Appendix S1: Reproductive maturity drives persistence of an endangered obligate seeder under future fire regimes irrespective of climate change, while targeted reseeding may enhance recovery

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Table 1: Major fire years (>30,000 ha burned) within the study area between 1990 and 2022. The study landscape covers 2.9 million ha across Victoria, New South Wales, and the Australian Capital Territory. Fire history records for Victoria obtained from Department of Energy, Environment and Climate Action (2025) and records for NSW and ACT obtained from the NSW Department of Climate Change, Energy, the Environment and Water (2025)

Year	Area burned (ha)
1998	39,919
2003	2,606,345
2007	634,198
2009	98,687
2013	56,000
2019	88,340
2020	1,168,900

References

Department of Energy, Environment and Climate Action, 2025. Fire history records of fires across Victoria. https://discover.data.vic.gov.au/dataset/fire-history-records-of-fires-across-victoria.

NSW Department of Climate Change, Energy, the Environment and Water, 2025. NPWS Fire History – Wildfires and Prescribed Burns. NSW Government SEED Platform.

Table 2: Description of the landscape metrics used in analysis.

Scale	Metric	Description
Landscape	Contagion	Measure of how clumped or dispersed different cover types are within a landscape. Higher values indicate a higher degree of clumping, lower values indicate more class dispersion
	Edge density	Sum of the length of all patch edges divided by the total landscape area (m/ha)
	Largest patch index	Percentage of the landscape covered by the largest patch of one class
	Mean Euclidean nearest neighbour	Mean edge-to-edge distance between a patch of one class to the nearest patch of the same class (m)
Class	Mean patch area	Mean area of the discrete patches of the same class within the landscape boundary (ha)
	Standard deviation of patch area	Standard deviation of the area of discrete patches of the same class within the landscape boundary (ha)
	Number of patches	Count of discrete, contiguous areas belonging to one class

