

**Appendix S1.** Bird and invertebrate fauna, and principal plant species in shrubland (S), intermediate (I) and grassland (G) blocks at our three sites. (a) Numbers of observations of the 22 bird species, observed on three mornings along transects; (b) and (c) Number of grids (out of 10) in which an invertebrate order or beetle family was captured (we treated subclasses Oligochaeta and family Platyhelminthes as orders, and subclass Formicidae and remaining Hymenoptera as separate ‘orders’). (d) Percent frequency of the 15 most common vascular plant species in plots and transects. Asterisks denote non-indigenous species introduced and naturalised since European settlement.

Common name	Latin name	Bendigo			Blackstone Hill			Cambrian		
		S	I	G	S	I	G	S	I	G
<b>(a) Bird species</b>										
Welcome swallow	<i>Hirundo tahitica</i>	-	1	-	-	-	-	-	-	-
South Island fantail	<i>Rhipidura f. fuliginosa</i>	5	-	-	-	-	-	-	-	-
*Rock pigeon	<i>Columba livia</i>	2	-	-	-	-	-	-	-	-
*European goldfinch	<i>Carduelis carduelis</i>	44	117	34	26	3	-	-	29	20
*California quail	<i>Callipepla californica</i>	30	16	6	7	17	4	-	1	-
*Common starling	<i>Sturnus vulgaris</i>	2	10	7	2	-	-	-	2	2
*Australian magpie	<i>Gymnorhina tibicen</i>	1	14	15	-	-	2	-	1	8
*European greenfinch	<i>Carduelis chloris</i>	4	34	87	23	31	8	9	53	13
Australasian harrier	<i>Circus approximans</i>	4	8	15	9	6	5	1	-	3
Silveryeye	<i>Zosterops lateralis</i>	42	30	56	18	17	19	25	75	51
Grey warbler	<i>Gerygone igata</i>	28	12	15	25	22	16	9	13	6
*Dunnock	<i>Prunella modularis</i>	22	12	20	37	44	42	14	23	31
*Eurasian blackbird	<i>Turdus merula</i>	3	9	2	15	13	16	4	18	4
*Common chaffinch	<i>Fringilla coelebs</i>	7	25	24	38	45	19	15	38	23
*Yellowhammer	<i>Emberiza citrinella</i>	-	6	22	62	53	54	4	29	24
*Common redpoll	<i>Carduelis flammea</i>	54	76	23	233	217	225	45	101	174
Black-backed gull	<i>Larus dominicanus</i>	-	1	-	5	-	-	-	-	-
*House sparrow	<i>Passer domesticus</i>	-	1	-	3	-	-	-	-	-
*Song thrush	<i>Turdus philomelos</i>	-	-	-	10	9	8	-	4	2
*Eurasian skylark	<i>Alauda arvensis</i>	-	-	3	2	22	33	-	-	-
Eastern falcon	<i>Falco novaeseelandiae</i> “eastern”	-	-	-	-	-	-	7	-	-
South Island tomtit	<i>Petroica m. macrocephala</i>	-	-	-	-	-	-	4	-	-
<b>(b) Invertebrate ‘order’</b>										
Springtails	Collembola	7	10	8	-	1	-	5	4	7
Snails	Gastropoda	-	-	1	1	-	-	-	-	-
Ants	Formicidae (Hymenoptera)	10	10	10	10	9	10	10	9	8
Spiders	Araneae	10	10	9	10	10	10	10	10	10
Beetles	Coleoptera	6	7	8	10	10	10	8	9	7
True flies	Diptera	1	2	2	-	4	4	4	6	7
Mites	Acari	-	1	6	-	4	8	5	6	5
Woodlice	Isopoda	4	2	1	10	6	6	1	2	2
Grasshoppers, crickets	Orthoptera	1	4	6	7	8	9	10	10	10
Harvestmen	Opiliones	2	1	1	6	4	3	5	1	6
Moths, butterflies	Lepidoptera	1	3	1	5	6	5	9	6	7
Flatworms	Platyhelminthes	-	-	-	-	-	-	1	-	2
True bugs	Hemiptera	-	2	2	2	5	9	5	5	2
Sawflies, wasps and bees	‘Other Hymenoptera’	2	-	1	5	5	2	5	5	5
Amphipods	Amphipoda	-	-	-	1	2	1	2	-	4
Cockroaches	Blattodea	-	-	-	1	1	-	6	5	2
Earwigs	Dermaptera	-	-	1	6	3	7	2	5	2
Pseudoscorpions	Pseudoscorpionida	-	-	-	-	-	-	2	-	-
Annelid worms	Oligochaeta	-	-	-	1	-	-	3	-	-
Jumping bristletails	Archaeognatha	-	-	-	1	-	-	-	-	-
Millipedes	Diplopoda	-	-	-	1	-	-	-	-	-
<b>(c) Beetle family</b>										
Darkling beetles	Tenebrionidae	2	1	-	-	-	-	-	1	-
Ant-like leaf beetles	Aderidae	-	-	-	-	-	-	-	1	-
Click beetles	Elateridae	1	-	-	-	1	1	-	-	-
Carabids or ground beetles	Carabidae	4	6	5	7	10	9	8	9	6
Weevils	Curculionidae	-	1	1	1	1	4	1	1	2
Ladybirds	Coccinellidae	-	2	2	1	-	2	-	-	-
Ant-like flower beetles	Anthracidae	-	-	-	-	1	-	-	-	-
Tiger beetles	Cicindelidae	-	-	-	-	1	-	-	-	-
Rove beetles	Staphylinidae	-	-	1	-	-	1	-	-	-
Scarab beetles	Scarabaeidae	-	1	1	10	6	10	2	-	2
Leaf beetles	Chrysomelidae	-	-	-	1	-	-	-	-	-

