Ecography

ECOG-03849
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Supplementary material

Appendix 1.

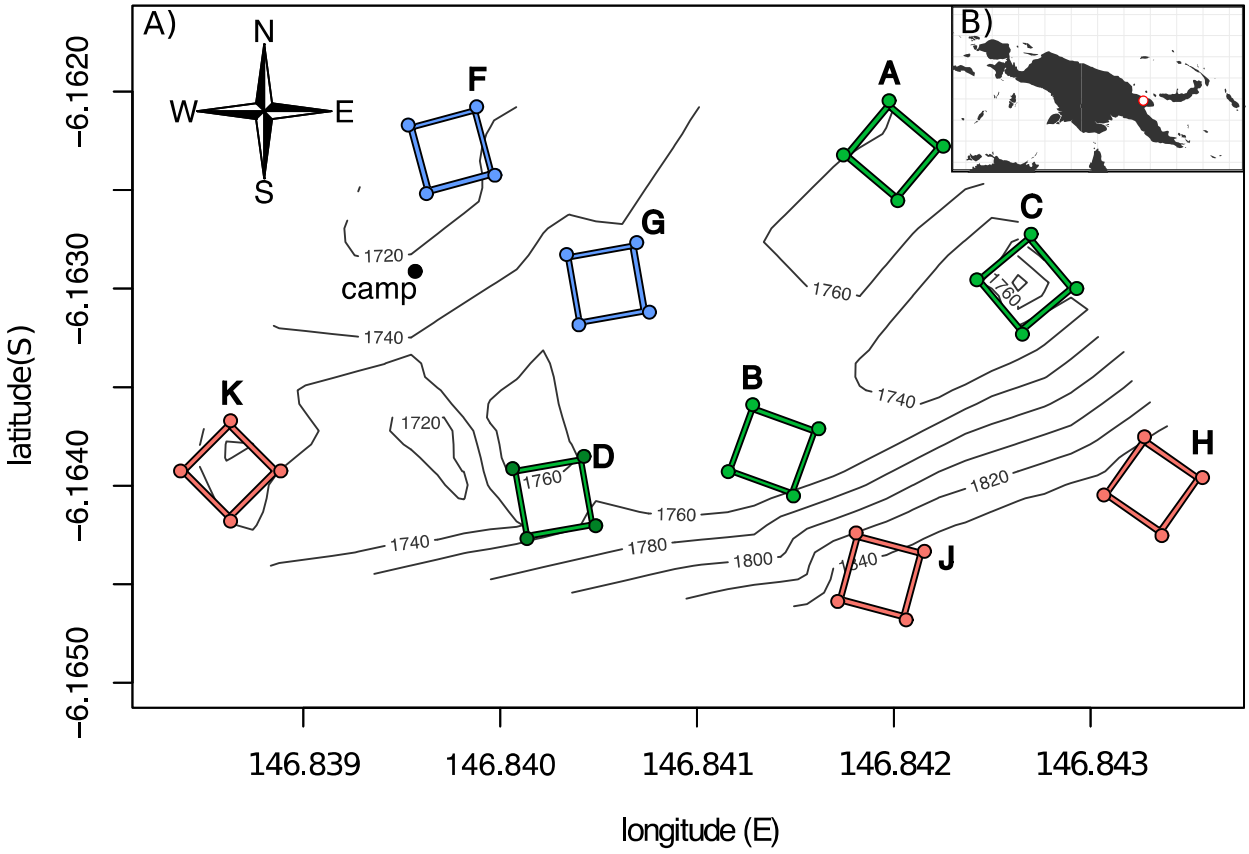

Figure A1. A- Location map of the nine 0.2ha montane forest plots sampled in Yawan, Papua New Guinea. Blue squares = Young secondary, Red squares = Mature secondary and Green squares = Primary plots.

B- Top right panel shows the location of Yawan on a map of Papua New Guinea marked as a red and white circle.

