

Appendix C. Ranking of candidate models for changes in functional diversity with land use.

Functional trait diversity was assessed based on functional dispersion (FDis) and functional evenness (FEve). Models with $\Delta AIC \leq 2$ are shown in bold, along with the direction of the estimated effect of model terms. All models include site as a random effect in the model. See Material and Methods for details about individual variables and the selection of candidate model sets.

a) Overstory

Effect trait diversity

Table C1. Candidate model rankings for functional dispersion of overstory effect trait diversity.

	K	AICc	$\Delta AICc$	AICc weight	Cumulative weight	Log likelihood
Site only	3	-28.39	0	0.4	0.4	18.39
Livestock	4	-25.56	2.83	0.1	0.49	19
LUI	4	-25.09	3.29	0.08	0.57	18.77
Elevation	4	-24.86	3.53	0.07	0.64	18.65
Biomass extraction	4	-24.55	3.84	0.06	0.7	18.5
PC2	4	-24.48	3.91	0.06	0.75	18.46
Grass cover	4	-24.43	3.96	0.05	0.81	18.44
PC1	4	-24.42	3.97	0.05	0.86	18.43
Fire	4	-24.37	4.02	0.05	0.91	18.41
Canopy openness	4	-24.34	4.04	0.05	0.97	18.39
Grass cover & Livestock	5	-20.89	7.5	0.01	0.98	19.19
Biomass extraction & Livestock	5	-20.53	7.86	0.01	0.98	19.02
Grass cover & LUI	5	-20.25	8.13	0.01	0.99	18.88
Grass cover & Biomass extraction	5	-19.6	8.79	0	0.99	18.55
PC1 & PC2	5	-19.49	8.89	0	1	18.5
Grass cover & Biomass extraction & Livestock	6	-14.45	13.94	0	1	19.22

Table C2. Candidate model rankings for functional evenness of overstory effect trait diversity.

	K	AICc	Δ AICc	AICc weight	Cumulative weight	Log likelihood
Site only	3	-4	0	0.37	0.37	6.71
PC1	4	-1.94	2.06	0.13	0.5	8.3
Elevation	4	-1.58	2.42	0.11	0.61	8.12
Fire	4	-1.4	2.59	0.1	0.71	8.03
Biomass extraction	4	-1.05	2.95	0.08	0.8	7.86
Grass cover	4	-0.21	3.78	0.06	0.85	7.44
LUI	4	0.12	4.11	0.05	0.9	7.28
PC2	4	1.15	5.14	0.03	0.93	6.76
Livestock	4	1.16	5.15	0.03	0.95	6.75
Canopy openness	4	1.24	5.23	0.03	0.98	6.72
PC1 & Biomass extraction	5	4.8	8.8	0	0.99	8.6
PC1 & LUI	5	4.93	8.92	0	0.99	8.54
PC1 & Livestock	5	5.19	9.18	0	0.99	8.41
PC1 & PC2	5	5.38	9.38	0	1	8.31
Biomass extraction & Livestock	5	6.06	10.06	0	1	7.97
PC1 & Biomass extraction & Livestock	6	15.8	19.79	0	1	8.6

Response trait diversity**Table C3.** Candidate model rankings for functional dispersion of overstory response trait diversity.

	K	AICc	Δ AICc	AICc weight	Cumulative weight	Log likelihood
Elevation (-)	4	-41.87	0	0.39	0.39	27.16
Elevation (-) & Biomass extraction (-)	5	-40.14	1.73	0.17	0.56	28.82
Elevation & LUI	5	-39.34	2.54	0.11	0.67	28.42
PC1	4	-38.91	2.96	0.09	0.76	25.68
Elevation & Livestock	5	-38.38	3.5	0.07	0.83	27.94
Canopy openness	4	-38.03	3.84	0.06	0.89	25.24
Site only	3	-37.33	4.54	0.04	0.93	22.87
PC1 & PC2	5	-35.51	6.36	0.02	0.94	26.51
Fire	4	-34.72	7.15	0.01	0.95	23.58
Livestock	4	-34.43	7.44	0.01	0.96	23.44
Elevation & Biomass extraction & Livestock	6	-34.1	7.78	0.01	0.97	29.05
Grass cover	4	-33.89	7.98	0.01	0.98	23.17
PC2	4	-33.52	8.36	0.01	0.99	22.98
LUI	4	-33.44	8.43	0.01	0.99	22.94
Biomass extraction	4	-33.37	8.5	0.01	1	22.91
Biomass extraction & Livestock	5	-31.88	9.99	0	1	24.69

Table C4. Candidate model rankings for functional evenness of overstory response trait diversity.

