CALL FOR EXPRESSION OF INTEREST FOR
ERP 23 – IGNITION LIKELIHOOD MODEL

Proposals due 22 February 2019 to office@bnhcrc.com.au

INTRODUCTION

The Bushfire and Natural Hazards Cooperative Research Centre (hereafter the CRC), in conjunction with the Department of Environment Land Water and Planning (Victoria) (DELWP) and the Country Fire Authority (CFA) is seeking expressions of interest for the following project.

Development of an improved ignition likelihood model for Victoria

PROJECT AIMS AND OBJECTIVES

The development of a robust method to model ignition likelihood and fire occurrence for a range of ignition cause classifications (I.e. natural, human accidental, human malicious, electrical, machinery, escaped fire and unknown) for the State of Victoria. This will be used for decision making purposes at planning stages:

      a.   strategic (years)

      b.   seasonal (months) and

      c.   readiness and response (weeks to days).

This model will primarily focus on Victoria, but wherever possible consideration will be given to potential application by other members of the Australian Fire and Emergency Services Authorities Council (AFAC).

BACKGROUND

Safer Together

1. In November 2015, the Victorian Government released the Safer Together policy platform, setting out the future direction for bushfire management in Victoria. Safer Together is part of broader government reform to Victoria's emergency management sector and sees land and fire management agencies working together, in partnership with local communities, to combine fire expertise with local knowledge.

2. A key pillar to Safer Together is science data and technology. The policy specifically states "we use the latest science, data and technology to make sure our actions are targeted at reducing bushfire risk and protecting those things we care about. It also notes under "what we do:" "Commission bushfire science research" (p. 9), "What we will do: continue to invest

in new science to address knowledge gaps and reduce uncertainties in our bushfire modelling." (p. 17) and "Risk is dynamic and constantly shifting, so we need to keep building on our evidence base. We will continue our investment in science, and in partnership with research institutions, to build knowledge of the relationship between fire and the environment and to better manage risk." (p. 18)

3. In May 2017, $23m was announced to fund a two-year Safer Together program. In part, these funds were allocated to ensuring that Victoria's significant investment in bushfire preparedness and response is supported by a systematic and ongoing investment in developing scientific evidence.

4. The implementation of Safer Together is improving the knowledge base by applying a systematic approach to understanding what some of the key sector knowledge gaps are, the resulting risks they may pose to the achievement of Safer Together objectives and determining how these risks can be mitigated by specific pieces of research.

5. Through being able to clearly articulate what existing research delivers, and where the priority knowledge gaps occur, the sector will be able to respond quickly and consistently in answering questions about resource requirements, in accessing external, collaborative or partnership opportunities, or in leveraging off existing programs.

6. Planning for bushfires and inter-agency cooperation has a long history within Victoria, and there is a strong foundation for new planning to build upon. With the introduction of *Safer Together* in 2015, additional emphasis has been placed on three key pillars: community first; land and fire agencies working together; and using science and technology to target actions to where the risk is.

7. The purpose of strategic bushfire management planning is to establish a shared understanding of risk across the sector, based upon the most up to date science available and the extensive knowledge that exists within our agencies.

CONTEXT

1. Providing a full picture of bushfire risk requires consideration of both the *likelihood* of bushfire events (the chance of events occurring) and the *consequence* of these events (the quantification of impacts on values).

2. The Department of Environment, Water, Land and Planning (DELWP) and the Country Fire Authority (CFA) systematically record reported fire ignitions and ignition causes. However, limited effort has been applied to optimise the capture of fire data and ignition cause to better understand ignition likelihood.

3. DELWP and CFA reported ignitions databases have been combined into a single dataset, known as the 'DELWP - CFA combined historical ignitions', which includes ignitions reported between the years 2000 and 2018.

4. The Safer Together program has shifted the approach to reducing the risk of bushfires from a hectare target for planned burns, to a risk reduction target for bushfire management. From 1 July 2016, DELWP's fuel management program on public land has been driven by a state-wide target to maintain bushfire risk at, or below, 70 per cent of Victoria's maximum bushfire risk. The method used to report on current bushfire risk levels (residual risk) considers only one weather scenario (worst case) and considers all

ignitions in a grid of simulated fires to be equally likely. The development of an ignition likelihood model will contribute to the enhancement of the residual risk calculation.