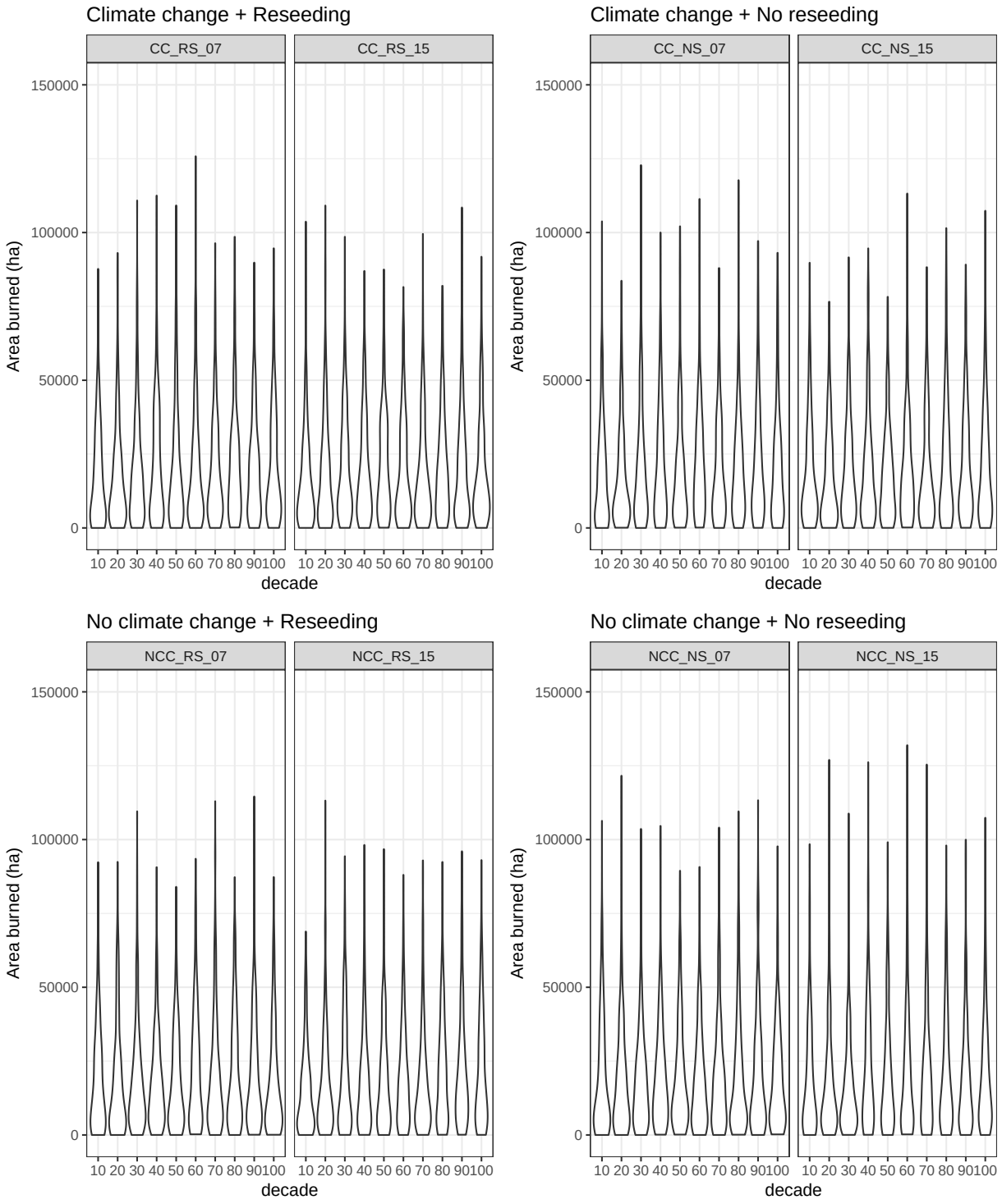

Fig. 1 Violin plot showing decadal area burned for the the primary scenarios evaluated in the study. CC = climate change, NCC = no climate change, RS = reseeding, NS = no reseeding, 07 = reproductive maturity at 7 years, 15 = reproductive maturity at 15 years