	K	AICc	Δ AICc	AICc weight	Cumulative weight	Log likelihood
PC2 (-)	4	-4.29	0	0.51	0.51	9.48
Site only	3	-2.68	1.61	0.23	0.74	6.05
Elevation	4	1.47	5.75	0.03	0.77	6.6
Fire	4	1.58	5.86	0.03	0.8	6.54
Biomass extraction	4	1.85	6.13	0.02	0.83	6.41
Canopy openness	4	1.89	6.17	0.02	0.85	6.39
Livestock	4	1.98	6.27	0.02	0.87	6.34
Grass cover	4	2.12	6.4	0.02	0.89	6.28
PC2 & LUI	5	2.33	6.62	0.02	0.91	9.83
PC2 & Biomass extraction	5	2.37	6.65	0.02	0.93	9.82
PC2 & Livestock	5	2.42	6.7	0.02	0.95	9.79
PC1	4	2.56	6.84	0.02	0.96	6.05
LUI	4	2.56	6.85	0.02	0.98	6.05
PC1 & PC2	5	2.91	7.2	0.01	1	9.54
Biomass extraction & Livestock	5	5.13	9.42	0	1	8.43
PC2 & Biomass extraction & Livestock	6	13.33	17.62	0	1	9.84

b) Understory, including all species**Effect trait diversity****Table C5.** Candidate model rankings for functional dispersion of understory (including all species) effect trait diversity.

	K	AICc	Δ AICc	AICc weight	Cumulative weight	Log likelihood
Grass cover (-)	4	-35.24	0	0.37	0.37	23.84
Grass cover (-) & Livestock (+)	5	-33.84	1.56	0.19	0.56	25.67
Elevation	4	-32.41	2.83	0.09	0.65	22.43
Grass cover & Biomass extraction & Livestock	6	-32.36	2.88	0.09	0.74	28.18
Grass cover & LUI	5	-31.02	4.21	0.05	0.78	24.26
Livestock	4	-30.94	4.3	0.04	0.83	21.69
Area only	3	-30.93	4.3	0.04	0.87	19.67
Grass cover & Biomass extraction	5	-30.18	5.06	0.03	0.9	23.84
Biomass extraction & Livestock	5	-29.67	5.57	0.02	0.93	23.58
PC1	4	-29.48	5.76	0.02	0.95	20.96
PC2	4	-28.15	7.08	0.01	0.96	20.3
Canopy openness	4	-28.07	7.17	0.01	0.97	20.26
LUI	4	-27.81	7.43	0.01	0.98	20.13
PC1 & PC2	5	-27.72	7.52	0.01	0.99	22.61
Fire	4	-26.93	8.3	0.01	0.99	19.69
Biomass extraction	4	-26.89	8.35	0.01	1	19.67

Table C6. Candidate model rankings for functional evenness of understory (including all species) effect trait diversity.

	K	AICc	Δ AICc	AICc weight	Cumulative weight	Log likelihood
Site only	3	-32.38	0	0.24	0.24	20.39
Biomass extraction (-)	4	-31.39	0.99	0.15	0.39	21.92
Fire (-)	4	-30.9	1.48	0.11	0.5	21.67
Grass cover (-)	4	-30.56	1.83	0.1	0.6	21.5
Elevation	4	-30.05	2.34	0.07	0.67	21.25
PC2	4	-29.69	2.69	0.06	0.73	21.07
LUI	4	-29.19	3.2	0.05	0.78	20.81
Biomass extraction & Livestock	5	-29.1	3.28	0.05	0.83	23.3
PC1	4	-29.01	3.37	0.04	0.87	20.73
Canopy openness	4	-28.39	3.99	0.03	0.91	20.42
Livestock	4	-28.35	4.03	0.03	0.94	20.4
Fire & Biomass extraction	5	-27.82	4.56	0.02	0.96	22.66
PC1 & PC2	5	-26.63	5.75	0.01	0.98	22.07
Fire & LUI	5	-26.33	6.06	0.01	0.99	21.91
Fire & Livestock	5	-25.85	6.53	0.01	1	21.67
Fire & Biomass extraction & Livestock	6	-23.74	8.65	0	1	23.87

Response trait diversity

Table C7. Candidate model rankings for functional dispersion of understory (including all species) response trait diversity.

