

Supplementary material

Susceptibility to climate change via effects on food resources: the feeding ecology of the endangered mountain pygmy-possum (*Burramys parvus*)

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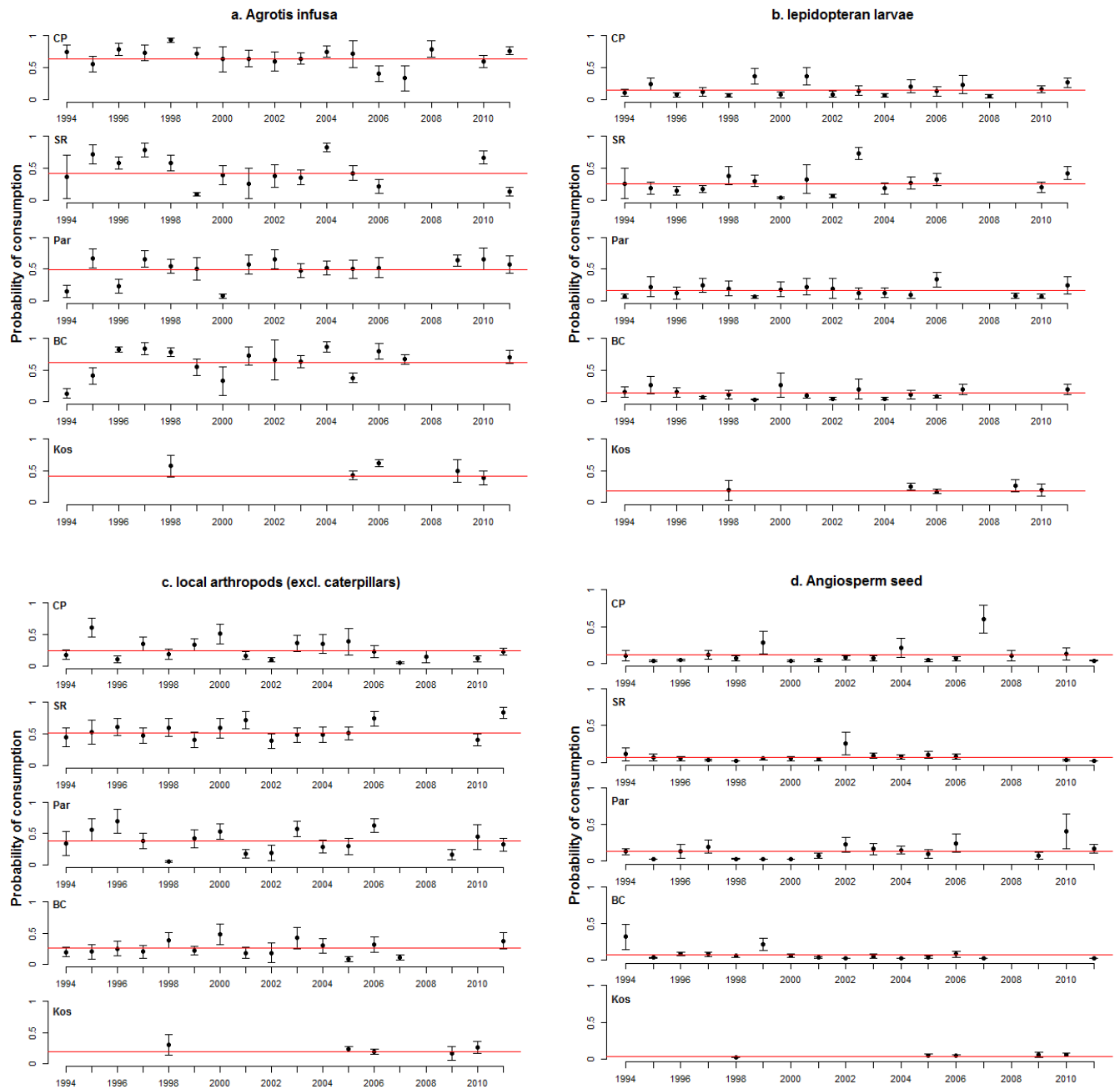
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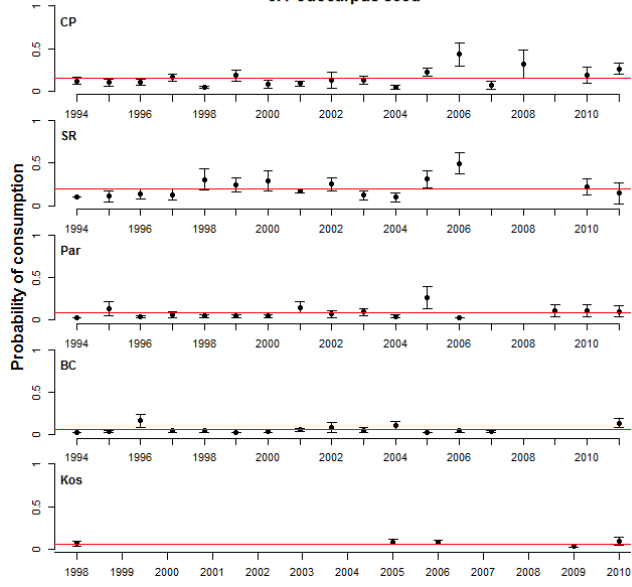
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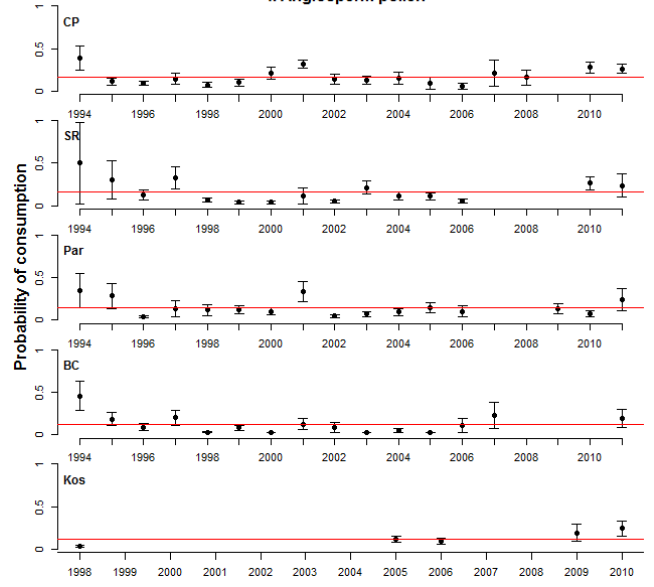
Fig. S1. Inter-annual variation in the probability of *Burramys parvus* consumption of a. *Agrotis infusa* (bogong moths), b. lepidopteran larvae (caterpillars) c. local arthropods (excl. caterpillars) and d. angiosperm seed, e. *Podocarpus* seed and f. angiosperm pollen at CP (Charlotte Pass), SR (Summit Road), Par (Paralyser), BC (Blue Cow) and Kos (Kosciuszko) between 1994 and 2011. Horizontal red lines indicate long term means.