5. DELWP has recently explored a range of methods to model ignition likelihood and has incorporated the use of ignition probabilities and weather frequencies to provide a more complete picture of bushfire risk (Risk = Likelihood x Consequence) for Strategic Bushfire Management Plans.

6. CFA uses the Victorian Fire Risk Register – Bushfire (VFRR-B) – a systematic process that identifies assets at risk from bushfire using bushfire ignition frequencies, assesses the level of bushfire threat based on catastrophic fire weather conditions, and then enables the identification of risk to communities and critical infrastructure.

7. While various approaches to modelling ignition likelihood and bushfire occurrence are used by agencies in Victoria, these have not been evaluated for suitability in the Victorian bushfire risk management context.

8. This project will provide ignition likelihood models that will be used in conjunction with weather likelihood and outputs from Phoenix RapidFire (used for modelling 'consequence') to inform bushfire risk assessments for decision-making at strategic (multi-year), seasonal preparedness (annual) and readiness (sub-weekly) time scales.

9. A robust ignition likelihood model will provide the following benefits:

   o Investments in strategic interventions that are optimised to target the sources of bushfire risk

   o Establish an understanding of natural ignition likelihood in contrast to anthropogenic ignition likelihood to best target suitable risk reduction strategies

   o A more realistic representation of likelihood of ignitions than that provided by fire occurrence models based solely on reported fires.

   o A better understanding of the relationship between ignition likelihood and fire weather probability for different cause classifications which will enable the development of effective prevention strategies.

SCOPE	

INCLUSIONS	1. Establishment of, and liaison with a Project Reference Group that includes members from predictive services and risk/fire behaviour analysts within DELWP and CFA in Victoria and AFAC Predictive Services working groups. The Project Reference group will provide sector input and advice to the project enabling better design, integration and uptake of any model to meet the applied need of the project.
	
	2. Undertake a robust international and national environmental scan of bushfire ignition datasets and ignition models, providing a description and an assessment of the reviewed modelling approaches, and including advice on how Victorian processes perform in relation with international best practice. The environmental scan will enable the following specific questions to be addressed:
	
	   a. Identify and describe any exemplars of ignition datasets and ignition models
	
	   b. Describe how well, and in what way existing ignition models are able to effectively model ignitions
	
	   c. How appropriate are the methods currently used by Victorian fire agencies to capture reported ignitions of vegetation fire ignitions for modelling purposes
	
	   d. How appropriate, accurate and useful are the current methods used by Victorian fire agencies for modelling ignition likelihood and for supporting the strategic (years), seasonal (months) and readiness and response (sub-weekly) planning stages.
	
	3. In the context of the above, review the ignition cause classification scheme used in the existing 'DELWP - CFA combined historical ignitions dataset'. Recommend an ignition cause classification scheme and associated data standard that best enables use of the historical ignition data set to inform development of an ignition likelihood model. Consideration should be given to recommending a classification scheme with a level of granularity that will enable quantification of the effect of specific strategic actions in ignition probability from specific causes.
	
	4. Production of an initial report including a detailed statistical analysis of the DELWP - CFA combined ignitions dataset. The statistical analysis should identify and correct (where possible) any potential data issues, such as data outliers that may have an impact on the final ignition probability model, but which must also consider the value of outliers in the robustness of modelling. The report should evaluate data quality (e.g. identify data gaps or inconsistencies) and identify additional datasets required to complete the project objectives.

5. Workshop to discuss the findings of the literature review and the contents of the initial report and to refine and agree on the classification scheme with the project reference group.

6. Development of a tiered ignition probability model (to be refined and agreed with the Project Reference Group), including:

   a. Spatially explicit dynamic probability distribution of ignitions that ignite fuels and have potential to spread and require limited response

   b. Spatially explicit dynamic probability distribution of ignitions that ignite fuels and have potential to spread and require heavy or extended response

   c. Spatially explicit dynamic probability distribution of ignitions that have potential to ignite fuels, but do not spread and require no response [potential ignitions (e.g. controlled use of fire) or failed ignitions (e.g. lightning, powerlines arcing]

   d. Spatially explicit dynamic probability distribution of any ignitions, irrespective of their spread potential (combined probability from 6.a, 6.b and 6.c).