Common name	Latin name	Bendigo			Blackstone Hill			Cambrian		
		S	I	G	S	I	G	S	I	G
<b>(d) Plant species</b>										
Kānuka	<i>Kunzea ericoides</i>	659	132	-	-	-	-	-	4	-
Matagouri	<i>Discaria toumatou</i>	7	13	29	66	80	32	125	77	59
*Sweet briar	<i>Rosa rubiginosa</i>	3	75	37	87	26	14	1	1	-
Mingimingi	<i>Coprosma propinqua</i>	14	2	9	25	20	12	65	40	6
*Sweet vernal	<i>Anthoxanthum odoratum</i>	4	15	17	38	52	46	110	138	105
Slim-leaved snow tussock	<i>Chionochloa rigida</i>	-	-	-	-	13	-	49	22	211
*Browntop	<i>Agrostis capillaris</i>	3	23	11	13	26	10	39	44	57
*Soft brome	<i>Bromus hordeaceus</i>	3	11	49	57	38	45	-	13	-
*Kentucky bluegrass	<i>Poa pratensis</i>	1	20	33	22	28	41	2	32	-
*Cocksfoot	<i>Dactylis glomerata</i>	1	6	1	4	22	10	17	56	9
*Chewings fescue	<i>Festuca rubra</i>	5	9	18	6	3	3	43	16	21
Fescue tussock, hard tussock	<i>Festuca novae-zelandiae</i>	0	19	15	6	29	17	12	4	19
Blue tussock	<i>Poa colensoi</i>	1	2	14	7	15	5	28	4	28
*Mouse-ear hawkweed	<i>Pilosella officinarum</i>	0	-	0	8	26	20	24	9	39
*Tussock hawkweed	<i>Hieracium lepidulum</i>	1	0	1	0	2	0	58	11	37