e. Podocarpus seed



f. Angiosperm pollen



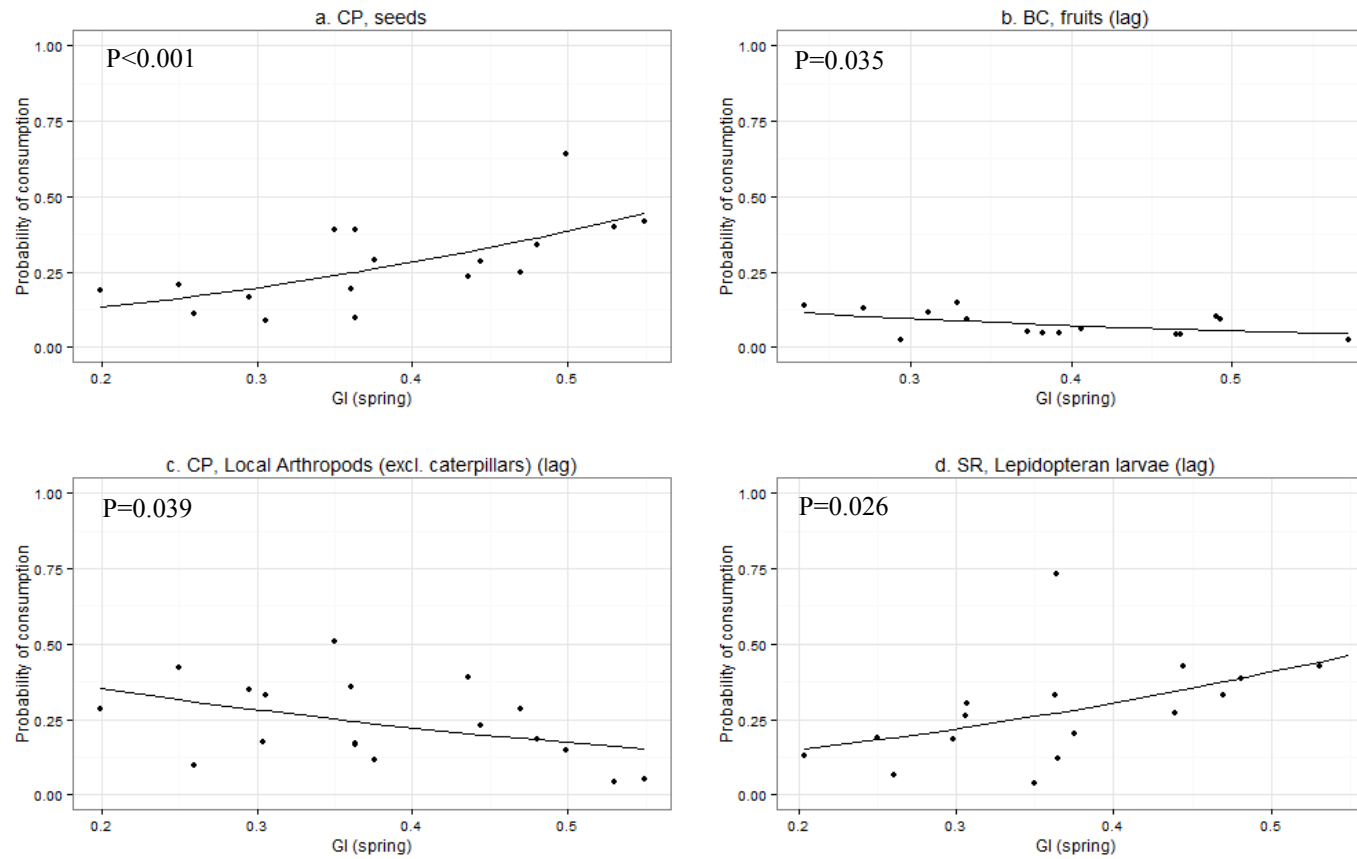


Fig. S2. The effect of Alpine Spring plant growth index on the probability of *Burramy parvus* consumption of a. seeds at Charlotte Pass, CP, b. fruits (in the following spring (lag)) at Blue Cow, BC, c. Local arthropods excluding caterpillars (in the following spring) at CP and d. Lepidopteran larvae (in the following spring) at Summit Road, SR.

Table S1a. Summary of samples included in the dietary analysis of inter-annual variation of spring samples only (i.e. interaction of population and growing season on *Burramys parvus* consumption of key food items). Populations are in ascending order of site elevation.

Population	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Sub-totals	
Happy Jacks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	9	17	
Snow Ridge	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	18	
Charlotte Pass	8	7	9	9	11	7	6	5	6	11	7	4	11	3	9	1	11	20	-	-	145	
Summit Road	2	4	7	9	9	6	6	4	6	13	7	9	8	-	-	-	9	4	-	-	103	
Paralyser	5	6	5	8	8	6	8	7	6	9	10	6	9	-	-	8	5	7	-	-	113	
Blue Cow	7	8	8	9	12	9	4	7	3	6	3	4	9	6	-	-	-	9	-	-	104	
Townsend	-	-	-	-	-	-	5	-	-	-	-	-	-	-	8	-	-	-	-	-	13	
Kosciuszko	-	-	-	-	6	-	-	-	-	-	-	30	41	-	-	5	8	-	-	-	90	
																					Total	603

Table S1b. Summary of samples included in the dietary analysis of inter-site and seasonal variation (i.e. effects of population and interaction of population by season on *Burramys parvus* consumption of key food items).