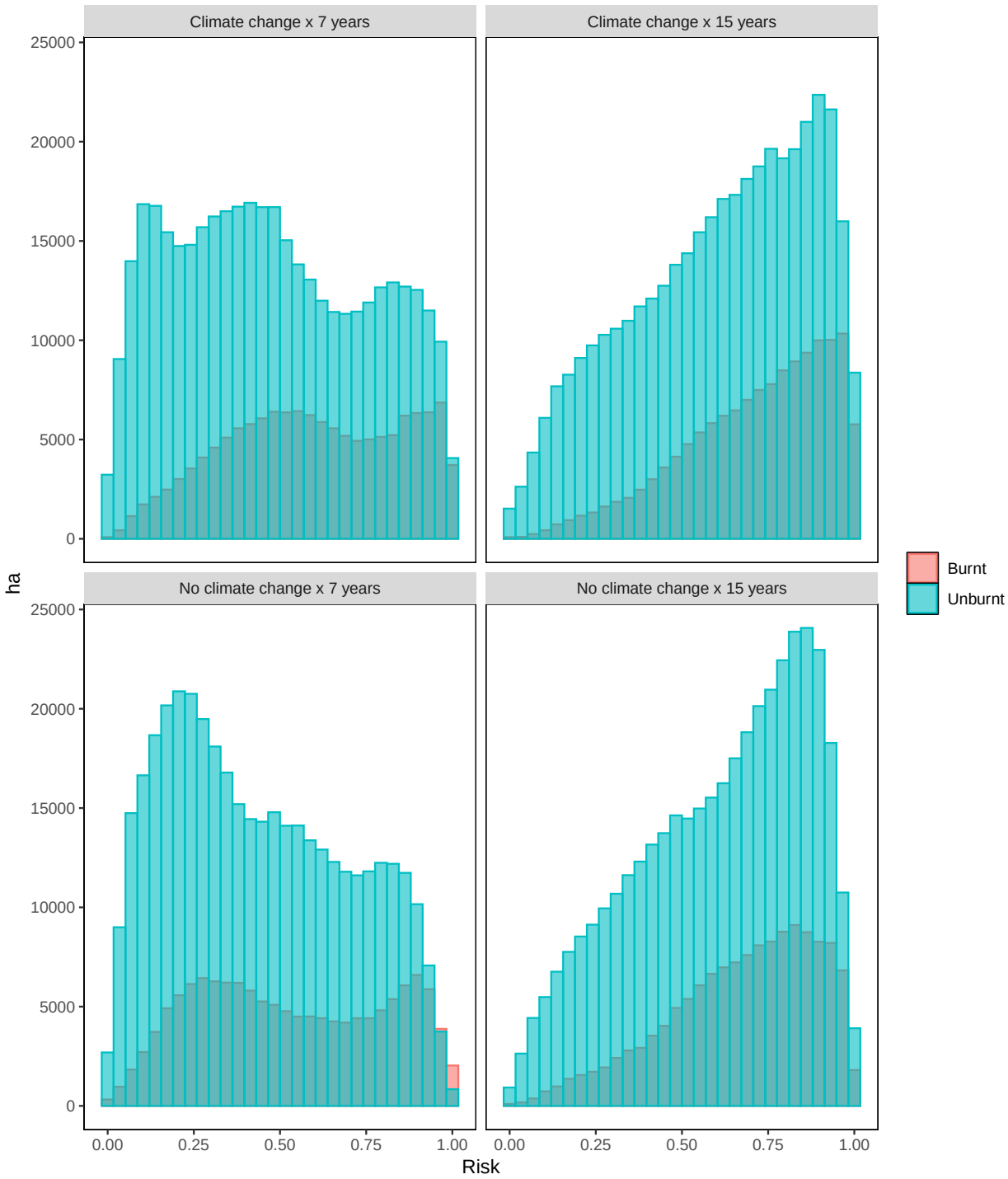

Fig. 2 Distributions of vulnerability scores of stands that burned and did not burn in the 2019/2020 fire season at time step 100.

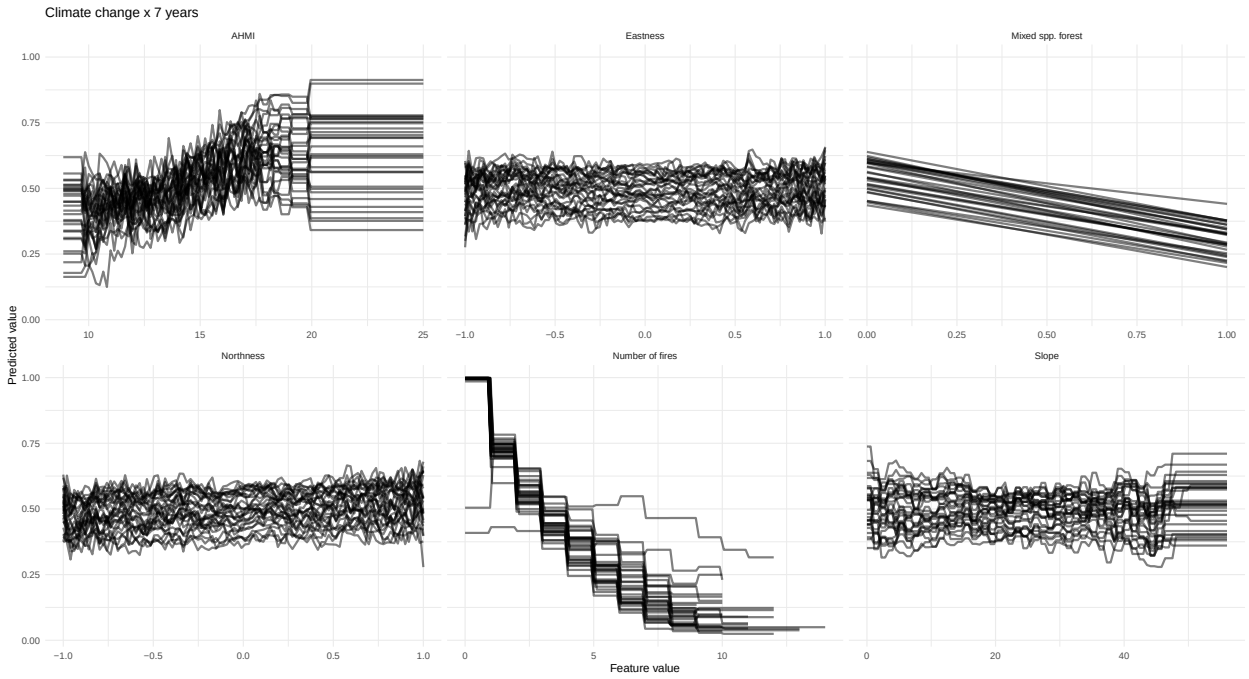

Fig. 3 Partial dependence plots for the variables included in the GBM analysis of the "climate change/reproductive maturity at 7 years" scenario. Each black line represents one replicate of the scenario