**Appendix S2.** Predictor variables used in our models, and brief explanations of their derivation and implications.

Predictor	Explanation
<b>Woodiness predictors</b>	
Block-level woodiness (categorical woodiness predictor)	Shrubland, intermediate, or grassland block. Represents the vegetation structure context of a sampling unit, such as location within a large continuous block of shrubland, a mosaic of grassland and scattered shrubs (or clumps of shrubs) or an expanse of open grassland.
Plot-level or transect-level woodiness (continuous woodiness predictor)	Frequency of woody species, a measure of relative abundance, was calculated as the summed number of presences of woody plants in each plot or transect, expressed as a percentage of the number of sampled points. Relative frequency can exceed 100% where woody species are present, on average, in more than one vertically contiguous sampling cube per point. The predictor represents the degree of woodiness in the immediate locality such as within the plot (plot-level) or along a transect (transect-level); thus a plot within a gap in a shrubland block (high block-level woodiness) may have low plot-level woodiness; conversely a plot within a shrubland clump in a grassland block may have high plot-level woodiness.
<b>Other vegetative habitat predictors, derived from vegetation height-frequency data</b>	
Plot-level or transect-level grassiness (amount of grass)	Frequency of indigenous plus exotic grass species, which is a measure of relative abundance of grasses, was calculated as the summed number of presences of woody plants in each plot or transect, expressed as a percentage of the number of sampled points. Relative frequency can exceed 100% where woody species are present, on average, in more than one vertically contiguous sampling cube per point.
Exotic grass frequency (amount of exotic grass)	Total frequency of exotic grass species.
Indigenous grass frequency (amount of indigenous grass)	Total frequency of indigenous grass species. The measure is generally higher where there is a greater amount of tussock biomass (mainly of <i>Chionochloa rigida</i> , <i>Festuca novae-zelandiae</i> and <i>Poa colensoi</i> tussock species) because one of these species tended to dominate indigenous grass biomass in the communities we sampled (see Appendix S1).
Proportion vascular plant species indigenous per plot	Proportion of plant species indigenous, calculated as the number of indigenous species divided by the number of all species in a plot (plants), expressed as a percentage and used as a measure of indigenous dominance of composition sensu Lee et al. (2005).
Indigenous structural dominance	Proportion of plant species frequencies that were indigenous, calculated as the total frequency of indigenous vascular plant species divided by the total frequency of all vascular plant species, expressed as a percentage. Used as a measure of the degree of dominance of plant biomass by indigenous species.
Exotic structural complexity	Structural complexity of the exotic component of vegetation, intended to indicate whether exotic species occur mainly in the ground and lower tiers (as in pasture; low exotic structural complexity) or reach taller height tiers (i.e. taller herbs and exotic shrub species are present; higher exotic structural complexity). The index is calculated as the Shannon–Weiner index ( $H'$ ) calculated for a matrix of exotic plant species vs height classes, where the table entries are the presence or absence of each species in that height class.
<b>Predictors derived from environmental and ground cover data at plots</b>	
North aspect	Degrees north, with range 0°–180°. Transformed from aspect measured in the field using sighting compass. Represents the relative orientation of the plot (and trapping grid) to the sun
West aspect	Degrees west, with range 0°–180°. Transformed from east aspect measured in the field using sighting compass. Represents relative orientation of the plot (and trapping grid) to the afternoon sun
Topographic position	One of three categories (face, gully, or ridge)
Topographic shelter	Average of positive and negative angles to the horizon (visually estimated) at eight cardinal compass points from the grid centre. An exposed plot (and trapping grid) will have a low topographic shelter index
Rock outcrop area	Visually estimated area of exposed large rock outcrops within a 10-m radius of plot centre in each of four cardinal compass sectors
Slope	Average slope at the GPS coordinates of each plot (and trapping grid) location from a 25-m digital elevation model in a GIS
Amount of ground litter	Visually estimated percentage ground cover of litter in a 12 × 12 m plot
Amount of ground rock, pebbles and/or gravel	Visually estimated percentage ground cover of rock, pebbles and/or gravel in a 12 × 12 m plot

**Appendix S3.** Correlation matrices showing Pearson's correlation coefficient  $r$  for the variables used to model bird, invertebrate and lizard variables in our analyses.