	K	AICc	Δ AICc	AICc weight	Cumulative weight	Log likelihood
Grass cover (-) & Livestock (+)	5	-43.75	0	0.49	0.49	30.62
Grass cover (-)	4	-42.53	1.21	0.26	0.75	27.49
Grass cover & LUI	5	-39.76	3.99	0.07	0.82	28.63
Grass cover & Biomass extraction & Livestock	6	-39.16	4.58	0.05	0.87	31.58
Livestock	4	-38.91	4.84	0.04	0.91	25.68
Grass cover & Biomass extraction	5	-37.88	5.87	0.03	0.93	27.69
Site only	3	-37.07	6.68	0.02	0.95	22.74
Elevation	4	-36.47	7.28	0.01	0.96	24.46
Biomass extraction & Livestock	5	-35.41	8.34	0.01	0.97	26.45
LUI	4	-35.03	8.72	0.01	0.98	23.74
PC1	4	-34.95	8.8	0.01	0.98	23.7
Canopy openness	4	-34.63	9.12	0.01	0.99	23.54
PC2	4	-34.2	9.55	0	0.99	23.32
Biomass extraction	4	-33.28	10.47	0	1	22.86
Fire	4	-33.14	10.6	0	1	22.79
PC1 & PC2	5	-31.85	11.9	0	1	24.67

Table C8. Candidate model rankings for functional evenness of understory (including all species) response trait diversity.

	K	AICc	Δ AICc	AICc weight	Cumulative weight	Log likelihood
Site only	3	-30.21	0	0.2	0.2	19.31
Elevation (+)	4	-29.87	0.34	0.17	0.37	21.16
PC2 (-)	4	-29.61	0.6	0.15	0.51	21.03
Canopy openness (+)	4	-28.29	1.93	0.08	0.59	20.37
Biomass extraction & Livestock	5	-28.16	2.05	0.07	0.66	22.83
Livestock	4	-28.05	2.16	0.07	0.73	20.25
Fire	4	-27.34	2.88	0.05	0.78	19.89
PC1	4	-26.82	3.39	0.04	0.81	19.63
PC1 & PC2	5	-26.8	3.41	0.04	0.85	22.15
Grass cover	4	-26.43	3.78	0.03	0.88	19.44
LUI	4	-26.41	3.8	0.03	0.91	19.43
Biomass extraction	4	-26.33	3.88	0.03	0.94	19.39
Elevation & Livestock	5	-26.21	4	0.03	0.96	21.86
Elevation & LUI	5	-25.45	4.76	0.02	0.98	21.47
Elevation & Biomass extraction	5	-24.96	5.25	0.01	1	21.23
Elevation & Biomass extraction & Livestock	6	-21.71	8.5	0	1	22.86

c) Understory, excluding non-native invasive species

Effect diversity

Table C9. Candidate model rankings for functional dispersion of understory (excluding non-native invasive species) effect trait diversity.

	K	AICc	Δ AICc	AICc weight	Cumulative weight	Log likelihood
Grass cover (-)	4	-31.56	0	0.32	0.32	22
Grass cover (-) & Livestock	5	-30.61	0.95	0.2	0.51	24.05
Grass cover (-) & Biomass extraction (-) & Livestock (+)	6	-30.21	1.35	0.16	0.67	27.11
Elevation	4	-28.72	2.85	0.08	0.75	20.58
Grass cover & LUI	5	-27.53	4.03	0.04	0.79	22.52
Site only	3	-27.47	4.09	0.04	0.83	17.94
Livestock	4	-27.37	4.19	0.04	0.87	19.91
Biomass extraction & Livestock	5	-26.52	5.04	0.03	0.9	22.01
Grass cover & Biomass extraction	5	-26.51	5.05	0.03	0.92	22.01
PC1	4	-26.03	5.54	0.02	0.94	19.24
Canopy openness	4	-25.93	5.63	0.02	0.96	19.19
PC2	4	-24.99	6.57	0.01	0.97	18.72
LUI	4	-24.39	7.17	0.01	0.98	18.42
PC1 & PC2	5	-24.09	7.47	0.01	0.99	20.79
Biomass extraction	4	-23.44	8.13	0.01	0.99	17.94
Fire	4	-23.43	8.13	0.01	1	17.94

Table C10. Candidate model rankings for functional evenness of understory (excluding non-native invasive species) effect trait diversity.

