Testing the performance of Australian grassland and forest fire spread models

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Introduction

The evaluation of bushfire model performance over a suite of environmental and weather conditions is often a neglected component of bushfire behaviour research. Understanding the predictive capabilities and limits of bushfire behaviour prediction models is a critical aspect in designing bushfire policy. This study evaluates the performance of bushfire rate of spread models (ROS) in eucalypt forests and grasslands in Australia.

Study design

The models that were tested include the McArthur grass and forest models, CSIRO grassland model and the Vesta forest models. Observed rate of spread, weather and fuel characteristic data were compiled for over 900 observation points, but after a stringent quality control procedure 370 observation points were used to enable the statistical validation. A fuel moisture lag time of 2 hours was applied for all forest cases.

Results & Discussion

Findings from this study demonstrated that the Vesta model outperformed the McArthur forest model (Figure 1, 2). CSIRO grassland model was better than the two McArthur grassland models (Figure 3). The key issues identified in this research are that a) poor predictions in moisture content can provide gross uncertainties of ROS, and b) the predicted increase in ROS with decrease in moisture content needs verification under very dry conditions.

From the standpoint of practical application; extrapolation beyond the bounds of the moisture model or the fire spread model increases uncertainty, and spreadsheets, computer applications and other decision support aids should be limited to the validation bounds of the model.

End user statement

This research is valuable because it improves our understanding of how different bushfire rate of spread models perform in predicting fire behaviour across a range of fuel types and weather conditions. Improved bushfire behaviour predictions will improve our ability to establish appropriate levels of resources, coordinate response and better inform communities.

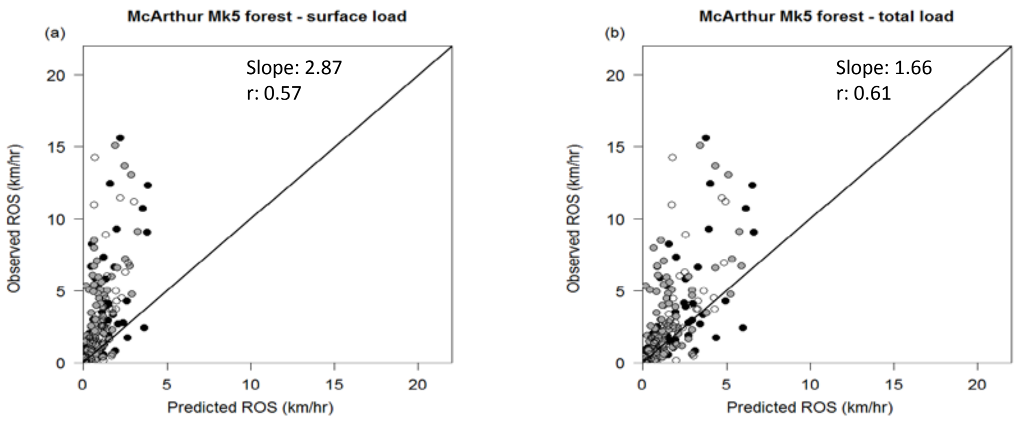

Figure 1. Predicted versus observed rate of spread for three versions of the McArthur Mk 5 forest model, shaded according to data reliability, with black filled circles corresponding to a weighting greater or equal to 0.85, grey filled circles corresponding to a weighting less than 0.85 and greater or equal to 0.80, and open circles corresponding to a weighting less than 0.80.

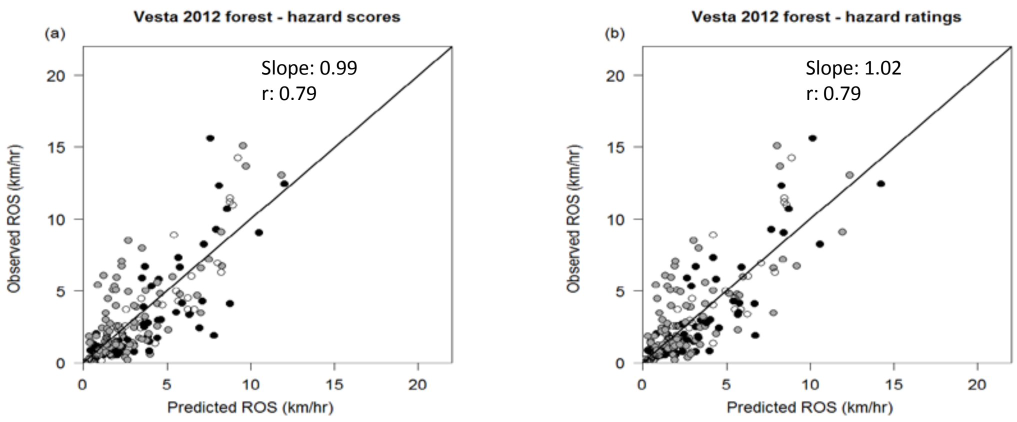

Figure 2. Predicted versus observed rate of spread for the Vesta forest models, where for a) and b) moisture content is estimated as in Matthews *et al.* (2010). Shading is according to data reliability, with black filled circles corresponding to a weighting greater or equal to 0.85, grey filled circles corresponding to a weighting less than 0.85 and greater or equal to 0.80, and open circles corresponding to a weighting less than 0.80.

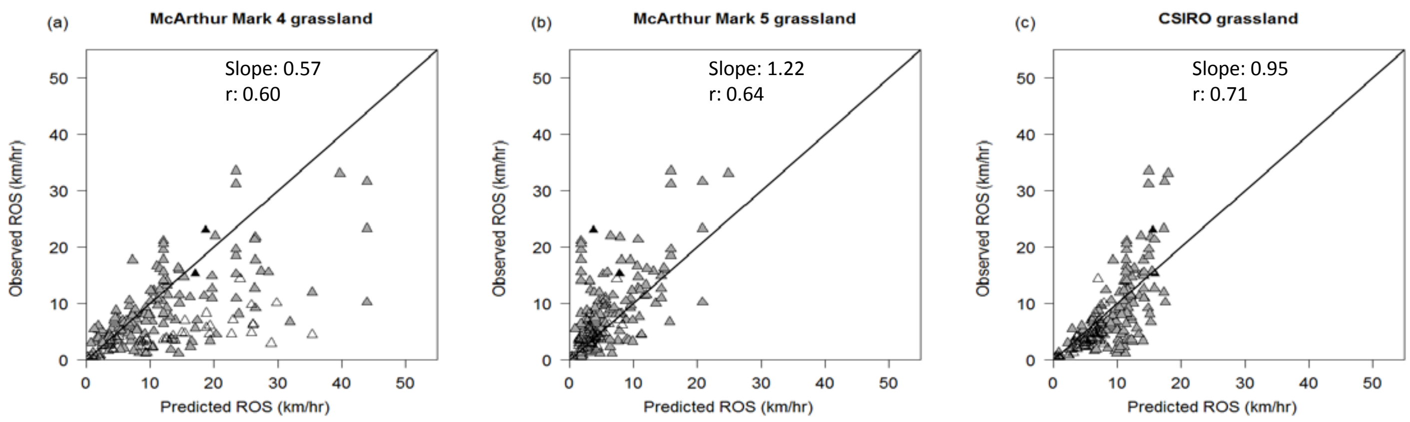

Figure 3. Predicted versus observed rate of spread for the grassland models, shaded according to grass conditions, with black filled triangles corresponding to natural grassland, grey filled triangles corresponding to grazed grassland, and open triangles corresponding to eaten out grassland.

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