Birds (on transects)

	Transect-level woodiness	Transect-level grassiness	Exotic structural complexity
Transect-level grassiness	-0.15		
Exotic structural complexity	-0.03	0.45	
Block-level woodiness	0.58	-0.33	0.09

Invertebrate orders and beetle families (in plots)

	Plot-level woodiness	Indigenous grass frequency	Proportion plant species indigenous	Exotic grass frequency	Litter
Indigenous grass abundance	-0.14				
Proportion indigenous species	0.09	0.58			
Exotic grass abundance	-0.43	-0.20	-0.30		
Litter	0.14	0.26	0.54	0.13	
Ground rock cover	0.05	-0.09	0.09	-0.19	-0.18

Skinks (in plots)

	Plot-level woodiness	Plot-level grassiness	Indigenous structural dominance	North aspect	Outcrop area
Grassiness	-0.20				
Indigenous structural dominance	0.53	0.01			
North aspect	-0.01	-0.38	-0.23		
Outcrop area	0.09	-0.27	0.18	-0.09	
Block-level woodiness	0.33	-0.17	0.30	-0.06	0.25

Geckos (in plots)

	Plot-level woodiness	West aspect	Outcrop area
West aspect	0.01		
Outcrop area	0.09	0.11	
Block-level woodiness	0.33	-0.01	0.25

**Appendix S4.** Sums of taxa observed in woody (shrubland), intermediate, and grassy blocks. Data are shown first for all three study sites (bold), and then for each individual site (Bendigo, Blackstone Hill and Cambrian). Numbers in parentheses are numbers of individuals observed and total length (km) of transect sampled for birds, numbers of undisturbed and lizard-free traps for invertebrate orders and beetle families, and numbers of undisturbed traps (i.e. by predators) for lizards.

Biotic group and site	Shrubland	Intermediate	Grassland
<b>(a) Indigenous bird species</b>	<b>7 (182, 14.0)</b>	<b>5 (185, 15.4)</b>	<b>3 (194, 17.4)</b>
Bendigo	4 (79, 4.0)	5 (52, 4.0)	3 (94, 5.3)
Blackstone Hill	4 (57, 6.0)	3 (45, 6.0)	3 (40, 6.0)
Cambrian	5 (46, 4.0)	2 (88, 5.4)	3 (60, 6.0)
<b>(b) Exotic bird species</b>	<b>14 (718, 14.0)</b>	<b>13 (1073, 15.4)</b>	<b>12 (955, 17.4)</b>
Bendigo	10 (169, 4.0)	11 (320, 4.0)	11 (243, 5.3)
Blackstone Hill	12 (458, 6.0)	10 (454, 6.0)	10 (411, 6.0)
Cambrian	6 (91, 4.0)	11 (299, 5.4)	10 (301, 6.0)
<b>(c) Invertebrate orders</b>	<b>21 (2321)</b>	<b>15 (2129)</b>	<b>17 (2205)</b>
Bendigo	10 (1120)	11 (1112)	14 (1090)
Blackstone Hill	16 (458)	15 (438)	13 (417)
Cambrian	18 (743)	14 (579)	16 (698)
<b>(d) Beetle families</b>	<b>7 (2321)</b>	<b>9 (2129)</b>	<b>6 (2205)</b>
Bendigo	3 (1120)	5 (1112)	5 (1090)
Blackstone Hill	5 (458)	6 (438)	6 (417)
Cambrian	3 (743)	4 (579)	3 (698)
<b>(e) Lizard species</b>	<b>3 (3684)</b>	<b>3 (3368)</b>	<b>3 (3694)</b>
Bendigo	3 (1209)	2 (1250)	2 (1225)
Blackstone Hill	3 (1238)	3 (1250)	3 (880)
Cambrian	3 (1194)	2 (1250)	1 (1250)

**Appendix S5.** Numbers of unique individuals of three lizard species captured in 10 randomly placed trapping grids (each of 25 baited pitfall traps) within 1-km<sup>2</sup> blocks over 5 trapping nights, grouped by site and woodiness level of the block (G = grassland, I = intermediate, S = shrubland). For each combination of site × woodiness level, central boxes show the interquartile range and medians, whiskers (error bars) indicate 10th and 90th percentiles, and open circles show values beyond that range. Note the different axis scale for McCann's skink (*Oligosoma maccanni*). Fluon® was not used to limit gecko escapes from pitfall traps at the Bendigo site. Central Otago gecko = *Woodworthia* "Central Otago"; common skink = *Oligosoma polychroma*.