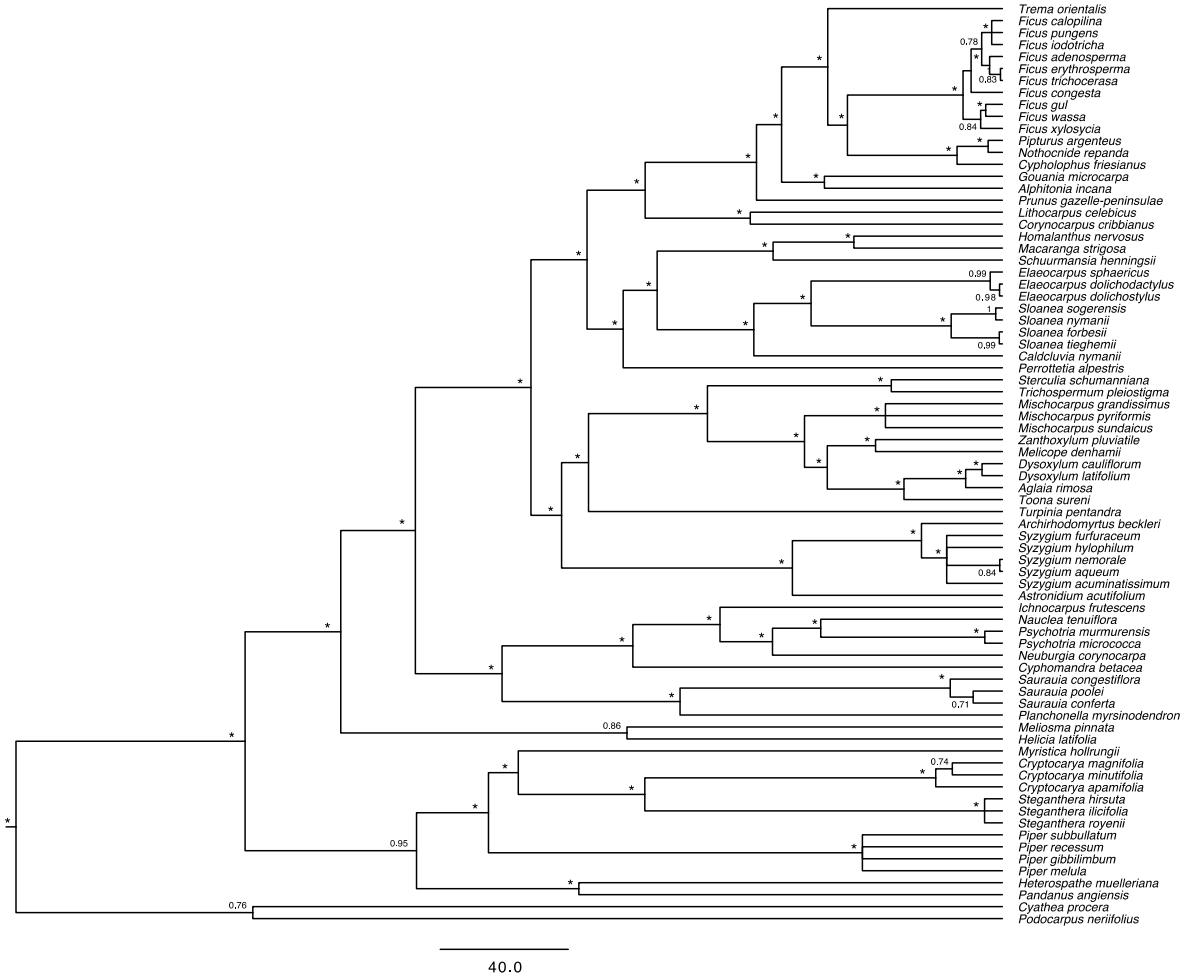

Figure A2. Reconstructed plant phylogeny of a montane rainforest community in Papua New Guinea. Host phylogeny was reconstructed using two loci: rbcL, and psbA-trnH, with these sequences located in the Barcode of Life Database (BOLD). DNA extraction, amplification and sequencing was carried out at the Canadian Centre for DNA Barcoding following standard protocols and administrated through the BOLD system. Existing sequences were sourced from online databases if available. Sequences were assembled and edited using Geneious 5.4 (Kearse et al. 2012). Host phylogeny was reconstructed using Bayesian inference as implemented in BEAST v2.4 (Drummond et al. 2012). The following substitution models were selected based on BIC computed in JModelTest 2 (Darriba et al. 2012) and were used for individual loci: rbcL: GTR+I+G, psbA-trnH: TIM1+I+G. The topology was constrained using Phylomatic 3 (Webb and Donoghue 2005). A log-normal relaxed molecular clock following Bell et al. (2010), dating based on Wikström et al. (2001) and clock rates based on Palmer (1991) were used for time-calibrating the phylogeny. Sampling was carried out every 10^3

generations for $2x10^7$ generations, the first 10% of all generations were discarded as 'burn in' and the results were summarized with a majority-rule consensus tree. All branches with posterior probability below 0.7 were treated as polytomies. Values at nodes represent posterior probabilities, nodes with a posterior probability of <0.7 were treated as polytomies. Asterisks indicate nodes that were constrained using Phylomatic 3 (Webb & Donoghue 2005). The scale represents time calibration, with dating based on Wikström, Savolainen & Chase (2001).

Table A1. Host plant taxonomic information, network host code, abundance according to number of individuals and basal area, and the number of associated herbivore interactions.

Plant Identifications	Network Code	Individuals	Basal Area (cm2)	Herbivore Interactions
Acanthaceae				
Graptophyllum pictum	na	1	27.5	0
Actinidiaceae				
Saurauia conferta	p67	156	8403.4	74
Saurauia congestiflora		4	263.1	
Saurauia poolei	p68	93	6082.2	126
Saurauia schumanniana	p69	34	1606.7	6
Anacardiaceae				
Rhus taitensis	na	4	211.7	0
Apocynaceae				
Ichnocarpus frutescens	p40	2	54.4	8
Araliaceae				
Gastonia spectabilis	na	6	869.2	0
Schefflera setulosa	na	13	480.3	0
Schefflera waterhousei	na	1	68.9	0
Arecaceae				
Heterospathe muelleriana	p38	24	1481.9	2
Asparagaceae				
Cordyline terminalis	na	1	32.5	0
Aspleniaceae				
Asplenium nidus	na	1	30.5	0

Athyriaceae				
Diplazium esculentum	na	1	58.9	0
Celastraceae				
Perrottetia alpestris	p56	19	1248.0	46
Clusiaceae				
Garcinia latissima	na	1	103.9	0
Corynocarpaceae				
Corynocarpus cribbianus	p8	2	101.4	63
Cunoniaceae				
Caldcluvia nymanii	p6	10	820.2	32
Cyatheaceae				
Cyathea auriculifera	p12	9	472.3	23
Cyathea contaminans	p13	111	7587.1	490
Cyathea procera	p14	1	32.5	2
Cyathea runensis	na	1	52.4	0
Cyathea werneri	na	1	86.4	0
Dicksoniaceae				
Dicksonia sciurus	p17	12	753.4	91
Elaeocarpaceae				
Elaeocarpus dolichodactylus	p20	33	3199.2	251
Elaeocarpus dolichostylus	p21	62	5802.9	3014
Elaeocarpus multisectus	na	2	75.4	0
Elaeocarpus sayeri	na	1	70.9	0
Elaeocarpus schlechterianus	p22	3	620.6	4
Elaeocarpus sphaericus	p23	32	2658.2	2253
Sloanea forbesii	p71	14	991.6	33
Sloanea nymanii	p72	6	840.8	43
Sloanea sogerensis	p73	10	964.7	117
Sloanea tieghemii	p74	54	5978.5	557
Euphorbiaceae				
Homalanthus nervosus	p39	224	11575.0	360
Homalanthus novoguineensis	na	6	301.1	0
Macaranga inermis	p42	2	116.8	19
Macaranga pleiostemona	p43	5	177.7	32
Macaranga polyadenia	na	1	78.4	0
Macaranga strigosa	p44	39	1950.7	760
Fabaceae				

Caesalpinia crista	na	4	115.8	0
Fagaceae				
Castanopsis acuminatissima	na	1	77.4	0
Lithocarpus celebicus	p41	10	536.7	658
Gesneriaceae				
Cyrtandra erectiloba	na	9	269.1	0
Himantandraceae				
Galbulimima belgraveana	na	1	27.5	0
Lauraceae				
Actinodaphne nitida	na	1	58.4	0
Cryptocarya apamifolia	p9	12	604.6	16
Cryptocarya magnifolia	p10	5	338.5	5
Cryptocarya minutifolia	p11	6	339.0	3
Cryptocarya multipaniculata	na	1	33.5	0
Cryptocarya pulchella	na	1	35.4	0
Cryptocarya viridiflora	na	2	52.9	0
Persea americana	na	3	393.4	0
Loganiaceae				
Neuburgia corynocarpa	p53	9	1113.4	9
Malvaceae				
Sterculia schlechteri	na	1	79.9	0
Sterculia schumanniana	p78	6	697.0	7
Trichospermum pleiostigma	na	59	6275.5	419
Melastomataceae				
Astronidium acutifolium	p4	11	787.4	16
Astronidium morobiense	p5	2	162.8	3
Meliaceae				
Aglaia brassii	na	1	65.5	0
Aglaia rimosa	p1	32	2164.0	87
Dysoxylum brevipaniculum	na	2	197.2	0
Dysoxylum cauliflorum	p18	1	69.9	14
Dysoxylum latifolium	p19	4	654.5	2
Dysoxylum parasiticum	na	2	178.7	0
Toona sureni	p85	4	143.3	4
Monimiaceae				
Kibara coriacea	na	2	70.4	0
Palmeria arfakiana	na	2	118.3	0