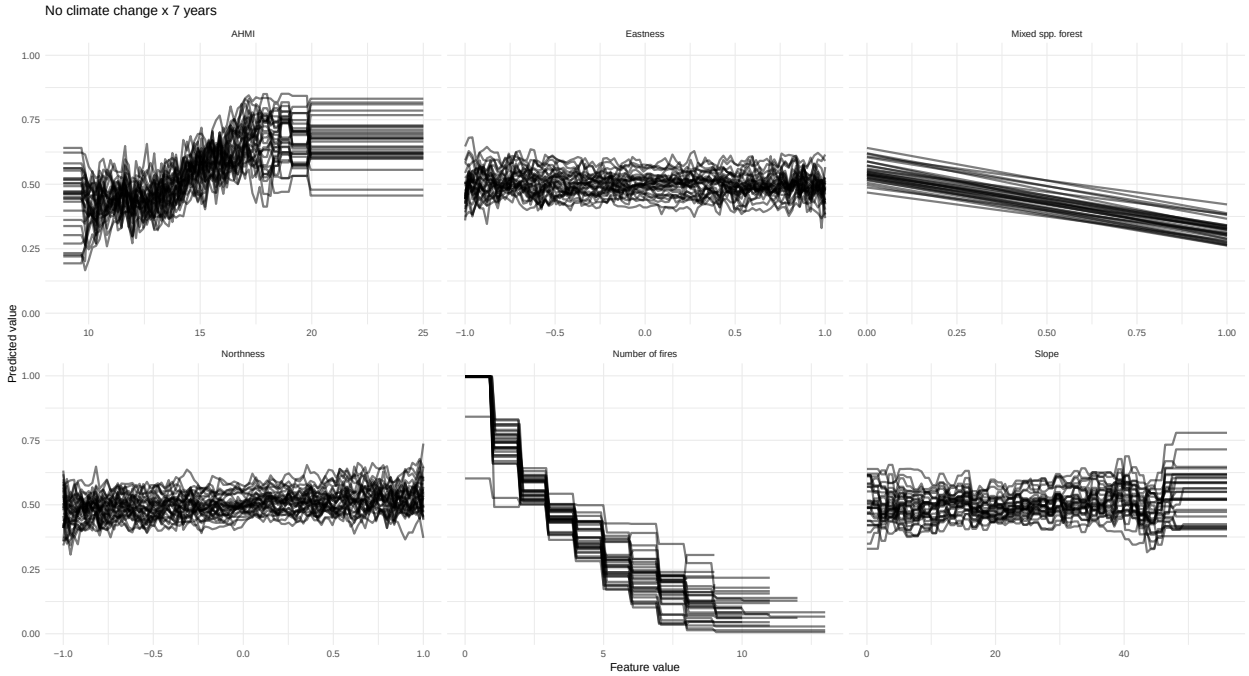

Fig. 4 Partial dependence plots for the variables included in the GBM analysis of the "no climate change/reproductive maturity at 7 years" scenario. Each black line represents one replicate of the scenario

