Ecography

E7514
Gallagher, R. V., Hughes, L. and Leishman, M. R. 2012. Species loss and gain in communities under future climate change: consequences for functional diversity. – Ecography 35: xxx–xxx.

Supplementary material

Appendix 1. Sources used to compile list of climbing plant species in eastern Australian Littoral Rainforests

1) Advice to the Minister for the Environment, Water, Heritage and the Arts from the Threatened Species Scientific Committee on Amendments to the List of Ecological Communities under the *Environment Protection and Biodiversity Conservation Act 1999* Attachment A: Flora species of littoral rainforest and coastal vine thickets of eastern Australia by bioregion [and references therein]
2) NSW Atlas NPWS under YETI Licence
3) NSW Herbarium database of specimen records
4) Australian National Herbarium Specimen Information Register
5) Field surveys by Rachael V. Gallagher (Macquarie University) & Stuart Allen
6) Field survey data compiled by Dr. Colin Bale, Honorary Associate of University of New England, Armidale NSW. Field surveys were originally conducted by: Colin Bale, Alex G. Floyd (Coffs Harbour Herbarium), William F. J. McDonald (QLD Herbarium), Kevin Mills (ecologist in private consulting), Tony O'Malley the late John B. Williams (University of New England)
7) Bass Point Plan of Management (1999) Prepared by Robert Menindis Pty. Ltd.
8) DECC (2006) *Endangered Ecological Communities Survey and Mapping, Coastal Vegetation Communities – Littoral Rainforest and Coastal Saltmarsh*
9) NSW Scientific Committee - final determination: *Littoral rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community listing*
10) Southern Rivers Catchment Management Authority (2006) *Recognition and management of endangered ecological communities in the South East corner of NSW: A report by Jackie Miles for the Eurobodalla and Far South Coast Local Management Teams of the Southern Rivers Catchment Management Authority*

Appendix 2. Occurrence data points used to calibrate models

We calibrated 163 individual Maxent models; one for each of the following species (numbers in parentheses represent the number of occurrence points available to calibrate models):

