Assessing the Multi-hazard Vulnerability of Animal Emergency Safe Places in the Hunter Region, NSW, Australia

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Research Problem Statement

The incidences of bushfires and floods have been increasingly recognised as significant hazards to communities globally (El Hadj et al., 2023; Liu et al., 2010). In Australia, bushfires and floods have been recognised as among the most frequently occurring hazards, resulting in losses worth millions of dollars (CSIRO, 2021; Disaster Assist, 2023). While it is difficult to affirm from the literature whether floods or bushfires dominate as causes for animal evacuations, both of these natural hazards require proper preparation for evacuation plans for animals and people within their affected regions (Ogunmakinde, 2022). Bushfires and floods do not have the same triggers, but they can occur consecutively, resulting in more damage. Consecutive and concurrent hazard events heighten the pressure on communities that are exposed and vulnerable because each hazard that follows increases the level of damage from the previous hazard event (Royal Commission into National Natural Disaster Arrangements, 2020a). For example, the Blue Mountains and Gospers Mountain Bushfires of 2019/2020 were put out by the heavy rainfall in 2020 that caused flash floods that led to more destructions (Clifford, 2022; Filkov et al., 2020; Richards et al., 2020). When bushfires and floods occur consecutively before a community recovers from the impact of the first hazard, i.e., bushfires, the scale of damage increases and complicates the response of emergency services.

In Australia, human lives are often given priority in emergency situations, and adequate preparation has been made in that regard. Evidence of this is the identification of formal human evacuation centres in the emergency management plans of most local councils (Royal Commission into National Natural Disaster Arrangements, 2020b). However, this is not the case for animals, as it is assumed they will be catered for by their owners (Egbelakin et al., 2022). Several challenges have been attributed to the evacuation of animals in disasters, which could hinder successful rescue and evacuation operations. One major challenge is the lack of comprehensive emergency plans and protocols that specifically address the needs of animals, how to transport them safely, and how to reunite them with their owners, including where to evacuate them (Heath & Linnabary, 2015). Discussion on the selection of emergency safe places that serve as animal evacuation centres has been increased by the frequent occurrences of natural hazards (Kako et al., 2022).

Currently, there are some places that are being used as animal emergency safe places, such as showgrounds, animal saleyards, racecourses, and animal shelters/facilities (Ogunmakinde et al., 2022). Previous experience with disasters in NSW has shown that some of these facilities could be vulnerable to disasters such as flooding and bushfires. For instance, East Gresford showground, Morisset showground, and Taree showground were flooded in 2015, 2020, and 2021, respectively (Driscoll, 2021; Egbelakin et al., 2022). When the Taree showground was flooded in 2021, Taree Saleyard was not (Cross et al., 2022). In 2022, Taree Saleyard made the list of animal-safe places. Some of these places, even if not impacted by flooding and bushfires, might be restricted due to the access roads being inundated by floods or bushfires because of their location (Douglas, 2021; Royal Commission into National Natural Disaster Arrangements, 2020b). Also, some of these places, which might be unusable as animal emergency safe places during flooding, could be useful in the event of a bushfire (Royal Commission into National Natural Disaster Arrangements, 2020b). Therefore, to identify the animal emergency safe places that would be usable during either bushfire, flood, or even both, it is necessary to assess the multi-hazard vulnerability of these places to bushfire and flooding.

This study aims to develop a framework to assess how physical characteristics and environmental parameters influence the multi-hazard vulnerability of animal emergency safe places in the Hunter Region, New South Wales, Australia. This will assist in adequately preparing for the evacuation of livestock animals during disaster emergencies.

Brief Research Methodology and Approach

This study was embarked on in response to the recommendations by the Australian 2020 Royal Commission into National Natural Disaster Arrangements' report at the national level, which was also supported at the State level by the Final Report of the NSW Bushfire Inquiry (Owens & O'Kane, 2020; Royal Commission into National Natural Disaster Arrangements, 2020b). Both established the need for the states and regions to provide animal emergency safe places. And following that publication, Egbelakin et al. (2022) found out that there is a need to conduct vulnerability assessments.