When developing the ignition probability model, consideration should be given to the following factors:

   a. Physical and non-physical predictive variables should be considered as part of the overall model development

   b. The model will be used to support bushfire risk management decision-making in strategic (years), seasonal (months) and readiness and response (sub-weekly) planning

   c. Ability for DELWP, CFA and other management agencies to: model (spatially and temporally), quantify, and compare the impact of specific strategic actions on ignition probability for ignition causes in line with the agreed classification scheme

   d. Inclusion of uncertainty as part of the modelling process

   e. Inclusion of temporal component in the ignition probability model. This will allow the model to be used for a range of strategic purposes, such as:

      i. Evolution of historical ignition probability and its relationship with a range of influencing factors such as land policy or demographic changes

      ii. Current ignition probability for use in readiness: ignition probability hot spots for the season/ week ahead

      iii. Future ignition probability: enabling modelling future ignition probability based on future scenario, such as demographic changes.

   f. Determination of fit for purpose spatial resolution

g. Spatial extent: the ignition probability model should cover the entire State of Victoria and will extend beyond the borders with New South Wales and South Australia to enable risk assessments of all ignitions that have the potential to impact Victorian values.

7. A technical guide document and technical support to implement the output model products for use in:
   a. Fire agency risk assessment processes at the strategic, preparedness and readiness planning levels
   b. Fire agency engagement with internal and external parties whose services or infrastructure are known sources of ignitions and involvement of these parties in shared mitigation strategies
   c. Evaluating the impact of ignition prevention strategies in reducing bushfire risk in Victoria.

8. A second workshop to present the ignition probability models developed in the project, with a focus on:
   a. Providing definitions, assumptions and limitations of the model
   b. Implementation of the models for fire agency risk assessment processes at the strategic, preparedness and readiness planning levels.

9. A final project report summarising findings which also makes recommendations/options for next steps, which may include:
   a. Future ignition cause classification scheme
   b. Utilisation of developed models in the risk assessment processes
   c. Future projects to develop the fire suppression index for the National Fire Danger Rating System Project (NFDRS), or incorporate findings into ignition modelling in the fire risk assessment process in bushfire simulators.

EXCLUSIONS

1. Review of overall risk assessment processes used by fire agencies in Victoria.

PROJECT SPECIFICATIONS

Key Steps

The following table details the key project requirements and indicative due dates to assist researchers in the preparation of their project proposal (EOI response).

Key Steps	Lead	Due Date
1. Project initiation, inception meeting and detailed project plan		March 2019
2. Establish Project Reference Group (PRG)		March 2019
3. Consultation with PRG on available data and data sharing agreements organised		April 2019
4. Environmental scan (international and national) of bushfire ignition datasets		August 2019
5. Review ignition cause classification scheme in DELWP-CFA combined historical ignitions dataset in the context of the environmental scan		October 2019
6. Recommend ignition cause classification scheme and data standard		November 2019
7. Initial report		December 2019
8. Workshop 1 – discuss findings and content of initial report		December 2019
9. Develop tiered ignition probability model		March 2020
10. Develop technical guide document and provide technical support to implement the output model products		May 2020
11. Workshop 2 – present ignition probability models		June 2020
12. Final report – including recommendations for next steps and an Evaluation Report		August 2020

Expected Outputs

1. Project plan

2. Environmental scan results (documents)

3. An initial report including:

   a. Statistical analysis of the 'DELWP-CFA combined historical ignitions dataset', including: identifying data issues, such as errors and bias in the data

   b. Quality assured DELWP-CFA combined ignitions dataset for ignition likelihood modelling purposes

   c. Recommended ignition cause classification scheme and associated data standard.

   d. Lists of additional datasets required to complete the project objectives.

