A mixed integer program for capacitated asset protection during escaped wildfire

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Abstract

Despite worthwhile efforts to implement wildfire prevention programmes, Australia is still suffering the impacts of wildfire due to human activities and climate change. Wildfire is a common natural phenomenon in many parts of world such as Australia, USA, Canada, New Zealand and South Africa in which communities and assets are impacted and destructed. In the past few years, many scholars focused on proposing evacuation plans (Haynes et al. 2010), (Shahparvari et al. 2016) and studied asset protection operations during wildfire (Roozbeh et al. 2018). Due to the complexity of the problem and operational challenges that incident management teams are dealing with, finding more effective solutions still needs further investigation. To this end, we formulated a model aimed at protecting as many assets as possible during an escaped wildfire. The model is a mixed integer linear programming model that determines the optimal set of routes for fleets of protection vehicles during wildfire subject to various constraints such as time windows, vehicle synchronisation and the capacity of vehicles to make it closer to real life operation. We also considered the possibility of refilling during the tour once vehicles can not fulfil the expected demand. This feature enables vehicles to accomplish more tasks in a single trip, rather than returning back to the depot to refuel. The computational results suggest that the proposed model will be a useful decision-aid incident managers.

Keywords: asset protection, wildfire, VRP

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