10.1071/WF24104
International Journal of Wildland Fire

Supplementary Material

A comparative analysis of wildfire initial attack containment objectives and modelling strategies in Ontario, Canada

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Supplementary material S1: Summary of logistic regression models for each of the eight IA success definitions

Table S1. Logistic regression model summaries for all eight IA success definitions presented in the main text. Coefficient and standard error represent the mean value for the bootstrapped iterations. All models except the final size of 2 ha used n = 20,096 observations used to fit the models, and the final size 2 ha model used n = 19,429 observations. The following proportion of IA success fires are classified in each model: time or size (98%); final size 4 ha (97%); 2 ha growth (96%); BHE 1900 (95%); final size 2 ha (94%); BHE 1300 (92%); 20% growth (81%); zero growth (79%).

Model	Covariate	Coefficient	Standard error	*p*-value
Time or size	Intercept	3.69	0.11	< 0.001
	ISI	-0.09	0.13	< 0.001
	Fire size at IA	-3.18	0.01	< 0.001
Final size 4 ha	Intercept	3.15	0.11	< 0.001
	ISI	-0.10	0.13	< 0.001
	Fire size at IA	-3.67	0.01	< 0.001
2 ha growth	Intercept	3.34	0.08	< 0.001
	ISI	-0.14	0.05	< 0.001
	Fire size at IA	-2.22	0.01	< 0.001
BHE 1900	Intercept	2.20	0.07	< 0.001
	Polynomial ISI (1)	0.02	0.02	0.11
	Polynomial ISI (2)	-0.001	0.001	0.15
	Fire size at IA	-1.95	0.05	< 0.001

Final size 2 ha	Intercept	5.47	0.11	< 0.001
	ISI	-0.11	0.06	< 0.001
	Fire size at IA	-2.62	0.01	< 0.001
BHE 1300	Intercept	1.79	0.06	< 0.001
	Polynomial ISI (1)	-0.004	0.01	0.79
	Polynomial ISI (2)	-0.0002	0.001	0.66
	Fire size at IA	-2.03	0.04	< 0.001
20% growth	Intercept	2.88	0.01	< 0.001
	ISI	-0.08	0.01	< 0.001
	Fire size at IA	-1.85	0.01	< 0.001
Zero growth	Intercept	2.95	0.04	< 0.001
	ISI	-0.08	0.04	< 0.001
	Fire size at IA	-2.22	0.01	< 0.001

Note: Abbreviations are: Initial Spread Index (ISI); initial attack (IA); being-held (BHE). The log transformation (log base 10) of fire size at IA was used for all models. A second order polynomial ISI was used for modelling for both the BHE by 1900 and BHE by 1300 definitions.

Supplementary material S2. Summary of model prediction metrics for models developed on a balanced training dataset

Table S2. Summary of model prediction metrics for each combination of initial attack (IA) success definition (n=8) and modelling method (n=3). Models were developed using a balanced training dataset derived from oversampling the minority class (i.e., IA escapes) using the 'SMOTE' package in R.

Modelling method	Metric	Time or size	Final size 4 ha	2 ha growth	BHE[c] 1900	Final size 2 ha	BHE 1300	20% growth	Zero growth
Logistic regression	AUC[a] (train)	0.90	0.92	0.92	0.83	0.90	0.82	0.76	0.79
	AUC (test)	0.94	0.95	0.90	0.84	0.96	0.77	0.76	0.79
	Accuracy	0.77	0.88	0.86	0.83	0.81	0.80	0.67	0.71
	Brier Score	0.14	0.11	0.11	0.14	0.10	0.15	0.19	0.17
	Sensitivity	0.77	0.87	0.87	0.84	0.79	0.80	0.64	0.70
	Specificity	0.90	0.91	0.82	0.72	0.95	0.70	0.78	0.75
Bagged classification trees	OOB MSE (%)[b]	9.08	10.8	11.7	20.15	12.16	22.44	30.61	29.65
	AUC (train)	1.00	1.00	1.00	0.99	0.99	0.99	0.99	0.99
	AUC (test)	0.87	0.90	0.83	0.74	0.91	0.72	0.66	0.70
	Accuracy	0.88	0.88	0.86	0.78	0.87	0.75	0.65	0.68
	Brier score	0.09	0.09	0.10	0.15	0.10	0.18	0.26	0.24
	Sensitivity	0.67	0.89	0.87	0.80	0.88	0.77	0.68	0.71
	Specificity	0.89	0.73	0.61	0.53	0.81	0.56	0.52	0.55
Random forest	OOB MSE (%)[b]	6.91	7.89	8.97	16.68	9.23	18.43	27.68	26.01

AUC (train)	0.99	0.99	0.99	0.94	0.98	0.92	0.85	0.87
AUC (test)	0.91	0.92	0.87	0.83	0.95	0.81	0.73	0.76
Accuracy	0.92	0.92	0.90	0.88	0.92	0.87	0.75	0.76
Brier score	0.08	0.07	0.08	0.08	0.08	0.11	0.22	0.19
Sensitivity	0.93	0.93	0.91	0.91	0.92	0.90	0.82	0.84
Specificity	0.75	0.79	0.67	0.58	0.88	0.56	0.46	0.47

Note. Abbreviations used are: Abbreviations used are: [a]Area under the Receiver Operating Characteristic Curve (AUC); [b]Out Of Bag Mean Squared Error (OOB MSE); [c]Being Held (BHE)