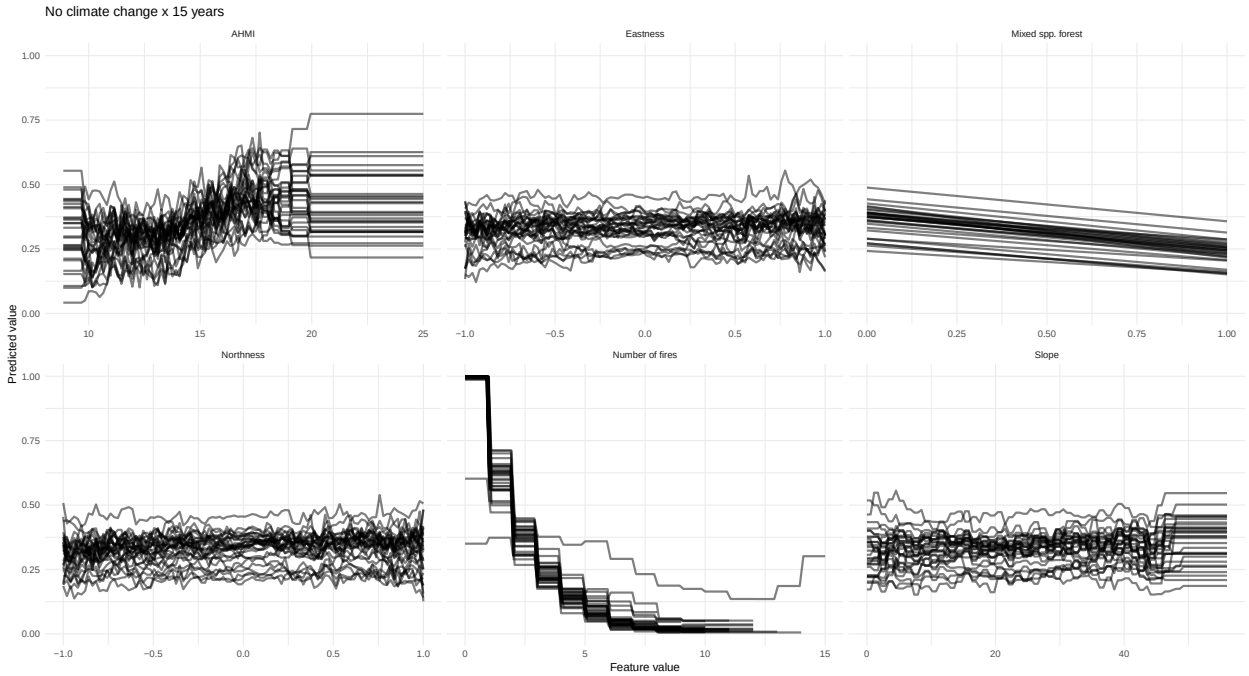

Fig. 5 Partial dependence plots for the variables included in the GBM analysis of the "no climate change/reproductive maturity at 15 years" scenario. Each black line represents one replicate of the scenario

