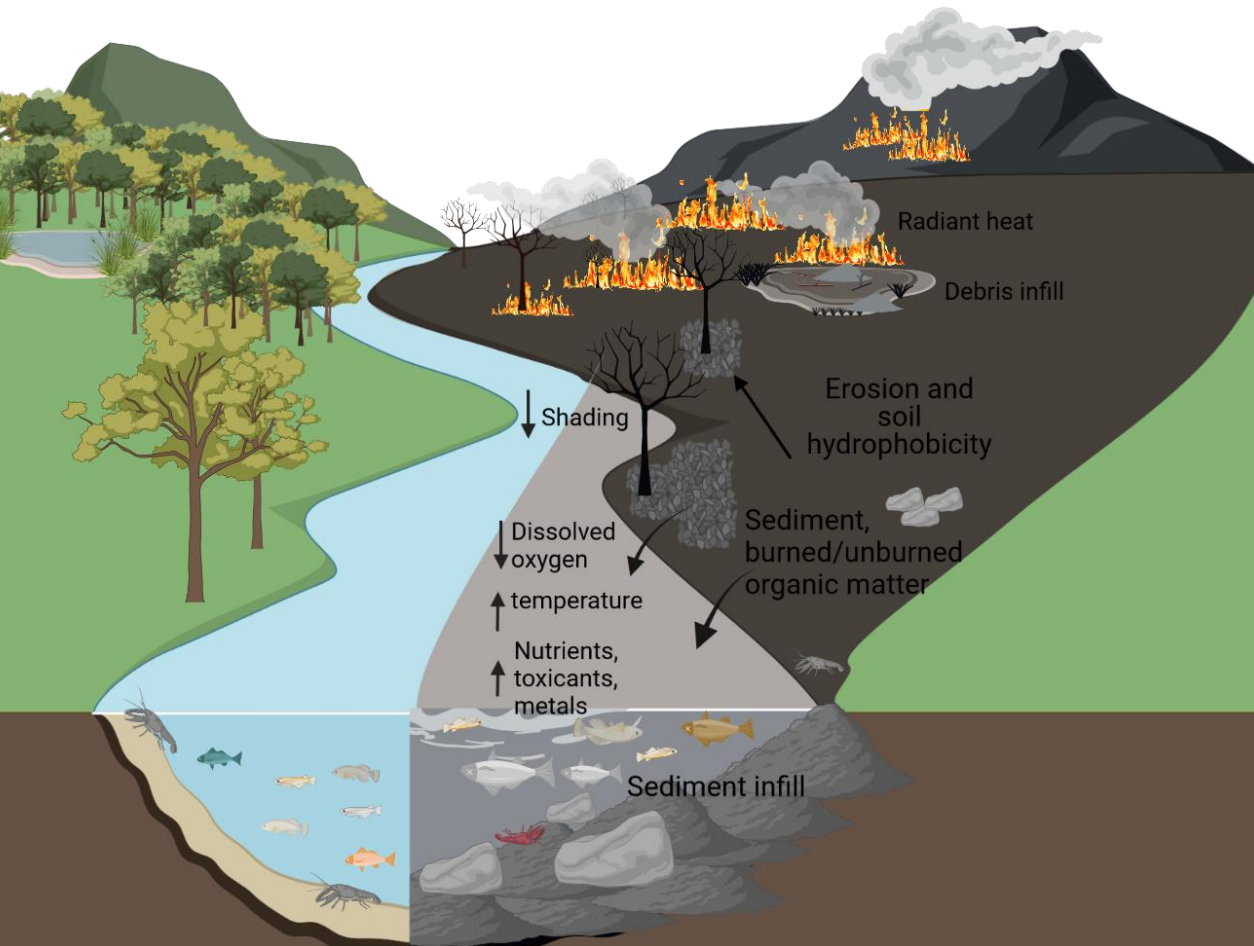
Mortalities observed in >30 fish sp.; many more likely undocumented.