Alyxia spicata (635)	*Comesperma volubile (1526)*	*Legnephora moorei (229)*	*Pycnarrhena novoguineensis (43)*
Alyxia stellata (32)	*Connarus conchocarpus (99)*	*Maclura cochinchinensis (213)*	*Rhagodia candolleana (1176)*
Aphanopetalum resinosum (303)	*Cynanchum carnosum (303)*	*Mallotus repandus (55)*	*Rhamnella vitiensis (70)*
Austrosteenisia blackii (296)	*Cynanchum elegans (54)*	*Marsdenia flavescens (99)*	*Rhynchosia acuminatissima (74)*
Billardiera scandens (811)	*Deeringia amaranthoides (321)*	*Marsdenia fraseri (75)*	*Ripogonum album (252)*
Caelospermum paniculatum (69)	*Deeringia arborescens (162)*	*Marsdenia hemiptera (45)*	*Ripogonum brevifolium (72)*
Caesalpinia bonduc (228)	*Derris involuta (121)*	*Marsdenia liisae (36)*	*Ripogonum discolor (129)*
Caesalpinia scortechinii (97)	*Derris trifoliata (105)*	*Marsdenia lloydii (63)*	*Ripogonum elseyanum (83)*
Caesalpinia subtropica (78)	*Desmodium brachypodum (355)*	*Marsdenia longiloba (46)*	*Ripogonum fawcettianum (53)*
Calamus australis (64)	*Desmodium nemorosum (100)*	*Marsdenia pleiadenia (156)*	*Rourea brachyandra (52)*
Calamus caryotoides (77)	*Desmodium rhytidophyllum (340)*	*Marsdenia rostrata (342)*	*Rubus moluccanus var trilobus (345)*
Calamus muelleri (93)	*Desmodium varians (386)*	*Marsdenia viridiflora (349)*	*Rubus moorei (49)*
Callerya megasperma (103)	*Dioscorea transversa (558)*	*Melodinus acutiflorus (142)*	*Rubus nebulosus (97)*
Calystegia marginata (160)	*Diplocyclos palmatus (314)*	*Melodinus australis (269)*	*Rubus parvifolius (597)*
Canavalia rosea (515)	*Echinostephia aculeata (69)*	*Melodorum leichhardtii (330)*	*Salacia chinensis (108)*
Cansjera leptostachya (121)	*Embelia australiana (139)*	*Melodorum uhrii (62)*	*Salacia disepala (83)*
Capparis ornans (32)	*Eustrephus latifolius (789)*	*Morinda canthoides (85)*	*Sarcopetalum harveyanum (192)*
Capparis sarmentosa (120)	*Flagellaria indica (626)*	*Morinda jasminoides (517)*	*Sarcostemma viminale (967)*
Capparis sepiaria (353)	*Freycinetia excelsa (125)*	*Mucuna gigantea (264)*	*Secamone elliptica (509)*
Carissa ovata (328)	*Freycinetia scandens (115)*	*Muehlenbeckia adpressa (874)*	*Sicyos australis (191)*
Carronia multisepalea (69)	*Geitonoplesium cymosum (426)*	*Muehlenbeckia gracillima (213)*	*Smilax australis (800)*
Cassytha glabella (1301)	*Glycine clandestina (1331)*	*Neosepicaea jucunda (55)*	*Smilax calophylla (37)*
Cassytha phaeolasia (54)	*Glycine microphylla (546)*	*Pachygone ovata (227)*	*Smilax glyciphylla (272)*
Cassytha pubescens (1190)	*Glycine tabacina (800)*	*Palmeria scandens (261)*	*Stephania japonica (653)*
Cayratia clematidea (278)	*Gymnanthera oblonga (321)*	*Pandorea jasminoides (119)*	*Stictocardia tiliifolia (31)*
Cayratia eurynema (31)	*Gynochthodes sessilis (35)*	*Pandorea pandorana (1188)*	*Tetragonia implexicoma (876)*
Celastrus australis (145)	*Hardenbergia violacea (1351)*	*Pararistolochia praevenosa (69)*	*Tetrastigma nitens (249)*
Celastrus subspicata (188)	*Hibbertia dentata (251)*	*Parsonsia fulva (102)*	*Tetrastigma thorsborneorum (38)*
Cephalaralia cephalobotrys (174)	*Hibbertia scandens (365)*	*Parsonsia induplicata (59)*	*Tinospora smilacina (622)*
Cissus antarctica (326)	*Hippocratea barbata (155)*	*Parsonsia longipetiolata (97)*	*Tinospora tinosporoides (41)*
Cissus cardiophylla (59)	*Hoya australis (463)*	*Parsonsia plaesiophylla (93)*	*Tragia novae-hollandiae (142)*
Cissus hastata (94)	*Hugonia jenkinsii (36)*	*Parsonsia rotata (88)*	*Trophis scandens (518)*
Cissus hypoglauca (333)	*Hydrocotyle acutiloba (225)*	*Parsonsia straminea (565)*	*Tylophora barbata (165)*
Cissus opaca (399)	*Hypserpa decumbens (140)*	*Parsonsia velutina (548)*	*Tylophora benthamii (165)*
Cissus repens (125)	*Hypserpa laurina (158)*	*Parsonsia ventricosa (138)*	*Tylophora paniculata (90)*
Cissus sterculiifolia (104)	*Jasminum dallachii (56)*	*Passiflora herbertiana (216)*	*Uvaria concava (46)*
Clematis aristata (684)	*Jasminum didymum (1580)*	*Petermannia cirrosa (96)*	*Vandasina retusa (116)*
Clematis fawcettii (67)	*Jasminum elongatum (63)*	*Piper novae-hollandiae (46)*	*ventilago pubiflora (54)*
Clematis glycinoides (693)	*Jasminum suavissimum (96)*	*Pisonia aculeata (220)*	*Vigna vexillata (468)*
Clerodendrum inerme (408)	*Jasminum volubile (33)*	*Pleogyne australis (127)*	*Zehneria mucronata (34)*
Colubrina asiatica (256)	*Kennedia rubicunda (592)*	*Pseudovanilla foliata (57)*	

An individual map for each species can be accessed using the Australian Virtual Herbarium (AVH) web portal: http://chah.gov.au/avh/public_query.jsp. Please note that the number of occurrence records listed for each species in the table above may vary slightly from the number reported in the AVH records as we also used BrisMAPPER data from the Queensland Herbarium which is not currently incorporated into the AVH. Figure 1 below shows the distribution of all species occurrences points used to calibrate Maxent models of habitat suitability in this study.