	K	AICc	Δ AICc	AICc weight	Cumulative weight	Log likelihood
PC2 (-)	4	-34.44	0	0.2	0.2	23.44
Site only	3	-34	0.44	0.16	0.36	21.2
Grass cover (-)	4	-33.66	0.78	0.13	0.49	23.05
Fire (-)	4	-33.57	0.87	0.13	0.62	23.01
Canopy openness (-)	4	-32.87	1.57	0.09	0.71	22.66
Elevation	4	-32.02	2.43	0.06	0.77	22.23
Biomass extraction & Livestock	5	-31.57	2.88	0.05	0.82	24.53
Livestock	4	-31.04	3.41	0.04	0.85	21.74
Biomass extraction	4	-30.4	4.04	0.03	0.88	21.42
PC1 & PC2	5	-30.25	4.19	0.02	0.9	23.88
LUI	4	-29.99	4.46	0.02	0.93	21.22
PC1	4	-29.96	4.48	0.02	0.95	21.2
PC2 & Biomass extraction	5	-29.64	4.8	0.02	0.97	23.57
PC2 & Livestock	5	-29.5	4.95	0.02	0.98	23.5
PC2 & LUI	5	-29.4	5.04	0.02	1	23.45
PC2 & Biomass extraction & Livestock	6	-25.19	9.26	0	1	24.59

Response diversity

Table C11. Candidate model rankings for functional dispersion of understory (excluding non-native invasive species) response trait diversity.

	K	AICc	Δ AICc	AICc weight	Cumulative weight	Log likelihood
Grass cover (-)	4	-46.42	0	0.53	0.53	29.43
Grass cover (-) & Livestock (+)	5	-44.96	1.46	0.26	0.79	31.23
Grass cover & LUI	5	-42.55	3.87	0.08	0.87	30.02
Grass cover & Biomass extraction	5	-41.4	5.02	0.04	0.91	29.45
Grass cover & Biomass extraction & Livestock	6	-39.67	6.75	0.02	0.93	31.84
Site only	3	-39.05	7.37	0.01	0.94	23.73
Livestock	4	-39.02	7.4	0.01	0.96	25.73
Elevation	4	-39.02	7.41	0.01	0.97	25.73
PC1	4	-38.78	7.65	0.01	0.98	25.61
Canopy openness	4	-36.93	9.49	0	0.99	24.69
LUI	4	-36.49	9.93	0	0.99	24.47
PC2	4	-35.65	10.77	0	0.99	24.05
Fire	4	-35.12	11.3	0	0.99	23.78
Biomass extraction	4	-35.09	11.33	0	1	23.77
Biomass extraction & Livestock	5	-35.03	11.4	0	1	26.26
PC1 & PC2	5	-34.58	11.85	0	1	26.04

Table C12. Candidate model rankings for functional evenness of understory (excluding non-native invasive species) response trait diversity.

	K	AICc	Δ AICc	AICc weight	Cumulative weight	Log likelihood
Livestock (+)	4	-35.21	0	0.24	0.24	23.83
Site only	3	-34.83	0.39	0.2	0.44	21.61
Biomass extraction (-) & Livestock (+)	5	-33.6	1.61	0.11	0.55	25.55
PC2	4	-32.63	2.58	0.07	0.61	22.54
Grass cover	4	-32.63	2.59	0.07	0.68	22.53
LUI	4	-32.19	3.02	0.05	0.73	22.32
Elevation	4	-32.09	3.13	0.05	0.78	22.27
Canopy openness	4	-31.89	3.32	0.05	0.83	22.17
PC1	4	-31.26	3.96	0.03	0.86	21.85
PC2 & Livestock	5	-31.22	4	0.03	0.9	24.36
Fire	4	-30.92	4.29	0.03	0.92	21.68
Biomass extraction	4	-30.89	4.32	0.03	0.95	21.67
PC2 & LUI	5	-30.75	4.47	0.03	0.98	24.12
PC1 & PC2	5	-28.78	6.43	0.01	0.99	23.14
PC2 & Biomass extraction	5	-28	7.21	0.01	0.99	22.75
PC2 & Biomass extraction & Livestock	6	-27.54	7.67	0.01	1	25.77

d) Saplings

Effect diversity

Table C13. Candidate model rankings for functional dispersion of sapling effect trait diversity.

	K	AICc	Δ AICc	AICc weight	Cumulative weight	Log likelihood
Fire (+)	4	-42.77	0	0.76	0.76	27.61
Fire & Biomass extraction	5	-38.65	4.12	0.1	0.85	28.08
Fire & Livestock	5	-37.88	4.89	0.07	0.92	27.69
Fire & LUI	5	-37.8	4.97	0.06	0.98	27.65
Fire & Biomass extraction & Livestock	6	-35.16	7.61	0.02	1	29.58
Grass cover	4	-28.98	13.79	0	1	20.71
Site only	3	-28.79	13.98	0	1	18.59
Canopy openness	4	-26.63	16.14	0	1	19.53
PC1	4	-25.24	17.53	0	1	18.84
Elevation	4	-25.14	17.63	0	1	18.79
LUI	4	-24.83	17.94	0	1	18.64
Livestock	4	-24.82	17.95	0	1	18.63
Biomass extraction	4	-24.8	17.97	0	1	18.62
PC2	4	-24.76	18.01	0	1	18.6
PC1 & PC2	5	-20.21	22.56	0	1	18.85
Biomass extraction & Livestock	5	-19.77	22.99	0	1	18.64

Table C14.Candidate model rankings for functional evenness of sapling effect trait diversity.