Research Methods

The study participants will include experts in disaster management, which includes geoscientists, disaster/crisis managers, hydrologists, spatial planners, environmental protection officers, geomorphologists, remote sensing experts, engineers, risk managers,

coastal engineers, climate change scientists, flood-hazard analysts, and flood risk managers (Allafta & Opp, 2021; Cabrera & Lee, 2019; Dash & Sar, 2020; Ljubomir Gigović et al., 2017; Ljubomir et al., 2019; Rehman et al., 2022). These study participants will be drawn from relevant government and non-government organisations such as local councils, local land services, emergency management agencies such as state emergency services, federal fire service, rural fire service, and other relevant organisations and people with emergency management experience.

Purposive and snowball sampling, which are non-probability sampling methods, will be employed in this study to select the participants. Purposive sampling method involves choosing participants based on specific criteria (Saunders et al., 2023). This will be employed to select the first set of participants, and other participants will be selected using the snowball sampling method. Snowball sampling method involves choosing participants based on recommendations from other participants (Cretois et al., 2020). Firstly, relevant vulnerability parameters for examining the vulnerability of animal emergency safe places will be identified from the literature. Then a survey, which will involve the use of a questionnaire, will be done to determine the weight of the vulnerability parameters in the Hunter Region.

The survey will entail asking the research participants (experts involved in disaster management) to rate the influence of the vulnerability parameters (physical characteristics and environmental parameters) in determining the susceptibility of animal emergency safe locations to bushfires and flooding. The rating will be done using a scale of 1–9, with a lower number (1) indicating lower importance and a higher number (9) indicating greater importance of that particular factor over another (Allafta & Opp, 2021; Goepel, 2013; Skilodimou et al., 2019). The data obtained using the questionnaire will be analysed using the analytical hierarchy process (AHP). The AHP will calculate the weights of the physical characteristics and environmental parameters in terms of their contribution to the vulnerability of animal emergency safe places. These weights will be required in the spatial analysis and modelling on the Geographic Information System (GIS) to produce the Hazard Vulnerability Maps and compute the Physical Vulnerability Index (PVI) of the animal emergency safe places.

Next, a field study in which a rapid visual screening (RVS) of the identified animal emergency safe places will be done. The RVS will employ an RVS form during the visit to each study site to assess the vulnerability of the 25 animal emergency safe places using their

physical characteristics. The data obtained from the RVS will be analysed using the weights obtained from the AHP to compute the PVI. To obtain the PVI, the physical characteristics of each emergency animal-safe place will be scored based on the observations from the rapid visual screening. Then, the weighted linear combination method will be employed to compute the PVI using the scores from the field survey, and the weights obtained through the AHP (Papathoma-Köhle et al., 2022). The number of research participants usually employed in collecting data using questionnaires to be analysed using AHP is not specified in the literature. Several studies used between 4 and 12 participants (Cabrera & Lee, 2019, 2020; Dash & Sar, 2020; Gigović et al., 2018; Gigović et al., 2017; Hadipour et al., 2020; Ljubomir et al., 2019). This study will adopt a sample of 12 participants.

Then, the results obtained from the analysed data will be integrated to develop a multi-hazard vulnerability assessment framework. This framework would be validated using subject matter experts (SMEs). Five SMEs will be interviewed in person, either physically or through an online platform such as Microsoft teams, Zoom, Google meet, etc., using a different sample of the population (described earlier) to validate the research findings.

Expected contribution of the study

This study is necessary to improve animal safety during disasters because of the current increase in the vulnerability of the Hunter Region and the need for evacuation to safe places due to natural disasters such as bushfires and flooding. Hence, there is a need to develop a framework for assessing the multi-hazard vulnerability of locations currently being used as animal emergency safe places in the Hunter Region, NSW, Australia, to adequately prepare for the evacuation of livestock animals during disaster emergencies. The Framework will contribute to improving pre-disaster planning, response, and recovery in the livestock sector and empower local farmers to improve resilience towards bushfire planning and flooding response.

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