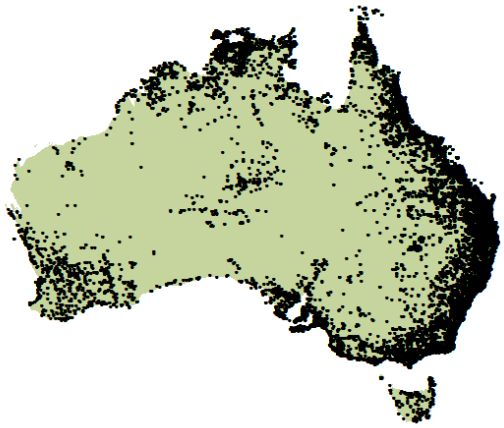

Figure S1. Combined distribution of all occurrence points used to calibrate Maxent models of climbing plants. The average number of georeferenced locations compiled for each species was 285, and varied between 31 and 1580 across the 163 species.

Appendix 3. Methods used to derive future climate surfaces from atmosphere-earth general circulation models

Raw data from GCM model runs was accessed through the Coupled Model Intercomparison Project website (http://cmip-pcmdi.llnl.gov/). We used the Climate of the 20th Century data provided for each GCM to generate a mean modeled baseline climate for the period 1960 to 2000. We then interpolated monthly maximum and minimum temperature, and precipitation data in 5-year blocks centered on 2050 to a 5 arc minute resolution for each GCM, and produced differences (anomalies) between each GCM baseline and the corresponding monthly temperature and precipitation data. These anomalies were added to monthly data for observed long-term baseline climate represented by the Wordclim data (www.worldclim.org) and averaged to provide the climate surface for 2050.

Appendix 4. Sources used to compile trait data

Brisbane Rainforest Action & Information Network
http://www.brisrain.webcentral.com.au/

Cooper, W. & Cooper, W. T. (2004) *Fruits of the Australian tropical rainforest.* Nokomis Editions, Melbourne.

Edwards & Krockenberger (2006) Seedling mortality due to drought and fire associated with the 2002 El Nino event in a tropical rainforest in north-east Queensland, Australia. *Biotropica*, **38**, 16-26.

Flora of Australia online (http://www.anbg.gov.au/abrs/online-resources/flora/)

Forster (1995) Circumscription of *Marsdenia* (Asclepiadaceae: Marsdenieae) with a revision of the genus in Australia and Papuasia. *Aust. Syst. Bot.*, 8, 703-933.

Hyland, B. P. M., Whiffin, T., Christophel, D. C., Gray, B. & Elick, R. W. (2003) Australian tropical rain forest plants. *Trees, shrubs and vines.* CD-ROM. CSIRO Publishing, Canberra.

Legume Web (http://www.ildis.org/LegumeWeb/)

NSW Flora Online (http://plantnet.rbgsyd.nsw.gov.au/)

Royal Botanic Gardens Kew Seed Information Database (http://data.kew.org/sid)

Appendix 5. Converting seed volume to seed mass

Seed measurements (length, width, breadth) for 87 species were compiled from floras and published sources. Seed mass measurements were known for 36 of these species and we used this data to model a predictive relationship between seed volume (length * width * breadth * π/6) and mass using linear regression following the methods outlined in Wright *et al.* (2007) (Fig. 1). Both mass and volume measurements were log10 transformed to reduce skew in the raw data.