	K	AICc	Δ AICc	AICc weight	Cumulative weight	Log likelihood
Biomass extraction (+)	4	-28.76	0	0.32	0.32	21.24
LUI (+)	4	-27.55	1.21	0.17	0.49	20.63
Site only	3	-27.46	1.3	0.16	0.65	18.23
PC1	4	-26.16	2.6	0.09	0.74	19.93
Livestock	4	-24.76	4	0.04	0.78	19.24
Fire & LUI	5	-24.66	4.1	0.04	0.82	22.33
Fire	4	-24.34	4.42	0.03	0.86	19.03
Fire & Biomass extraction	5	-24.16	4.6	0.03	0.89	22.08
Elevation	4	-23.69	5.07	0.03	0.91	18.7
Fire & Livestock	5	-23.39	5.37	0.02	0.93	21.7
Grass cover	4	-22.8	5.96	0.02	0.95	18.26
Canopy openness	4	-22.79	5.97	0.02	0.97	18.25
PC2	4	-22.76	6	0.02	0.98	18.24
Biomass extraction & Livestock	5	-22.48	6.28	0.01	1	21.24
PC1 & PC2	5	-19.88	8.88	0	1	19.94
Fire & Biomass extraction & Livestock	6	-15.92	12.84	0	1	22.36

Response diversity**Table C15.**Candidate model rankings for functional dispersion of sapling response trait diversity.

	K	AICc	Δ AICc	AICc weight	Cumulative weight	Log likelihood
PC1 (+)	4	-48.18	0	0.38	0.38	30.31
Elevation	4	-45.63	2.55	0.1	0.48	29.04
PC1 & Biomass extraction	5	-45.31	2.87	0.09	0.57	31.41
Canopy openness	4	-45.28	2.9	0.09	0.66	28.86
Site only	3	-45.16	3.02	0.08	0.74	26.78
PC1 & LUI	5	-44.98	3.21	0.08	0.82	31.24
PC1 & Livestock	5	-44.09	4.09	0.05	0.86	30.8
Grass cover	4	-43.62	4.56	0.04	0.9	28.03
PC1 & PC2	5	-43.2	4.98	0.03	0.93	30.35
Livestock	4	-41.65	6.53	0.01	0.95	27.05
Fire	4	-41.31	6.87	0.01	0.96	26.88
Biomass extraction	4	-41.18	7	0.01	0.97	26.81
LUI	4	-41.18	7	0.01	0.98	26.81
PC2	4	-41.17	7.01	0.01	0.99	26.81
PC1 & Biomass extraction & Livestock	6	-38.82	9.36	0	1	31.41
Biomass extraction & Livestock	5	-37.23	10.95	0	1	27.37

Table C16. Candidate model rankings for functional evenness of sapling response trait diversity.

	K	AICc	Δ AICc	AICc weight	Cumulative weight	Log likelihood
Site only	3	-18.59	0	0.29	0.29	13.8
Fire (+)	4	-17.72	0.87	0.18	0.47	15.72
Biomass extraction (+)	4	-17.06	1.53	0.13	0.6	15.39
PC2 (+)	4	-16.94	1.66	0.12	0.73	15.33
Elevation	4	-15.36	3.24	0.06	0.78	14.54
LUI	4	-14.85	3.74	0.04	0.83	14.28
PC1	4	-14.38	4.21	0.03	0.86	14.05
Grass cover	4	-14.2	4.39	0.03	0.89	13.96
Canopy openness	4	-14.01	4.58	0.03	0.92	13.86
Livestock	4	-13.9	4.7	0.03	0.95	13.81
Biomass extraction & Livestock	5	-12.42	6.17	0.01	0.96	16.21
Fire & Biomass extraction	5	-12.18	6.42	0.01	0.97	16.09
Fire & LUI	5	-11.71	6.88	0.01	0.98	15.86
Fire & Livestock	5	-11.48	7.12	0.01	0.99	15.74
PC1 & PC2	5	-11.33	7.26	0.01	1	15.66
Fire & Biomass extraction & Livestock	6	-3.91	14.68	0	1	16.35