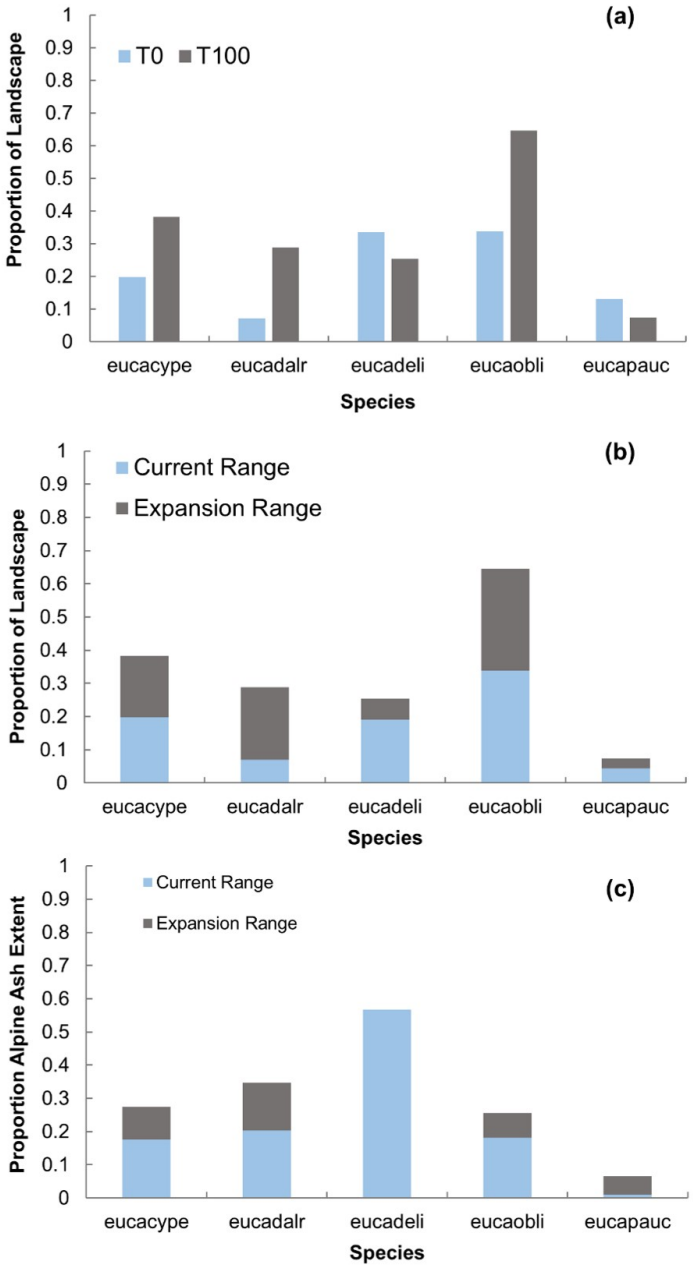

Fig. 6 Bar plots showing change in species occupancy across the Victorian portion of the simulated landscape after 100 years under climate change with no sowing. Species occurrence is based on areas of the landscape where a species occurred at time 100 across all replicates. (a) Proportion of the total simulation landscape where occupancy was maintained for five eucalypt species at the beginning and end of all replicated simulations. (b) Proportion of the landscape occupied by each species, with bars colour-coded to distinguish the proportion initially occupied and the additional area expanded into during the simulation. (c) Proportion of the alpine ash range initially occupied by each species and the additional area colonised within the alpine ash range over the course of the simulation. Species: eucacype = *E. cypellocarpa*, eucadalr = *E. dalrympleana*, eucadeli = *E. delegatensis*, eucaobli = *E. obliqua*, eucapauc = *E. pauciflora*.

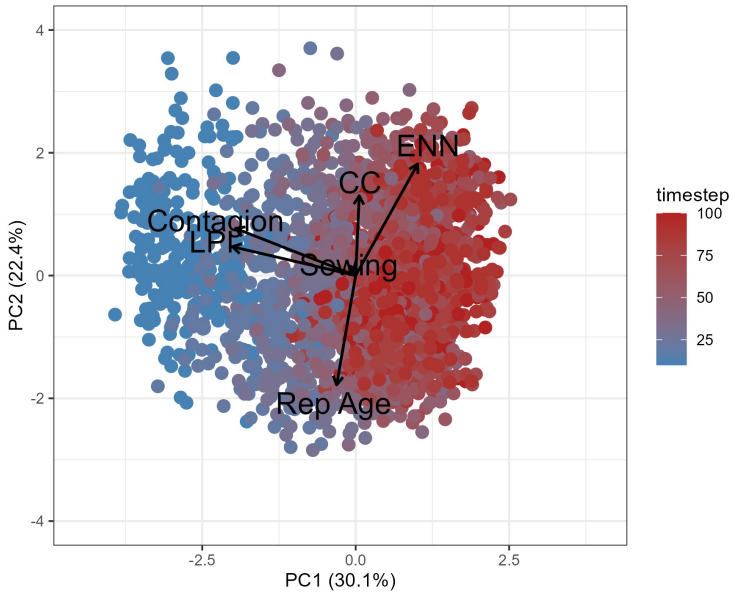

Fig. 7 Principal Component Analysis (PCA) of time, landscape metrics and scenario parameters. The PCA incorporates three landscape metrics—mean Euclidean nearest neighbor distance (ENN), Contagion, and Largest Patch Index (LPI)—and three scenario parameters: climate change (CC), aerial resowing (Sowing), and reproductive age (Rep Age). Points represent simulation outcomes at different timesteps, with color indicating the simulation progression. Arrows show the contribution of each variable to the principal components. The PCA shows that ENN increases over time but also with climate change and is higher in the 7 year reproductive age scenario. Contagion and LPI decrease with time and increase slightly with climate change and decreasing reproductive age.