4. A dynamic model that has relevant user inputs to allow scenario analysis to be performed, for ignition causes in line with agreed classification scheme (e.g.: natural, human accidental, human malicious, electrical, machinery, escaped fire and unknown) in the selected district/regional level and weather scenario. The model must provide:

    a. Spatially explicit dynamic probability distribution of ignitions that ignite fuels and have potential to spread and require limited response.

    b. Spatially explicit dynamic probability distribution of ignitions that ignite fuels and have potential to spread and require heavy or extended response.

    c. Spatially explicit dynamic probability distribution of ignitions that have potential to ignite fuels, but do not spread and require no response [potential ignitions (e.g. controlled use of fire) or failed ignitions (e.g. lightning, powerlines arcing].

    d. Spatially explicit dynamic probability distribution of any ignitions, irrespective of their spread potential (combined probability from 3.a, 3.b and 3.c).

5. A technical guide document and technical support to implement the output model products for use in:

    a. Fire agency risk assessment processes at the strategic, preparedness and readiness planning levels

    b. Fire agency engagement with internal and external parties whose services or infrastructure are known sources of ignitions and involvement of these parties in shared mitigation strategies

    c. Evaluating the impact of ignition prevention strategies in reducing bushfire risk in Victoria.

6. A final project report summarising findings which also makes recommendations/options for next steps.

Quality Control

Final report and other project outputs

It is the expectation of the Bushfire and Natural Hazards CRC and our clients DELWP and CFA that the material delivered as part of this project will meet the highest scientific standards and will be suitable for internal and external distribution.

It is a requirement of this project that the final report (and any supporting material) is 'submitted to the States' satisfaction'. To ensure the final report meets this expectation it will be subject to up to two rounds of review (with a minimum of two weeks for each review) by DELWP and CFA. Research organisations are required to ensure an internal peer review process is undertaken prior to the draft final report being submitted for DELWP and CFA consideration.

Before the report is final report is submitted to the State's representative for approval it must be peer reviewed, by an independent reviewer approved by the Bushfire and Natural Hazards CRC Project Manager, and professionally proof read and copy edited.

These steps must be arranged by the research organisation costed as part of project budget and completed within the project timeframe.

Reports that have not been independently peer reviewed and professionally proof read and copy edited will not be considered final. A copy of the independent peer review and the researcher response to any comments must be provided to the CRC.

Communication

To further assist with the quality assurance it is expected that:

- The project team will utilise a consultative approach when developing the overall framework and data management processes/criteria, and will demonstrate this by documenting engagement activities within the relevant reports. This will involve seeking input from DELWP and CFA subject matter experts to ensure development of a framework and processes that are fit for purpose.

- The research team leader will give periodic presentations (e.g. annually) to key stakeholder groups (Ecological Risk Assessment Working Group, Landscape Evaluators Working Group) to gain critical feedback on project milestones.

Any further quality control processes that are required for this piece of work, as well as key success measures, will be agreed with the DELWP and CFA Policy Lead as part of the planning process.

PROJECT MANAGEMENT AND PROCESSES

Contractual Arrangements

This project is being delivered under an Agreement in place between the Bushfire and Natural Hazards Cooperative Research Centre and the Department of Environment, Land Water and Planning (DELWP) in the State of Victoria. Under this Agreement the CRC is responsible for the delivery of a number of bushfire related research projects. The contract put in place between the CRC and the research organisation selected to undertake this work will reflect the terms of the Agreement between DELWP and the CRC.

A copy of the draft contract the CRC will provide to the successful research organisation is provided with this document. This contract should be reviewed as part of the EOI process. This is a standard agreement, and any changes will be at the sole discretion of the CRC. If you would like to request amendments to any of the terms and conditions set out in the proposed contract, details of the proposed changes and the reason the changes are requested must be included with the submitted response.

In considering this contract and proposing changes, please note that: (i) changes to provisions relating to the ownership of Intellectual Property will only be varied to take account of substantial in-kind contribution from the successful research organisation/s and (ii) no changes can be made to the publications approvals processes.

Project Governance

Each project is carried out under the supervision of a Project Control Board (PCB) and in accordance with the governance arrangements agreed between CRC and DELWP.

While the contractual relationship for the delivery of this project will be between the research organisation and the Bushfire and Natural Hazards CRC there will also be a strong relationship between the research team and DELWP/CFA staff. Communication is an important element of the success of this project and Researchers will be required to maintain strong links with both the DELWP and CFA Policy Leads and the CRC Project Manager throughout the project.