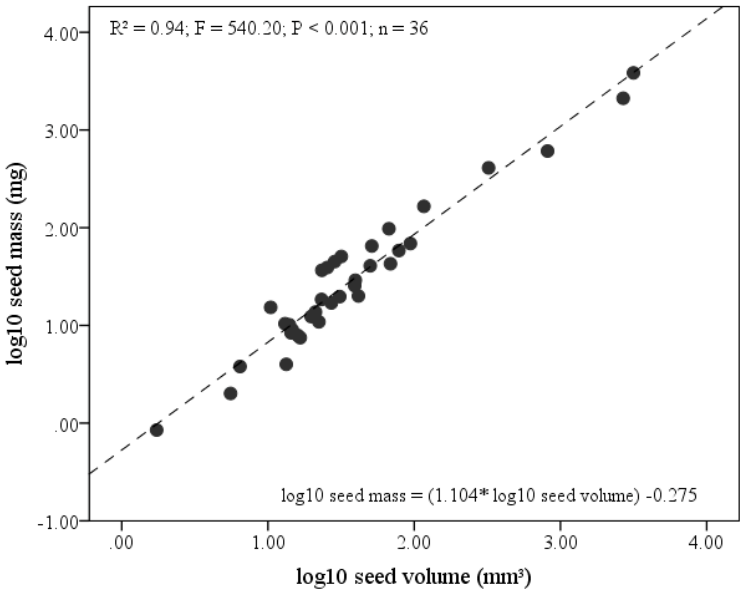

Figure A1. Relationship between log10 seed mass and log10 seed volume for 36 species of climbing plants from littoral rainforests in eastern Australia.

References

Wright, I. J et al. 2007. Relationships among ecologically important dimensions of plant trait variation in seven neotropical forests. - Ann. Bot. 99: 1003-1015.

Figure A2a. Comparative histograms of seed mass (cm^2) in climbing plant communities derived from baseline and 2050 climate conditions (a) Wooyung Nature Reserve, (b) Iluka Nature Reserve, (c) Bongil Bongil National Park, (d) Sea Acres Nature Reserve, (e) Myall Lakes National Park, (f) Wyrrabalong National Park, (g) Bass Point Reserve, (h) Beecroft Peninsula, (i) Mimosa Rocks National Park.