Impacts far removed from fire-affected areas

Effects will continue to impact FW animals for years to decades



Bushfire impacts on water quality – a biological perspective



Direct (immediate) effects:

- Heat load (from fire)
- Loss of riparian vegetation (shading)
- Deposition of ash/debris ->
 - Smothering aquatic substrates/vegetation
 - Increased soil erodibility, hydrophobicity

Indirect (post-fire) effects:

- Ash, sediment, debris runoff – acute hypoxic events
- Heavy metal, carcinogen mobilisation
- Increased water pH
- Long term temperature changes
- Turbidity
- Altered water flow patterns

Impacts on aquatic species

Changes to water quality affect physiological function – tolerance vs intolerance determines impact

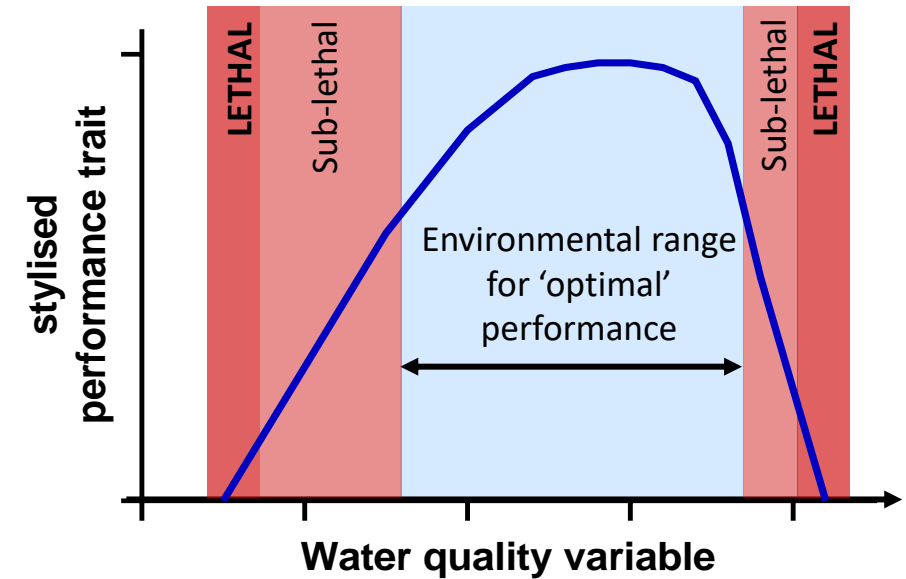
Impacts can be lethal vs sublethal

Temperature and oxygen key parameters

Suspended ash and sediments can clog gills

Heavy metals, carcinogens leach from sediments/ash ->toxic

Nutrient loads can cause sustained eutrophication



Managing impacts of bushfire on freshwater systems

Responses of Australia's most at-risk aquatic fauna to fire-associated water quality changes are unknown

Changes in physiological performance metrics
indicators of impacts:

- Define allowable limits for water quality changes
- 'Triggers' for management interventions / recovery trajectories
- Informing species management guidelines (pre & post fire)
- Informing emergency actions



Case study – Physiological responses of fish frogs and crayfish

4 fish sp., 4 crustacean sp., 3 frog sp. (larvae)
exposed to bushfire ash + fine sediments

Few negative effects on amphibians – slight
positive effect from eutrophication

Fish and crustaceans

- Species from high altitude/temperate climates had lower thermal and oxygen tolerance limits
- Temperature and oxygen tolerance limits further reduced following ash/sediment exposure
- Gill damage





Management Implications

Water quality changes differentially affect species → changes in community composition

Species/populations from cooler climates at greater risk relative to lowland species → preventative management is required

Chronic exposure to ash/sediment can impair oxygen and temperature tolerances - complex abiotic interactions need to be considered when developing management intervention triggers/thresholds.

Low-level fires that occur outside the breeding season may act to fertilise aquatic ecosystems – benefit some amphibian species

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More information...