A governance plan has been prepared which shows the roles and responsibilities of each of the participants. The successful research team will be required to comply with the processes and expectations as set out in that document.

Project Planning

The project overview included in this document describes the way the DELWP and CFA subject matter experts believe the project can most successfully be undertaken. Alternative approaches can be considered. Any alternative approaches must ensure the delivery of the required outputs including any intermediate outputs identified in this document.

Following acceptance of a project proposal the successful research organisation must prepare a detailed project plan and risk treatment plan using the DELWP template. This plan must be approved by the DELWP and CFA Policy Leads and will become an attachment to the contract. The project plan must be approved within three months of the notification of the acceptance of the project proposal.

Reporting

The successful research organisation will be required to make at least one presentation (and possibly two) annually to the Project Control Board or other nominated DELWP/CFA group during the life of the project.

Research organisations will also be required to:

- provide a poster for the annual AFAC/BNHCRC conferences

- prepare quarterly progress reports, and

- contribute to the Project Evaluation Report.

Dates for submitting Quarterly Progress Reports are detailed in the table below.

Period covered	Report required
1 July to 30 September	24 October
1 October to 31 December	24 January following calendar year
1 January to 31 March	24 April
1 April to 30 June	24 July

SUBMISSION OF EXPRESSION OF INTEREST

Submission Requirements

Research teams responding to this Call for Expression of Interest are required to submit their response, including:

- A draft project proposal (4-6 pages) clearly addressing the requirements of the specifications set out in this document. Proposals must include achievable timelines, which will be used to monitor progress. A statement of capability demonstrating the ability of the proposed project team to undertake the work. This statement of capability should include the names and experience of key team members and their proposed contribution to the project. (The capability statement should not exceed 4 pages)

- Project budget including details of any in kind contribution from the research organisation. A statement of acceptance of the terms and conditions of the proposed contractual arrangements. If such arrangements are not acceptable details of any changes must be included with the submitted response.

Additional information

- Research bids from a consortium of research organisations with expertise in the relevant fields are specifically encouraged.

- Attached is a draft contract which we ask your organisation to review. In your response to the EOI you should identify any items in this contract that will require attention /amendment should your organisation be selected to undertake this piece of work. This contract is based on the Head Agreement between DELWP and the Bushfire and Natural Hazards CRC and as such there is very limited scope to make changes to the draft contract.

The total maximum budget for this project is $200,000 (excl GST) and all work must be completed by 31 August 2020.

Any research proposal once submitted will be treated as commercial in confidence.

Applications, must be submitted to: office@bnhcrc.com.au by 22 February 2019.

Evaluation Criteria

After the closing date the Bushfire and Natural Hazards CRC along with the DELWP and CFA Policy Leads will review proposals against the evaluation criteria below and make a recommendation to the State's representative on the most appropriate organisation to undertake this work. The evaluation criteria provide an indication of those matters that should be included in the project proposal and associated documentation. Details are provided below.

The decision of the BNHCRC and our client DELWP/CFA will be final. The BNHCRC reserves the right not to offer the work, or only allocate a proportion of the available funding, if a proposal does not meet the client's needs. The Project Control Board reserves the right to invite any other specific researchers as it sees fit to submit proposals before or after the due date.

Evaluation Criterion	% weighting
Research Capability The capacity and capability to deliver an excellent applied research project in a Victorian environment	15
Project Proposal A clear demonstration that the research team has an understanding of the project scope through the proposed research approach The proposal must also include an indicative timetable of work and interim milestones/project outputs as described in this document **Quality Control** Clear documentation of quality control processes including proposed internal and external reviewers. Identification of copy editors and proof readers	50
Industry Engagement Strong Track record of industry engagement with the ability to support and influence bushfire management in Victoria through interaction with land and fire agency personnel **Victorian Focus** Ability to undertake research in Victorian environments individually and/or in cooperation with land and fire managers	15
Value for Money Delivery of required outcome within available budget along with the ability to leverage the funds provided with in-kind contributions or supplementary opportunities The evaluation team will consider the membership of the project team and the proposed roles and time commitment	20

Attachments

1. Copy of the Governance Agreement
2. BNHCRC subcontract including project plan template and evaluation report template
3. Quarterly report template
4. DELWP report template.