Steganthera hirsuta	p75	1	30.0	10
Steganthera hospitans	na	1	26.0	0
Steganthera ilicifolia	p76	3	346.1	19
Steganthera royenii	p77	7	685.8	49
Moraceae				
Artocarpus lacucha		1	31.0	0
Ficus adenosperma	p24	18	867.2	68
Ficus calopilina	p25	19	1394.5	62
Ficus congesta	p26	63	4225.9	100
Ficus copiosa	na	1	63.4	0
Ficus dammaropsis	na	5	155.3	0
Ficus erythrosperma	p27	36	1347.1	48
Ficus gul	p28	8	619.1	6
Ficus hombroniana	na	3	114.3	0
Ficus iodotricha	p29	19	1493.1	30
Ficus melinocarpa	na	1	71.9	0
Ficus morobensis	na	1	34.0	0
Ficus pachyclada	p30	1	129.3	3
Ficus pungens	p31	12	885.2	2
Ficus trichocerasa	p32	10	680.0	4
Ficus wassa	p33	31	2266.4	78
Ficus xylosycia	p34	2	649.3	2
Streblus glaber	na	1	31.5	0
Trophis philippinensis	na	1	64.9	0
Musaceae				
Musa peekelii	na	7	680.0	0
Myristicaceae				
Myristica hollrungii	p51	1	48.9	4
Myristica lancifolia	na	1	132.8	0
Myristica subalulata	na	61	2454.5	0
Myrsinaceae				
Rapanea involucrata	na	8	251.1	0
Myrtaceae				
Archirhodomyrtus beckleri	p3	1	50.9	2
Syzygium acuminatissimum	p79	22	1096.9	9
Syzygium aqueum	p80	1	231.7	10
Syzygium decipiens	p81	5	240.7	2

Syzygium furfuraceum	p82	30	2110.1	13
Syzygium hylophilum	p83	7	341.5	20
Syzygium nemorale	p84	2	138.8	4
Syzygium versteegii	na	11	847.7	0
Ochnaceae				
Schuurmansia henningsii	p70	9	438.9	2
Oleaceae				
Chionanthus ramiflora	p7	4	167.3	7
Pandanaceae				
Pandanus adinobotrys	na	18	588.2	0
Pandanus angiensis	p55	79	5253.6	12
Pandanus rostellatus	na	18	703.9	0
Piperaceae				
Piper aduncum	na	4	113.8	0
Piper gibbilimbum	p57	135	4731.7	273
Piper melula	p58	34	1055.5	27
Piper recessum	p59	73	2200.3	4
Piper subbullatum	p60	21	713.5	5
Pittosporaceae				
Pittosporum ramiflorum	na	1	30.0	0
Podocarpaceae				
Podocarpus neriifolius	p63	1	101.4	279
Proteaceae				
Helicia latifolia	p37	1	99.4	7
Rhamnaceae				
Alphitonia incana	p2	7	519.8	202
Gouania microcarpa	p35	4	136.3	148
Rosaceae				
Prunus dolichobotrys		1	29.5	0
Prunus gazelle-peninsulae	p64	3	83.4	14
Rubus diclinis		1	27.0	0
Rubiaceae				
Mussaenda ferruginea	p50	2	52.9	5
Nauclea tenuiflora	na	14	1020.3	92
Psychotria micrococca	p65	10	329.5	11
Psychotria murmurensis	p66	4	142.8	2
Timonius densiflorus	na	1	154.8	0
Uncaria nervosa	na	1	32.5	0
Rutaceae				

Melicope denhamii	p45	16	1147.8	9
Melicope elleryana	na	8	345.5	0
Zanthoxylum pluviatile	p89	10	696.0	6
Sabiaceae				
Meliosma pinnata	p46	11	870.2	4
Salicaceae				
Flacourtia zippelii	na	2	90.4	0
Sapindaceae				
Guioa subsericea	p36	1	32.0	11
Mischocarpus grandissimus	p47	1	46.4	2
Mischocarpus largifolius	na	1	44.4	0
Mischocarpus pyriformis	p48	7	379.5	72
Mischocarpus sundaicus	p49	4	141.8	26
Sapotaceae				
Planchonella myrsinodendron	p62	1	94.9	2
Solanaceae				
Cyphomandra betacea	p16	42	1521.3	20
Staphyleaceae				
Turpinia pentandra	p88	65	4271.6	131
Symplocaceae				
Symplocos cochinchinensis	na	1	43.2	0
Tetramelaceae				
Tetrameles nudiflora	na	1	79.9	0
Ulmaceae				
Trema orientalis	p86	5	453.3	382
Urticaceae				
Cypholophus friesianus	p15	7	230.7	2
Debregeasia longifolia	na	1	27.5	0
Dendrocnide cordata	na	4	402.9	0
Nothocnide melastomatifolia	na	1	31.5	0
Nothocnide repanda	p54	2	154.8	1
Pipturus argenteus	p61	30	2564.6	411
Vitaceae				
Cayratia trifolia	na	1	34.0	0
Winteraceae				
Bubbia sylvestris	na	1	37.4	0

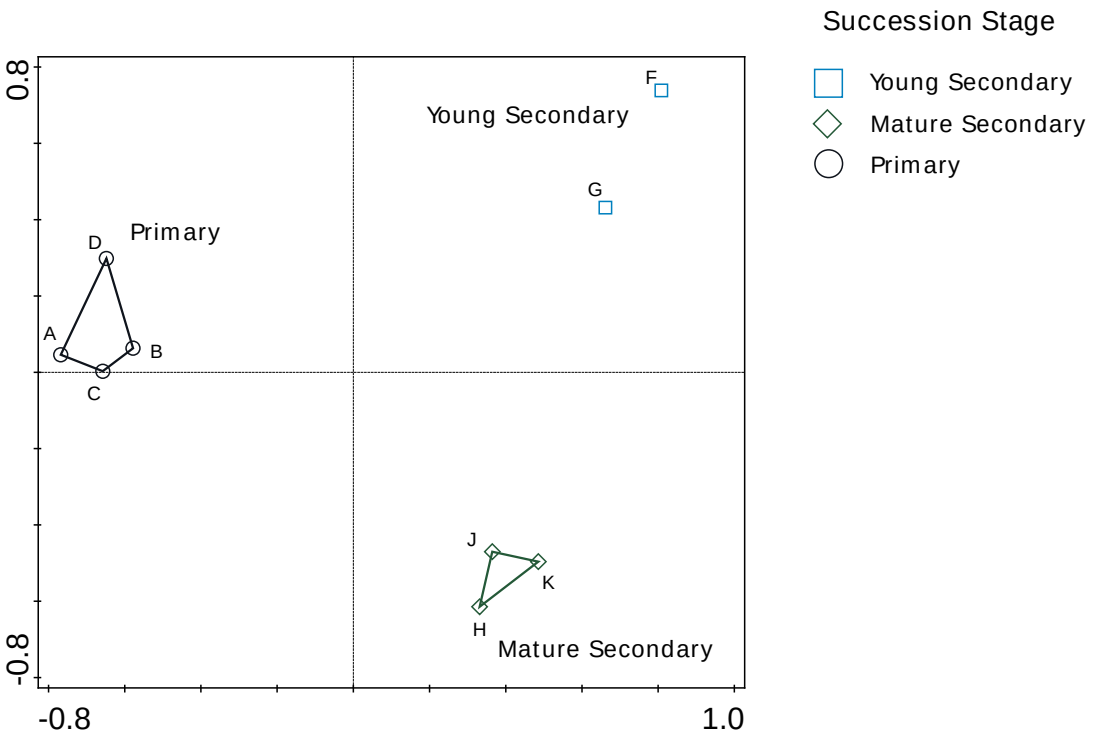

Figure A3. Principal components analysis (PCA) of host communities (>5cm dbh) and successional stage in montane rainforest in Papua New Guinea. Young secondary (~ 9 years since disturbance) plots are represented by blue squares, mature secondary (~ 25 years) plots by diamonds, and primary forest (>100 years) plots by circles. First canonical axis eigenvalue = 0.372 and the second = 0 .186, with the combined variation explained = 54.85%.