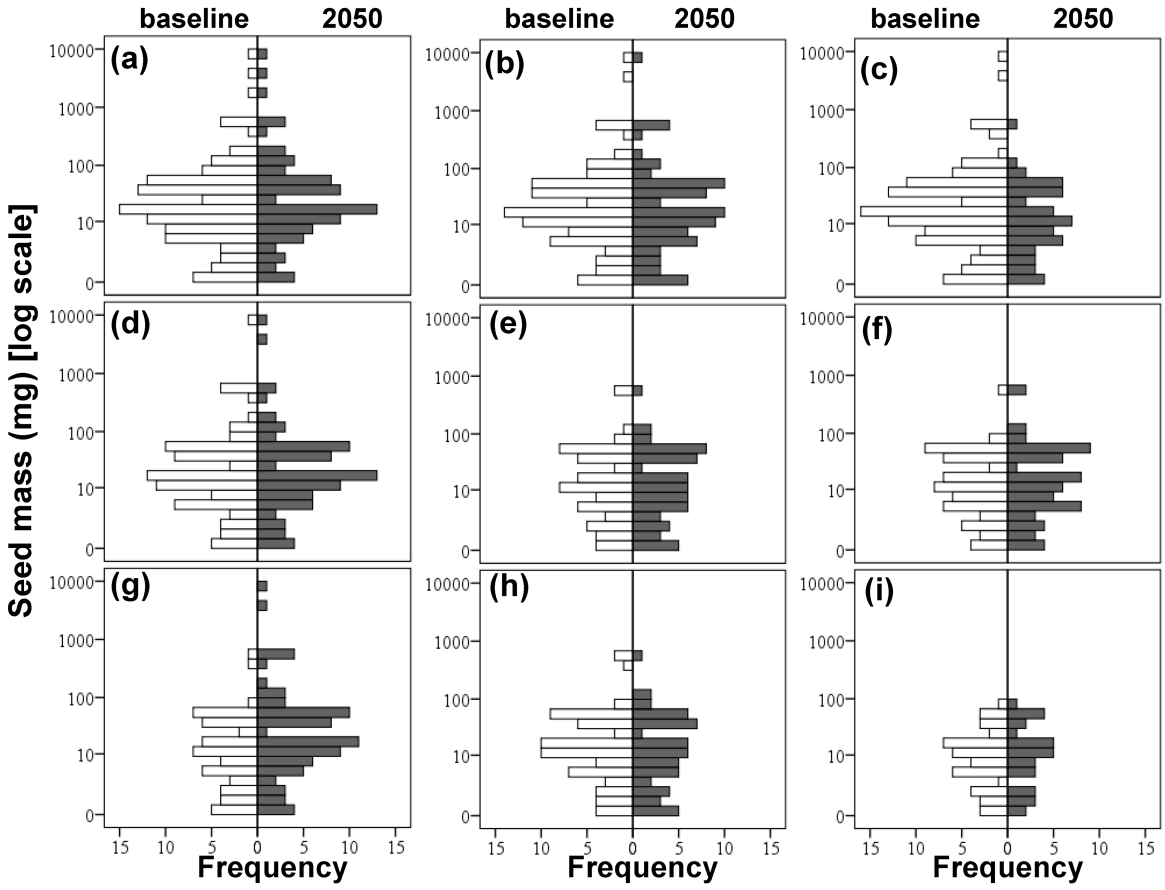

Figure A2b. Stacked bar graphs showing the proportion of species with each climbing mechanism in baseline (1950-2000) and 2050 littoral rainforest climbing plant communities. (a-f) follow reserve names presented in Figure A1a.

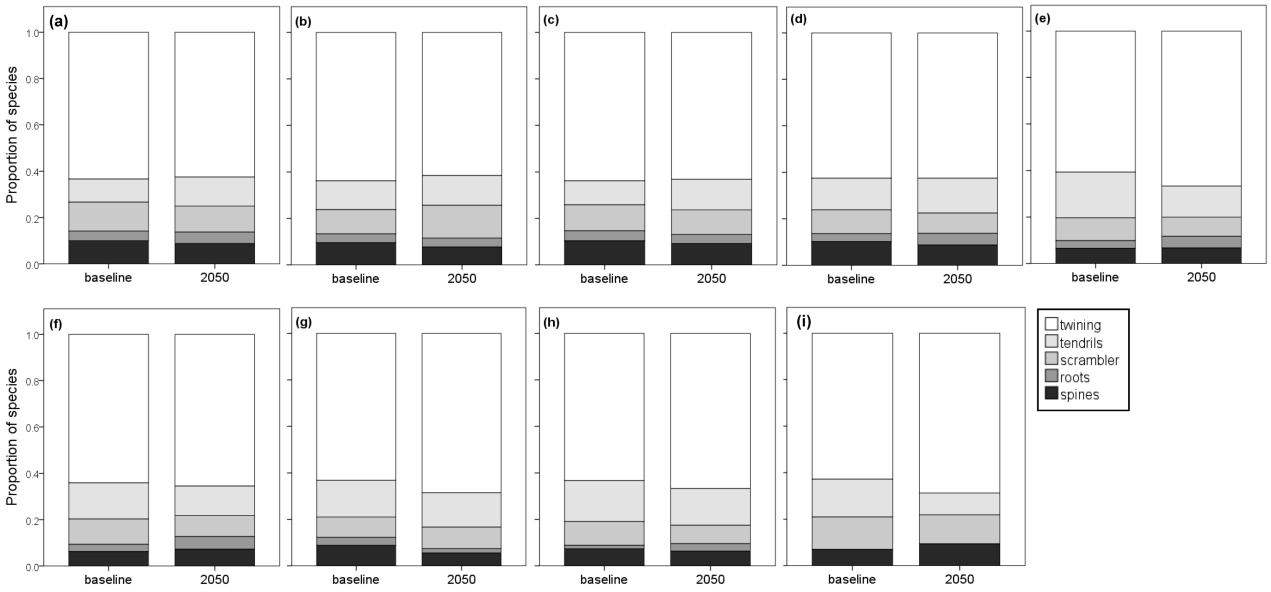

Figure A2c. Stacked bar graphs showing the proportion of species with each dispersal mode in baseline (1950-2000) and 2050 littoral rainforest climbing plant communities (a-f) follow reserve names presented in Figure A1a.