Population	Autumn	Spring	
Happy Jacks	-	17	
Snow Ridge	9	18	
Charlotte Pass	39	145	
Summit Road	19	103	
Paralyser	10	113	
Blue Cow	22	104	
Townsend	6	13	
Kosciuszko	10	90	Total
Sub-totals	115	603	718

Table S2. Summary of results from beta regression modelling of population, season, sex and inter-annual variation in the probability of consumption of key food groups in *Burramys parvus* (Mountain Pygmy-possum), including local seeds, fruits and angiosperm pollen. ^ Kruskal-wallis test Pr(>Chisq)

Coefficients	Response variable																			
	Fruit				Angiosperm pollen				Podocarpus pollen				Podocarpus seed				Angiosperm seed			
	Est	Std. Er	Z value	p value	Est	Std. Er	Z value	p value	Est	Std. Er	Z value	p value	Est	Std. Er	Z value	p value	Est	Std. Er	Z value	p value
Main Effects																				
year	-0.01	0.01	-1.44	0.151	0.00	0.01	-0.44	0.658	0.01	0.01	1.47	0.141	0.00	0.01	1.15	0.247	0.00	0.00	0.05	0.957
season	-0.05	0.10	-0.52	0.601	0.22	0.12	1.81	0.070	0.06	0.08	0.84	0.400	-0.03	0.12	-0.25	0.801	-0.79	0.14	-5.78	<0.001
sex	0.03	0.07	0.48	0.631	0.04	0.09	0.45	0.652	-0.02	0.07	-0.32	0.744	-0.14	0.08	-1.70	0.089	-0.07	0.08	-0.91	0.363
site^	n/a	n/a	n/a	0.015	n/a	n/a	n/a	0.011	n/a	n/a	n/a	<0.001	n/a	n/a	n/a	<0.001	n/a	n/a	n/a	0.201
Two-way Interactions																				
year x season	-0.01	0.02	-0.30	0.764	-0.01	0.02	-0.59	0.554	-0.02	0.01	-1.23	0.217	-0.03	0.02	-1.13	0.256	0.14	0.03	5.67	<0.001
year x sex	-0.01	0.01	-0.66	0.510	-0.01	0.02	-0.60	0.549	-0.01	0.02	-0.47	0.640	-0.01	0.02	-0.63	0.529	0.04	0.03	1.68	0.09
season x sex	0.02	0.22	0.10	0.919	0.25	0.25	0.98	0.329	-0.04	0.16	-0.29	0.771	-0.09	0.25	-0.35	0.726	0.31	0.28	1.11	0.267
Interactions at Site level																				
CP																				
year	-0.01	0.01	-0.69	0.491	0.01	0.01	1.01	0.315	0.02	0.01	1.33	0.183	0.02	0.02	1.56	0.120	0.00	0.02	0.26	0.798
season	0.00	0.15	0.03	0.977	0.56	0.18	3.05	0.002	0.31	0.15	2.10	0.035	-0.03	0.25	-0.13	0.895	-0.28	0.17	-1.69	0.090
sex	0.03	0.12	0.22	0.828	0.23	0.15	1.53	0.126	0.07	0.16	0.45	0.652	-0.28	0.19	-1.48	0.138	-0.04	0.18	-0.25	0.802
SR																				
year	0.01	0.02	0.68	0.494	0.00	0.02	-0.23	0.817	0.03	0.02	2.07	0.039	0.02	0.02	0.76	0.444	0.00	0.02	0.12	0.902
season	-0.33	0.22	-1.49	0.137	0.11	0.27	0.41	0.681	-0.19	0.14	-1.42	0.157	0.48	0.31	1.54	0.124	-1.80	0.36	-5.03	<0.001
sex	-0.14	0.17	-0.84	0.399	-0.20	0.20	-1.00	0.317	-0.11	0.14	-0.75	0.450	-0.53	0.21	-2.52	0.012	-0.19	0.18	-1.05	0.293
Par																				
year	-0.01	0.01	-0.61	0.540	-0.01	0.02	-0.27	0.786	0.00	0.01	0.43	0.668	0.00	0.02	0.57	0.566	0.03	0.02	1.49	0.137
season	0.03	0.25	0.12	0.903	0.17	0.34	0.49	0.621	-0.14	0.17	-0.86	0.390	-0.16	0.31	-0.51	0.608	-1.75	0.42	-4.2	<0.001
sex	0.15	0.14	1.02	0.309	0.10	0.21	0.48	0.634	-0.08	0.12	-0.70	0.482	-0.20	0.19	-1.07	0.284	-0.11	0.22	-0.49	0.622
BC																				
year	-0.02	0.02	-1.39	0.165	-0.01	0.02	-0.53	0.598	0.00	0.01	0.47	0.637	0.02	0.02	0.99	0.321	-0.04	0.02	-1.85	0.065
season	-0.12	0.21	-0.59	0.558	0.21	0.25	0.86	0.392	0.18	0.19	0.94	0.346	0.09	0.22	0.43	0.664	-1.11	0.33	-3.42	<0.001
sex	0.02	0.17	0.10	0.921	-0.01	0.20	-0.03	0.974	-0.08	0.15	-0.58	0.558	-0.12	0.16	-0.72	0.468	-0.05	0.19	-0.28	0.780
Kos																				
year	0.01	0.04	0.13	0.894	-0.02	0.05	-0.38	0.703	0.04	0.02	1.71	0.087	0.00	0.04	-0.09	0.922	0.03	0.03	0.78	0.438
season	0.19	0.31	0.61	0.540	-0.04	0.35	-0.12	0.902	-0.22	0.19	-1.15	0.251	-0.02	0.32	-0.06	0.949	-0.11	0.28	-0.39	0.698
sex	0.09	0.23	0.41	0.681	-0.04	0.27	-0.16	0.873	-0.01	0.11	-0.11	0.912	0.03	0.20	0.17	0.861	0.00	0.17	0.03	0.972