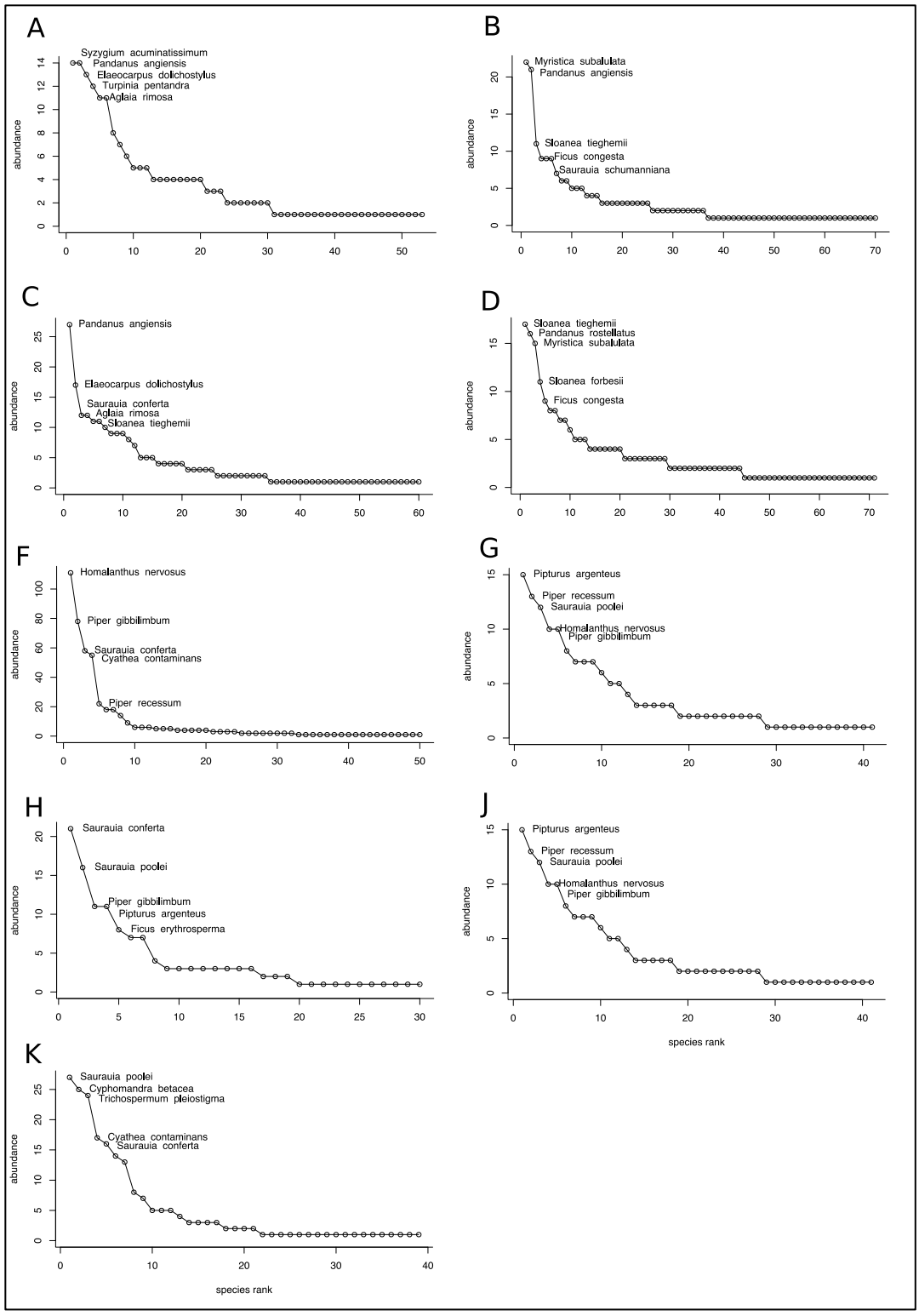

Figure A4. Dominance curves of host communities (>5cm dbh) in montane forest in Papua New Guinea. Primary forest plots (A,B,C,D), Young Secondary (F,G) and Mature Secondary (H,J,K) with labels for the 5 most dominant species in those plots.

Table A2. Herbivore (Lepidoptera) taxonomic information, total species abundance, and abundance in each succession stage. Species BIN numbers provided, further details may be found on the Barcode of Life Database. Asterisk indicate a species placement based upon phylogenetic inference.