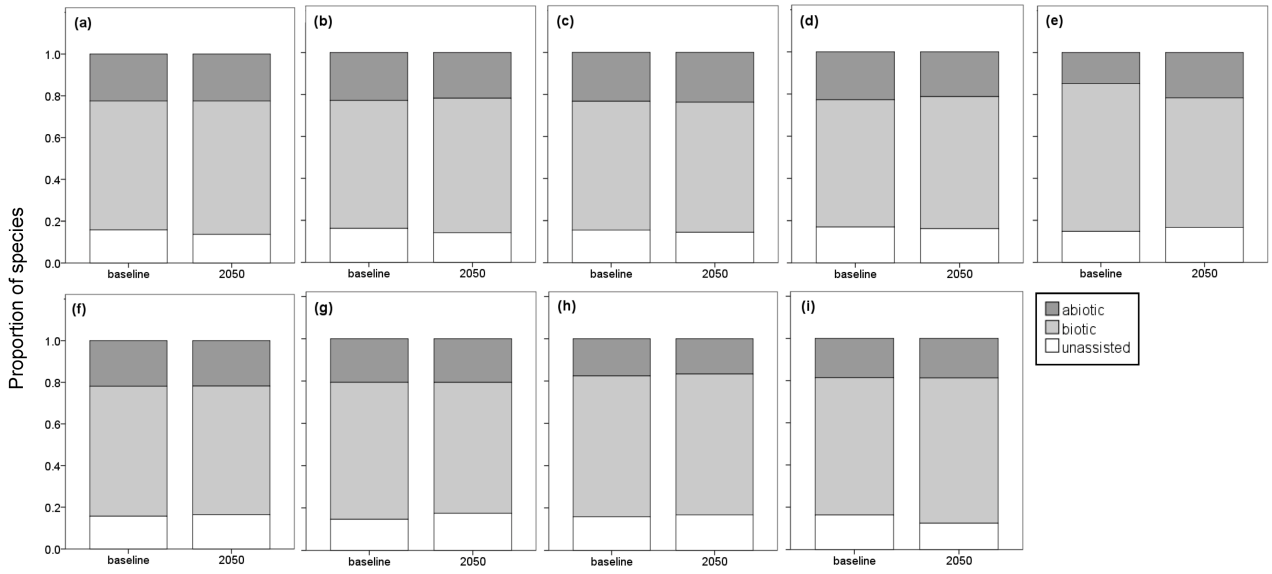

Figure A2d. Stacked bar graphs showing the proportion of species with each growth habit in baseline (1950-2000) and 2050 littoral rainforest climbing plant communities (a-f) follow reserve names presented in Figure A1a.

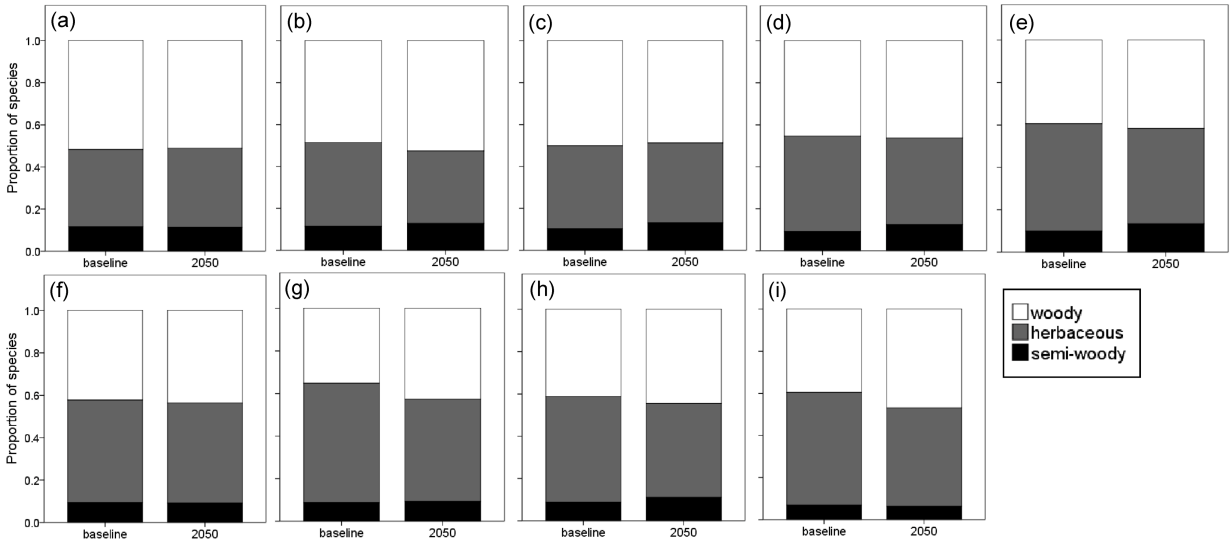

Figure A3. Non-metric multidimensional scaling plots of functional dispersion for seven communities under baseline and 2050 climate conditions (a) Iluka Nature Reserve, (b) Sea Acres Nature Reserve, (c) Myall Lakes National Park, (d) Wyrrabalong National Park, (e) Bass Point Reserve, (f) Beecroft Peninsula, (g) Mimosa Rocks National Park.