Table S3. Summary of results from beta regression modelling of population, season, sex and inter-annual variation in the probability of consumption of key food groups in *Burramys parvus* (Mountain Pygmy-possum), including the migratory *Agrotis infusa* (Bogong moths), caterpillars (possibly *A. infusa* larvae) and other local arthropods. ^Kruskal-wallis test Pr(>Chisq)

Coefficients	Response variable											
	<i>Agrotis infusa</i>				Lepidopteran larvae				Local arthropods			
	Est	Std. Er	Z value	p value	Est	Std. Er	Z value	p value	Est	Std. Er	Z value	p value
Main Effects												
year	0.00	0.01	-0.27	0.785	0.01	0.008	1.44	0.150	-0.02	0.009	-2.32	0.021
season	1.32	0.15	8.70	<0.001	0.03	0.13	0.27	0.791	0.44	0.14	3.07	0.002
sex	0.06	0.10	0.62	0.539	-0.14	0.09	-1.58	0.113	-0.29	0.09	-3.02	0.002
site^	n/a	n/a	n/a	<0.001	n/a	n/a	n/a	<0.001	n/a	n/a	n/a	<0.001
Two-way Interactions												
year x season	-0.02	0.03	-0.56	0.574	-0.009	0.02	-0.35	0.723	-0.006	0.03	-0.24	0.807
year x sex	-0.02	0.02	-0.87	0.386	-0.003	0.02	-0.15	0.879	0.04	0.03	1.30	0.193
season x sex	0.29	0.30	0.98	0.325	-0.25	0.26	-0.97	0.333	-0.21	0.29	-0.69	0.485
Interactions at Site level												
CP												
year	0.00	0.02	-0.05	0.960	-0.01	0.02	-0.62	0.536	-0.03	0.02	-1.36	0.175
season	2.02	0.23	8.89	<0.001	-0.23	0.25	-1.18	0.240	0.35	0.26	1.34	0.179
sex	0.04	0.19	0.23	0.821	-0.09	0.25	-0.36	0.717	-0.44	0.27	-1.66	0.097
SR												
year	-0.01	0.02	-0.29	0.772	0.09	0.03	3.14	0.002	0.03	0.04	0.79	0.426
season	0.97	0.31	3.17	0.002	0.13	0.29	0.45	0.651	1.27	0.35	3.65	<0.001
sex	0.17	0.23	0.74	0.457	-0.20	0.23	-0.73	0.467	0.44	0.34	1.30	0.193
Par												
year	0.05	0.02	2.32	0.021	0.001	0.03	0.05	0.963	-0.02	0.03	-0.80	0.423
season	1.07	0.40	2.68	0.007	0.09	0.39	0.23	0.819	0.55	0.43	1.26	0.208
sex	0.12	0.25	0.49	0.627	-0.08	0.33	-0.25	0.799	-0.50	0.36	-1.38	0.17
BC												
year	0.08	0.02	3.38	0.001	-0.02	0.04	-0.55	0.579	0.03	0.04	0.702	0.483
season	1.66	0.29	5.71	<0.001	0.15	0.28	0.55	0.581	-0.11	0.32	-0.33	0.743
sex	0.17	0.23	0.74	0.461	-0.02	0.28	-0.07	0.946	-0.16	0.33	-0.49	0.617
Kos												
year	-0.12	0.06	-1.95	0.05	0.07	0.05	1.33	0.182	0.05	0.05	0.917	0.359
season	-0.04	0.42	-0.11	0.917	-0.02	0.35	-0.04	0.966	0.62	0.37	1.67	0.095
sex	-0.18	0.33	-0.56	0.58	-0.12	0.27	-0.44	0.656	-0.10	0.28	-0.36	0.718