				Abundance/Succession Stage		
Family	Species	BIN Number	Total	Young Secondary	Mature Secondary	Primary
Plutellidae	*Plutella sp. AAA1513*	BOLD:AAA1513	5	0	1	4
Crambidae	*Meekiaria sp. AAA3383*	BOLD:AAA3383	9	0	0	9
Erebidae	*Asota sp. AAA5335*	BOLD:AAA5335	2	0	2	0
Noctuidae	*Condica illecta*	BOLD:AAB2411	2	0	2	0
Noctuidae	*Tiracola sp. AAB5638*	BOLD:AAB5638	2	2	0	0
Choreutidae	*Choreutis sp. AAB5921*	BOLD:AAB5921	7	0	7	0
Choreutidae	*Choreutis cf. porphyratma*	BOLD:AAC0560	5	0	5	0
Geometridae	*Paradromulia sp. AAC1158*	BOLD:AAC1158	5	5	0	0
Choreutidae	*Choreutis niphocrypta*	BOLD:AAC1274	9	5	0	4
Tortricidae	*Adoxophyes nr. marmarygodes*	BOLD:AAC1387	246	138	8	100
Crambidae	*Herpetogramma stultalis*	BOLD:AAC2327	2	0	0	2
Geometridae	*Petelia sp. AAC2735*	BOLD:AAC2735	3	0	3	0
Choreutidae	*Choreutis sp. AAC7453*	BOLD:AAC7453	2	2	0	0
Nolidae	*Etanna brunnea*	BOLD:AAC9321	3	3	0	0
Crambidae	*Talanga exquisitalis*	BOLD:AAD8828	104	20	48	36
Sphingidae	*Gnathothlibus meeki*	BOLD:AAE7108	12	7	4	1
Geometridae	*Craspedosis aurigutta*	BOLD:AAE9296	25	6	17	2
Erebidae	*Catada apoblepta*	BOLD:AAF1549	24	0	0	24
Nolidae	*Earias uniplaga*	BOLD:AAF6217	6	6	0	0
Tortricidae	*sp. AAF9348*	BOLD:AAF9348	16	6	5	5
Tortricidae	*sp. AAF9349*	BOLD:AAF9349	26	4	14	8
Tortricidae	**Isotenes sp. AAF9350*	BOLD:AAF9350	4	4	0	0
Geometridae	*sp. AAF9464*	BOLD:AAF9464	2	0	0	2
Noctuidae	*Chasmina tibiopunctata*	BOLD:AAG6014	3	1	2	0
Erebidae	*Metaemene sp. AAI1490*	BOLD:AAI1490	4	4	0	0
Crambidae	*Meekiaria sp. AAL5545*	BOLD:AAL5545	4	0	0	4
Nolidae	*Gadirtha impingens*	BOLD:AAL6729	3	3	0	0
Notodontidae	*Chadisra striata*	BOLD:AAL8395	4	4	0	0
Geometridae	*Craspedosis sp. AAM0235*	BOLD:AAM0235	4	0	0	4
Erebidae	*Hypena gonosp.ilalis*	BOLD:AAM0874	10	0	10	0
Thyrididae	*Mellea sp. AAM5436*	BOLD:AAM5436	25	14	0	11
Geometridae	**Ascotis sp. AAM6936*	BOLD:AAM6936	6	6	0	0
Tortricidae	*sp. AAM7269*	BOLD:AAM7269	16	8	6	2
Noctuidae	*Tiracola sp. AAM9672*	BOLD:AAM9672	4	4	0	0
Crambidae	*Udea sp. AAO2713*	BOLD:AAO2713	2	2	0	0
Erebidae	*Ophyx owgarra*	BOLD:AAO3382	10	0	5	5
Thyrididae	*Mellea sp. AAO4080*	BOLD:AAO4080	16	0	16	0
Erebidae	*Axiocteta sp. AAO4116*	BOLD:AAO4116	6	0	2	4
Crambidae	*Omiodes sp. AAO4249*	BOLD:AAO4249	3	0	0	3
Tortricidae	*Rhabdotenes sp. AAP2731*	BOLD:AAP2731	7	0	7	0
Geometridae	*sp. AAP2900*	BOLD:AAP2900	102	74	10	18
Tortricidae	*Adoxophyes sp. AAP5694*	BOLD:AAP5694	92	42	4	46
Tortricidae	*sp. AAP6512*	BOLD:AAP6512	6	2	3	1
Erebidae	**Euproctis sp. AAP7433*	BOLD:AAP7433	2	0	0	2
Tortricidae	*sp. AAP7648*	BOLD:AAP7648	6	4	0	2
Erebidae	*Ophyx sp. AAQ2186*	BOLD:AAQ2186	52	9	19	24
Tortricidae	*Thaumatotibia sp. AAW6610*	BOLD:AAW6610	4	4	0	0
Pyralidae	*Faveria sp. AAY6061*	BOLD:AAY6061	37	37	0	0

Erebidae	*Lambula sp. AAY6219*	BOLD:AAY6219	24	1	5	18
Erebidae	*Calliteara sp. ABW5916*	BOLD:ABW5916	3	3	0	0
Erebidae	*Euproctis sp. ABW8356*	BOLD:ABW8356	2	0	2	0
Geometridae	*Paradromulia rufibrunnea*	BOLD:ABW8597	24	1	1	22
Geometridae	sp. ADF6011	BOLD:ADF6011	3	0	0	3
Noctuidae	*Tiracola aureata*	BOLD:ABX5542	5	5	0	0
Geometridae	*Craspedosis aurigutta*	BOLD:ABX6387	18	0	17	1
Tortricidae	*Dudua sp. ABY6340*	BOLD:ABY6340	3	3	0	0
Erebidae	*Olene sp. ABY9175*	BOLD:ABY9175	25	0	20	5
Crambidae	*Pycnarmon nr. dryocentra*	BOLD:ABZ0583	4	0	0	4
Gelechiidae	*Dichomeris sp. ABZ6084*	BOLD:ABZ6084	320	0	320	0
Geometridae	*sp. ACA3495*	BOLD:ACA3495	6	6	0	0
Geometridae	*Alcis irrufata*	BOLD:ACA8529	39	14	3	22
Geometridae	*Casbia sp. ACB0448*	BOLD:ACB0448	16	16	0	0
Geometridae	*Prasinocyma sp. ACB0527*	BOLD:ACB0527	7	0	0	7
Geometridae	*sp. ACB0687*	BOLD:ACB0687	35	32	0	3
Geometridae	*sp. ACB1815*	BOLD:ACB1815	2	0	0	2
Geometridae	*Gymnoscelis sp. ACB8931*	BOLD:ACB8931	200	200	0	0
Geometridae	*Paradromulia sp. ACB8986*	BOLD:ACB8986	35	5	9	21
Crambidae	*Agrotera semipictalis*	BOLD:ACD3447	3	3	0	0
Tortricidae	*sp. ACD3548*	BOLD:ACD3548	3	3	0	0
Tortricidae	*Diadelomorpha sp. ACD3549*	BOLD:ACD3549	27	8	10	9
Tortricidae	**Cryptoptila sp. ACD3622*	BOLD:ACD3622	2	0	0	2
Tortricidae	*sp. ACD3790*	BOLD:ACD3790	11	0	0	11
Tortricidae	*sp. ACD3861*	BOLD:ACD3861	139	136	0	3
Tortricidae	*Gatesclarkeana sp. ACE7876*	BOLD:ACE7876	5	5	0	0
Geometridae	*sp. ACK5418*	BOLD:ACK5418	47	12	0	35
Geometridae	*Casbia sp. ACK6572*	BOLD:ACK6572	52	52	0	0
Geometridae	*sp. ACK6876*	BOLD:ACK6876	2	0	2	0
Geometridae	*sp. ACK7565*	BOLD:ACK7565	5	0	5	0
Geometridae	*sp. ACK7570*	BOLD:ACK7570	26	19	0	7
Geometridae	*sp. ACK7831*	BOLD:ACK7831	4	0	0	4
Erebidae	*Arctornis sp. ACK8100*	BOLD:ACK8100	5	5	0	0
Geometridae	*sp. ACK9224*	BOLD:ACK9224	58	11	47	0
Geometridae	*Myrioblephara sp. ACK9384*	BOLD:ACK9384	54	1	1	52
Geometridae	*sp. ACL2137*	BOLD:ACL2137	96	28	19	49
Tortricidae	*sp. ACL2152*	BOLD:ACL2152	13	0	0	13
Tortricidae	*sp. ACL2211*	BOLD:ACL2211	3	1	1	1
Geometridae	*Prasinocyma sp. ACL2220*	BOLD:ACL2220	7	1	3	3
Tortricidae	*sp. ACL2255*	BOLD:ACL2255	2	0	0	2
Roeslerstammiidae	*Amphithera sp. ACL2288*	BOLD:ACL2288	24	1	6	17
Geometridae	*sp. ACL2297*	BOLD:ACL2297	15	15	0	0
Geometridae	*sp. ACL2314*	BOLD:ACL2314	32	0	4	28
Crambidae	*Palpita sp. ACL2380*	BOLD:ACL2380	4	0	0	4
Geometridae	*sp. ACL2383*	BOLD:ACL2383	88	9	29	50
Geometridae	*Casbia sp. ACL2414*	BOLD:ACL2414	32	32	0	0
Geometridae	*Paradromulia sp. ACL2441*	BOLD:ACL2441	35	9	1	25
Geometridae	*Hyposidra sp. ACL2461*	BOLD:ACL2461	9	2	0	7
Cosmopterigidae	*Macrobathra sp. ACL2485*	BOLD:ACL2485	3	3	0	0
Crambidae	*Synclera sp. ACL2524*	BOLD:ACL2524	12	0	12	0
Tortricidae	*sp. ACL2557*	BOLD:ACL2557	18	18	0	0
Tortricidae	*sp. ACL2558*	BOLD:ACL2558	195	195	0	0
Geometridae	*sp. ACL2584*	BOLD:ACL2584	53	7	1	45
Geometridae	*sp. ACL2687*	BOLD:ACL2687	2	0	2	0
Geometridae	*sp. ACL2772*	BOLD:ACL2772	4	2	0	2
Geometridae	*sp. ACL2773*	BOLD:ACL2773	3	0	0	3

