

# Climate Change Adaptation Research Grants Program

## - Emergency Management Projects

### **Project title:**

Exploring the adaptive capacity of emergency management using agent-based modelling.

**Principal investigators:** Professor Lin Padgham

**Lead organisation:** RMIT University

### **Objectives:**

To further explore, in close collaboration with the City of Port Phillip (CoPP) and end-users from across the Prevention, Preparedness, Response, Recovery (PPRR) spectrum:

1. the use of agent-based modelling to support an understanding of the emergency management sector's capacity to support PPRR under a changing climate, and
2. to support informed decision making about policy and governance issues for adapting to the changing climate.

(see **Emergency Management Project** “*Agent based simulation framework for improved understanding and enhancement of community and organisational resilience to extreme events*” by Lin Padgham, RMIT University at [www.nccarf.edu.au](http://www.nccarf.edu.au) for further information)

### **Project design and methods:**

The key aspect of the project design is a very close relationship between the social science and computer science team members, combined with detailed interactions with emergency management sector players and those involved with planning and capacity building related to climate change adaptation. The project will explore specific aspects of the use of agent based modelling in understanding capacity related issues of substantial concern within the sector. We will be working very closely with City of Port Phillip staff to identify questions of concern for their climate change adaptation program, regarding intensive storm and flood events requiring emergency management, under a variety of potential scenarios. In our modelling we will be using both primary and secondary data. Initially we will work with CoPP to review their existing data on such things as hydrologic modelling and flood mapping of the stormwater drainage system for the catchments within CoPP's boundaries, to assess how this can be used, and identify any additional data needs. We aim to use existing data and resources to the greatest extent possible. We will then review with CoPP personnel their current or proposed plans regarding what they expect communities and emergency services to do, and assess how these can be incorporated into the model to facilitate interaction and exploration of relevant issues. At this point we will also identify any additional required data and make plans to obtain this. Finally, guided by CoPP needs and existing plans we will use workshops and focus groups with communities and other stakeholders in the CoPP to identify behavioural drivers and reveal potential drivers of vulnerability to flooding and storm surge. In order to identify community behaviour for modelling, as well as capacity building needs, we will collect primary data surrounding:

- *What actually Happened during past events and why?*
- *What would/could communities do differently?*
- *What would be desired behaviour under different scenarios?*
- *What would communities need in order to achieve the most desired behaviour?*

The simulation model resulting from this work will then be demonstrated and discussed in relevant focus groups, in order to understand and implement the refinements required in order for it to be successfully used. This will be an iterative process.

We will also be continuing to work with the Community Fire Authority (CFA) building on initial work done with them, to understand how this work can be generalised to meet specific needs, as well as exploring any additional aspects regarding what is required in *order* for the ABM approach to have impact and provide value across the sector. We will conduct one or more workshops with people from

CFA, DSE and the Fire Commissioner to explore the particulars of what would be required to take the existing prototype to something which is fully usable for specific aspects of bushfire evacuation planning. We will focus in particular on what information needs to be modifiable by end users, as well as what kinds of visualisation or data are required in order for the tool to be useful.

The technical team will bring their expertise to bear on finding and developing leading edge solutions to address those issues which are identified by stakeholders as being of key importance. We already know that one key factor is to facilitate the ability for the different sub-groups to bring to the table their particular knowledge, expertise, and possibly tools, without having to change these to fit someone else's model - whether it be that of tool developers, or that of other stakeholder groups. It is essential to be able to build on and reuse existing domain expertise. One of the technical pieces of work will be to continue to explore the technical basis for realisation of this objective.

An additional issue which we have already identified as important to stakeholders is the ability to both understand and manipulate the assumptions underlying the model. While we know from preliminary interactions that this is important as an abstract principle, we need to work with end-users to understand more precisely what is of value to them, and how to realise this technically in a principled manner. We will again balance the focus on specific projects, working with the CFA and CoPP, with the demonstration and discussion of these with broader stakeholder groups in order to generalise and extend (in order to then document) the understanding developed.

Working closely with CoPP as well as CFA contacts and a broader stakeholder group, we will identify some specific scenarios, based around extreme weather events, for exploration with respect to adaptive capacity. We will also work with the relevant groups to understand and model their processes and current capacity. We will then implement these in a prototype system, combining the module with identified extreme scenarios and the module(s) capturing current capacity and processes. Following this we will work with the end users to understand and develop the interface they require to use and to trust the application for exploring additional scenarios. We will also obtain broader input at this stage from the wider stakeholder community. We will arrange a workshop with a diverse range of emergency management personnel from across different sectors, different levels of government, and if possible different states, to present and discuss the outcomes of the project as well as potential for wider use of this technology. We will work with NCCARF closer to the time, to determine the location of the workshop as well as potential invitees.

The workshop will be a half to one day event, where we aim to do the following:

- 1) Present (a) the 2 specific ABM projects, and (b) our findings regarding use and applicability of ABM for emergency management planning and capacity assessment.
- 2) Presentation by CoPP and CFA users regarding their view of ABM and its usefulness, plus the process of working with IT people in developing the tools.
- 3) Participants brainstorm in small groups, followed by plenary about potential applications of ABM to their fields, as well as potential barriers.
- 4) Feedback on our applicability conclusions for addition into the final document.
- 5) Discussion about any further potential projects and how to pursue those.

We will book a meeting room at a location determined as most convenient for key stakeholders. Catering will be provided.

Finally we will document our findings about how ABM can be used to aid in analysing capacity under a broad range of possible future scenarios, and the requirements in terms of transparency and ability to modify assumptions that is required if such systems are to be usable and have impact within the sector. We will place both reports and software on a web page for download by interested parties.