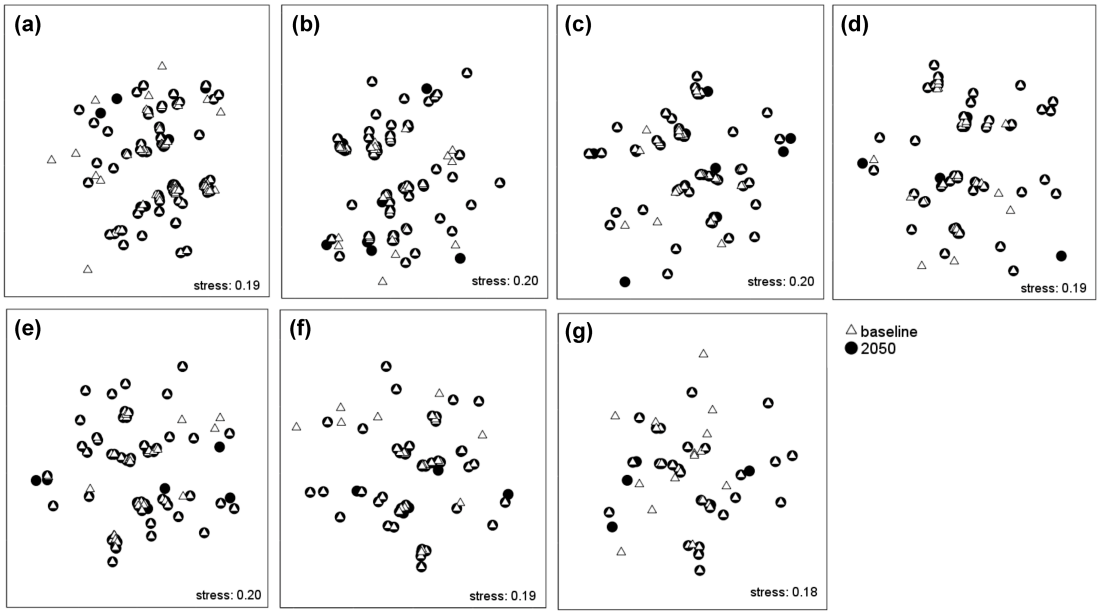

Table A1. Results of tests comparing the distribution and proportion of trait values in nine littoral rainforest climbing plant communities under baseline (1950-2000) and 2050 climate conditions. Two-sample Kolmogorov-Smirnov tests and chi-squared statistics were used to test for differences in continuous and categorical traits respectively.

	Leaf area (cm^2)		**Seed mass (mg)**		**Climbing mechanism**		**Dispersal mode**		**Growth habit**	
Littoral rainforest community	**K-S**	***P***	**K-S**	***P***	χ^2	***P***	χ^2	***P***	χ^2	***P***
Wooyung Nature Reserve	0.49	0.97	0.40	1.00	0.43	0.98	0.17	0.92	0.02	0.99
Iluka Nature Reserve	0.52	0.95	0.23	1.00	0.71	0.95	0.43	0.80	0.56	0.76
Bongil Bongil National Park	0.56	0.91	0.39	1.00	0.41	0.98	0.16	0.92	0.36	0.84
Sea Acres Nature Reserve	0.2	1.00	0.17	1.00	0.50	0.97	0.18	0.91	0.63	0.73
Myall Lakes National Park	0.5	0.96	0.16	1.00	0.89	0.60	1.14	0.56	0.57	0.75
Wyrrabalong National Park	0.22	1.00	0.35	1.00	0.71	0.95	0.02	0.99	0.03	0.99
Bass Point Reserve	0.20	1.00	0.24	1.00	0.94	0.83	0.02	0.99	1.06	0.59
Beecroft Peninsula	0.33	1.00	0.27	1.00	0.78	0.94	0.06	0.97	0.27	0.87
Mimosa Rocks National Park	0.48	0.98	0.31	1.00	0.29	0.96	0.22	0.90	0.41	0.82