Geometridae	*sp. ACL2774*	BOLD:ACL2774	2	0	0	2
Tortricidae	*sp. ACL2809*	BOLD:ACL2809	5	0	5	0
Crambidae	*Herpetogramma sp. ACL2815*	BOLD:ACL2815	10	0	10	0
Geometridae	*Tolmera sp. ACL2838*	BOLD:ACL2838	3	0	0	3
Geometridae	*Tolmera sp. ACL2839*	BOLD:ACL2839	6	4	0	2
Geometridae	*sp. ACL2840*	BOLD:ACL2840	9	6	2	1
Geometridae	*sp. ACL2851*	BOLD:ACL2851	27	3	0	24
Tortricidae	*sp. ACL2861*	BOLD:ACL2861	3	0	3	0
Tortricidae	*sp. ACL2861*	BOLD:ACL2916	8	0	0	8
Geometridae	*sp. ACL2861*	BOLD:ACL2922	3	3	0	0
Tortricidae	*sp. ACL2943*	BOLD:ACL2943	13	13	0	0
Elachistidae	*Zaratha sp. ACL2964*	BOLD:ACL2964	76	0	76	0
Tortricidae	*sp. ACL2965*	BOLD:ACL2965	2	0	0	2
Tortricidae	*sp. ACL2981*	BOLD:ACL2981	22	0	0	22
Geometridae	*sp. ACL2986*	BOLD:ACL2986	7	7	0	0
Pyralidae	*sp. ACL3232*	BOLD:ACL3232	3	0	0	3
Tortricidae	*Cryptophlebia sp. ACL3303*	BOLD:ACL3303	4	0	0	4
Tortricidae	*sp. ACL3304*	BOLD:ACL3304	3	0	0	3
Tortricidae	*Zacorisca holantha*	BOLD:ACL3429	176	12	61	103
Tortricidae	*Zacorisca aptycha*	BOLD:ACL3430	15	0	0	15
Geometridae	*sp. ACL3435*	BOLD:ACL3435	101	6	0	95
Geometridae	*sp. ACL3436*	BOLD:ACL3436	8	1	0	7
Pyralidae	*Adoxophyes sp. ACL3493*	BOLD:ACL3493	2	2	0	0
Tortricidae	*sp. ACL3540*	BOLD:ACL3540	33	2	3	28
Erebidae	*sp. ACL3603*	BOLD:ACL3603	5	5	0	0
Choreutidae	*Choreutis sp. ACL3612*	BOLD:ACL3612	21	0	9	12
Geometridae	*sp. ACL3687*	BOLD:ACL3687	3	3	0	0
Alucitidae	*sp. ACL3689*	BOLD:ACL3689	2	0	2	0
Tortricidae	*Zacorisca cyprantha*	BOLD:ACL3736	39	5	17	17
Depressariidae	*sp. ACL3783*	BOLD:ACL3783	75	2	20	53
Pyralidae	*sp. ACL3835*	BOLD:ACL3835	180	36	79	65
Tineidae	*Trachycentra sp. ACL3836*	BOLD:ACL3836	12	0	0	12
Geometridae	*Scopula sp. ACL3931*	BOLD:ACL3931	10	0	0	10
Geometridae	*sp. ACL3940*	BOLD:ACL3940	5	3	2	0
Geometridae	*sp. ACL3967*	BOLD:ACL3967	6	1	0	5
Geometridae	*Parachaetolopha sp. ACL4036*	BOLD:ACL4036	36	4	32	0
Geometridae	*sp. ACL4038*	BOLD:ACL4038	4	0	0	4
Geometridae	*Myrioblephara sp. ACL4039*	BOLD:ACL4039	2	0	0	2
Tortricidae	*sp. ACL4127*	BOLD:ACL4127	14	6	1	7
Oecophoridae	*Delonoma sp. ACL4138*	BOLD:ACL4138	4	0	0	4
Noctuidae	*Rusicada bicolor*	BOLD:ACL4187	11	9	2	0
Erebidae	*Lineopalpa rufa*	BOLD:ACL4188	7	7	0	0
Erebidae	*Lemyra sp. ACL4203*	BOLD:ACL4203	238	3	220	15
Tortricidae	*sp. ACM3112*	BOLD:ACM3112	9	0	1	8
Tortricidae	*sp. ACM3119*	BOLD:ACM3119	14	0	7	7
Tortricidae	*sp. ACM3124*	BOLD:ACM3124	98	37	0	61
Tortricidae	*sp. ACM3125*	BOLD:ACM3125	12	3	4	5
Tortricidae	*sp. ACM3127*	BOLD:ACM3127	50	38	4	8
Tortricidae	*Adoxophyes sp. ACM3127*	BOLD:ACM3234	4	0	0	4
Tortricidae	*sp. ACM3250*	BOLD:ACM3250	9	0	3	6
Tortricidae	*sp. ACM3328*	BOLD:ACM3328	62	2	15	45
Tortricidae	*sp. ACM3342*	BOLD:ACM3342	7	0	3	4
Depressariidae	*Agriophara sp. ACM3388*	BOLD:ACM3388	2	0	0	2
Tortricidae	*sp. ACM3393*	BOLD:ACM3393	19	19	0	0
Tortricidae	*sp. ACM3412*	BOLD:ACM3412	16	14	0	2
Tortricidae	*sp. ACM3419*	BOLD:ACM3419	7	2	0	5