Table S4. Effects of the spring (3 months to November) alpine microtherm growth index (gi) at each population site on the probability of *Burramys parvus* consumption of major food groups excluding *A. infusa* (seeds, fruits, pollen, Lepidopteran larvae and local arthropods). Lag responses represent the probability of consumption of the following year.

<i>Model</i>	Response variable																			
	Seeds				Fruits				Angiosperm Pollen				Lepidopteran larvae				Local arthropods			
	Est	Std. Er	z value	p value	Est	Std. Er	z value	p value	Est	Std. Er	z value	p value	Est	Std. Er	z value	p value	Est	Std. Er	z value	p value
response~gi_spring	1.04	0.93	1.12	0.262	-0.41	0.764	-0.54	0.587	-0.77	0.90	-0.85	0.392	-0.37	0.90	-0.42	0.676	-0.15	0.96	-0.16	0.871
response(lag)~gi_spring	-0.69	0.89	-0.78	0.436	-1.11	0.724	-1.53	0.126	-0.96	0.87	-1.11	0.268	0.87	0.87	0.99	0.318	-0.50	0.96	-0.52	0.602
Effects at Population Level																				
CP																				
response~gi1_spring	4.73	1.29	3.67	<0.001	-1.88	1.18	-1.60	0.110	-1.2	1.54	-0.78	0.435	1.03	1.72	0.56	0.550	-0.23	1.73	-0.13	0.894
response(lag)~gi1_spring	1.61	1.50	1.07	0.283	-0.64	1.18	-0.54	0.586	-1.1	1.51	-0.72	0.469	-1.76	1.66	-1.06	0.289	-3.17	1.54	-2.06	0.039
SR																				
response~gi1_spring	1.48	1.50	0.99	0.324	0.50	1.58	0.32	0.750	-1.87	2.07	-0.91	0.365	-0.83	2.19	-0.38	0.705	0.77	1.53	0.50	0.614
response(lag)~gi1_spring	1.52	1.57	0.97	0.333	1.48	1.59	0.93	0.350	-1.36	2.07	-0.66	0.511	4.48	2.02	2.22	0.026	1.21	1.77	0.68	0.495
Par																				
response~gi1_spring	1.88	1.95	0.96	0.336	-1.56	1.34	-1.16	0.245	-0.96	1.71	-0.56	0.578	0.86	1.50	0.57	0.568	2.09	1.98	1.06	0.288
response(lag)~gi1_spring	-1.39	1.94	-0.72	0.472	-1.35	1.33	-1.01	0.312	0.21	1.73	0.12	0.901	0.21	1.52	0.14	0.888	-2.12	1.94	-1.09	0.274
BC																				
response~gi1_spring	-3.69	1.97	-1.87	0.061	0.273	1.47	0.18	0.853	0.09	2.17	0.04	0.966	-1.05	1.42	-0.74	0.458	-0.82	1.44	-0.57	0.567
response(lag)~gi1_spring	-3.59	1.98	-1.81	0.070	-2.97	1.40	-2.11	0.035	-1.33	2.21	-0.60	0.548	1.81	1.41	1.29	0.196	-0.91	1.48	-0.61	0.539