Tortricidae	*sp. ACM3440*	BOLD:ACM3440	34	34	0	0
Tortricidae	*sp. ACM3442*	BOLD:ACM3442	5	0	0	5
Tortricidae	*sp. ACM3468*	BOLD:ACM3468	5	5	0	0
Tortricidae	*sp. ACM3509*	BOLD:ACM3509	3	0	0	3
Tortricidae	*sp. ACM3510*	BOLD:ACM3510	18	0	4	14
Tortricidae	*sp. ACM3533*	BOLD:ACM3533	6	0	0	6
Tortricidae	*sp. ACM3602*	BOLD:ACM3602	4	2	0	2
Plutellidae	*sp. ACM3613*	BOLD:ACM3613	37	37	0	0
Tortricidae	*sp. ACM3694*	BOLD:ACM3694	4	4	0	0
Nolidae	*sp. ACM3703*	BOLD:ACM3703	4	0	4	0
Nolidae	*Nola sp. ACM3704*	BOLD:ACM3704	10	2	0	8
Tortricidae	*sp. ACM3711*	BOLD:ACM3711	7	1	0	6
Tortricidae	*sp. ACM3761*	BOLD:ACM3761	9	0	0	9
Nolidae	*Nola opalina*	BOLD:ACM3797	12	3	2	7
Tortricidae	*Zacorisca sp. ACM3802*	BOLD:ACM3802	34	5	6	23
Limacodidae	*sp. ACM3873*	BOLD:ACM3873	26	0	7	19
Erebidae	*Hypena poecila*	BOLD:ACM3910	2	0	2	0
Geometridae	*Sauris sp. ACM3914*	BOLD:ACM3914	22	4	7	11
Gelechiidae	*sp. ACM3945*	BOLD:ACM3945	65	20	8	37
Gelechiidae	*sp. ACM3982*	BOLD:ACM3982	2	0	0	2
Nolidae	*Nycteola avola*	BOLD:ACM4128	8	8	0	0
Nolidae	*Nycteola kebea*	BOLD:ACM4129	9	9	0	0
Tortricidae	*Cryptophlebia sp. ACM4140*	BOLD:ACM4140	4	0	0	4
Erebidae	*Somena sp. ACM4172*	BOLD:ACM4172	6	0	0	6
Erebidae	*Leucoma ACM4173 & ACM4174 complex*	BOLD:ACM4173 + ACM4174	4412	0	0	4412
Erebidae	*Euproctis kunupi*	BOLD:ACM4175	7	2	2	3
Thyrididae	*Mellea sp. ACM4185*	BOLD:ACM4185	100	44	5	51
Erebidae	*sp. ACM4197*	BOLD:ACM4197	55	7	44	4
Geometridae	*sp. ACM4248*	BOLD:ACM4248	99	0	98	1
Geometridae	*sp. ACM4260*	BOLD:ACM4260	127	67	59	1
Geometridae	*sp. ACM4261*	BOLD:ACM4261	4	4	0	0
Erebidae	*sp. ACM4272*	BOLD:ACM4272	104	21	17	66
Erebidae	*sp. ACM4273*	BOLD:ACM4273	2	2	0	0
Erebidae	*sp. ACM4274*	BOLD:ACM4274	85	0	26	59
Erebidae	*sp. ACM4274*	BOLD:ACM4275	9	0	0	9
Thyrididae	*Mellea sp. ACM4292*	BOLD:ACM4292	51	8	32	11
Immidae	*Imma sp. ACM4351*	BOLD:ACM4351	20	12	0	8
Geometridae	*sp. ACM4429*	BOLD:ACM4429	30	0	3	27
Nolidae	*sp. ACM4452*	BOLD:ACM4452	10	0	10	0
Erebidae	*Dura sp. ACM4458*	BOLD:ACM4458	13	0	0	13
Immidae	*sp. ACM4494*	BOLD:ACM4494	26	8	5	13
Nolidae	*sp. ACM4525*	BOLD:ACM4525	16	16	0	0
Erebidae	*Euproctis petasma*	BOLD:ACM4533	94	57	25	12
Geometridae	*Lobocraspeda sp. ACM4541*	BOLD:ACM4541	10	0	10	0
Erebidae	*Euproctis iseres*	BOLD:ACM4556	22	0	15	7
Erebidae	*sp. ACM4557*	BOLD:ACM4557	5	0	0	5
Nolidae	*Nycteola aroa*	BOLD:ACM4561	66	66	0	0
Geometridae	*Chloroclystis sp. ACM4629*	BOLD:ACM4629	37	37	0	0
Crambidae	*Udea sp. ACM4670*	BOLD:ACM4670	282	94	186	2
Geometridae	*Idiomilionia ventralis*	BOLD:ACM4680	38	0	0	38
Erebidae	*Somena sp. ACM4686*	BOLD:ACM4686	24	19	1	4
Erebidae	*sp. ACM4698*	BOLD:ACM4698	2	0	0	2
Eupterotidae	*Cotana nr. aroa*	BOLD:ACM8731	12	0	0	12
Erebidae	*Spilosoma sp. ACM9052*	BOLD:ACM9052	18	0	18	0
Eupterotidae	*Cotana nr. kebea*	BOLD:ACM9094	269	72	14	183

Eupterotidae	*Cotana nr. pallidipascia*	BOLD:ACM9095	76	0	0	76
Lycaenidae	*Psychonotis hebes*	BOLD:ACM9606	6	0	6	0
Hesperiidae	*Allora major*	BOLD:ACM9721	35	0	0	35
Erebidae	*Euproctis mycoides*	BOLD:ACM9751	32	24	0	8
Geometridae	*sp. ACM9942*	BOLD:ACM9942	6	0	0	6
Erebidae	*Pinacia sp. ACM9982*	BOLD:ACM9982	6	4	0	2
Erebidae	*sp. ACM9983*	BOLD:ACM9983	10	0	3	7
Crambidae	*Tyspanodes radiata*	BOLD:ACN0624	48	13	0	35
Geometridae	*sp. ACN0654*	BOLD:ACN0654	17	3	2	12
Geometridae	*Milionia sp. ACN0900*	BOLD:ACN0900	8	8	0	0
Lycaenidae	*Hypochrysops sp. ACN1400*	BOLD:ACN1400	346	264	82	0
Noctuidae	*Argyrolepidia sp. ACN1848*	BOLD:ACN1848	23	8	10	5
Thyrididae	*sp. ACN9209*	BOLD:ACN9209	7	0	0	7
Thyrididae	*sp. ACN9210*	BOLD:ACN9210	17	0	3	14
Tortricidae	*sp. ACN9347*	BOLD:ACN9347	2	0	2	0
Tortricidae	*sp. ACN9403*	BOLD:ACN9403	182	122	40	20
Tortricidae	*sp. ACN9405*	BOLD:ACN9405	38	0	0	38
Thyrididae	*sp. ACN9810*	BOLD:ACN9810	2	2	0	0
Tortricidae	*sp. ACN9885*	BOLD:ACN9885	5	5	0	0
Tortricidae	*sp. ACN9899*	BOLD:ACN9899	64	62	0	2
Pyralidae	*Salma chlorographalis*	BOLD:ACO0191	19	19	0	0
Tortricidae	*Lobesia sp. ACO0243*	BOLD:ACO0243	80	48	15	17
Thyrididae	*Mellea sp. ACO0290*	BOLD:ACO0290	14	0	6	8
Tortricidae	*sp. ACO0554*	BOLD:ACO0554	118	67	48	3
Geometridae	*sp. ACQ4822*	BOLD:ACQ4822	24	0	2	22
Lycaenidae	*sp. ACS9688*	BOLD:ACS9688	17	1	16	0
Erebidae	*sp. ACS9712*	BOLD:ACS9712	31	12	12	7
Erebidae	**Calliteara sp. ACS9712*	BOLD:ACT0038	18	0	11	7
Erebidae	*sp. ACT0909*	BOLD:ACT0909	29	7	17	5
Geometridae	*sp. ACT1506*	BOLD:ACT1506	2	0	2	0
Noctuidae	**Tiracola sp. ACT2243*	BOLD:ACT2243	2	1	1	0
Geometridae	*sp. ACT2444*	BOLD:ACT2444	7	1	0	6
Eupterotidae	**Cotana sp. ACT2703*	BOLD:ACT2703	3	0	0	3
Erebidae	*sp. ACT4130*	BOLD:ACT4130	32	9	7	16
Erebidae	*sp. ACT4598*	BOLD:ACT4598	3	0	0	3
Lasiocampidae	**Pseudophyllodes sp. ACT4640*	BOLD:ACT4640	7	0	0	7
Limacodidae	*sp. ACT5001*	BOLD:ACT5001	14	0	0	14
Erebidae	*sp. ACT5170*	BOLD:ACT5170	3	0	0	3
Erebidae	*sp. ACU4085*	BOLD:ACU4085	2	2	0	0
Erebidae	*sp. ACU4278*	BOLD:ACU4278	4	4	0	0
Crambidae	*sp. ACU4379*	BOLD:ACU4379	7	6	0	1
Erebidae	*sp. ACU4382*	BOLD:ACU4382	4	0	4	0
Thyrididae	*sp. ACU4433*	BOLD:ACU4433	2	0	0	2
Erebidae	**Spilosoma sp. ACU4479*	BOLD:ACU4479	15	0	15	0
Erebidae	**Lambula sp. ACU4513*	BOLD:ACU4513	3	3	0	0
Pyralidae	*sp. ACU4601*	BOLD:ACU4601	3	0	0	3
Crambidae	*sp. ACU4642*	BOLD:ACU4642	2	2	0	0
Erebidae	*sp. ACU4645*	BOLD:ACU4645	10	2	5	3
Noctuidae	*sp. ACU4658*	BOLD:ACU4658	2	0	1	1
Thyrididae	*sp. ACU4732*	BOLD:ACU4732	5	5	0	0
Saturniidae	*sp. ACU4765*	BOLD:ACU4765	2	0	2	0
Geometridae	**Lomographa sp. ACU4779*	BOLD:ACU4779	3	0	3	0
Geometridae	**Chorodna sp. ACU4784*	BOLD:ACU4784	2	1	0	1
Pyralidae	**Orthaga sp. ACU5090*	BOLD:ACU5090	9	0	8	1
Crambidae	**Pleuroptya sp. ACU5148*	BOLD:ACU5148	8	8	0	0
Geometridae	**Eucyclodes sp. ACU5150*	BOLD:ACU5150	19	0	3	16

Depressariidae	*sp. ACU5195*	BOLD:ACU5195	5	5	0	0
Nolidae	*sp. ACU5242*	BOLD:ACU5242	27	27	0	0
Bombycidae	**Elachyophthalmasp. ACU5409*	BOLD:ACU5409	2	1	1	0
Erebidae	**Notata sp. ACU5445*	BOLD:ACU5445	2	1	0	1
Erebidae	**Hypena sp. ACU5948*	BOLD:ACU5948	3	0	0	3
Pyralidae	*sp. ACU6119*	BOLD:ACU6119	2	0	0	2
Erebidae	*sp. ACU6207*	BOLD:ACU6207	2	0	0	2
Erebidae	*Hypena subalbida*	BOLD:ACU6882	40	0	40	0
Xyloryctidae	*sp. ACU6918*	BOLD:ACU6918	14	1	0	13
Geometridae	*sp. ACU7039*	BOLD:ACU7039	2	0	0	2
Erebidae	*sp. ACU7423*	BOLD:ACU7423	2	0	0	2
Geometridae	*sp. ACU7479*	BOLD:ACU7479	3	2	0	1
Pyralidae	*sp. ACW0938*	BOLD:ACW0938	11	11	0	0
Erebidae	*sp. ACW0964*	BOLD:ACW0964	2	0	2	0
Tortricidae	*sp. ACW0973*	BOLD:ACW0973	19	0	1	18
Anthellidae*	*sp. ACW1234*	BOLD:ACW1234	3	0	0	3
Geometridae	**Tripteridia sp. ACW1281*	BOLD:ACW1281	11	7	4	0
Erebidae	*sp. ACW1304*	BOLD:ACW1304	2	2	0	0
Gelechiidae	*sp. ACZ1730*	BOLD:ACZ1730	3	0	3	0
Thyrididae*	*sp. ACZ1731*	BOLD:ACZ1731	25	25	0	0

Table A3. Mean Distance Based Specialisation Index (DSI*) of lepidopteran families across the successional chronosequence with SE and number species represented within each family and stage combination.

Family	Habitat	DSI*	+/-se	N Species
Choreutidae	Young Secondary	1.000	NA	1
Crambidae	Young Secondary	0.888	0.075	5
Erebidae	Young Secondary	0.593	0.099	13
Eupterotidae	Young Secondary	0.429	NA	1
Gelechiidae	Young Secondary	0.991	NA	1
Geometridae	Young Secondary	0.836	0.044	27
Immidae	Young Secondary	0.577	0.160	2
Lycaenidae	Young Secondary	0.957	NA	1
Noctuidae	Young Secondary	0.802	0.198	3
Nolidae	Young Secondary	1.000	0.000	6
Pyralidae	Young Secondary	0.822	0.162	5
Thyrididae	Young Secondary	0.924	0.076	4
Tortricidae	Young Secondary	0.693	0.070	25
Choreutidae	Mature Secondary	0.992	0.008	3
Crambidae	Mature Secondary	0.792	0.119	4
Erebidae	Mature Secondary	0.802	0.055	19
Eupterotidae	Mature Secondary	0.405	NA	1
Gelechiidae	Mature Secondary	0.986	0.014	2
Geometridae	Mature Secondary	0.701	0.097	13
Immidae	Mature Secondary	1.000	NA	1
Lycaenidae	Mature Secondary	0.922	0.078	3
Noctuidae	Mature Secondary	1.000	NA	1
Nolidae	Mature Secondary	1.000	NA	1
Pyralidae	Mature Secondary	0.931	0.069	2
Thyrididae	Mature Secondary	1.000	0.000	4
Tortricidae	Mature Secondary	0.815	0.097	15
Choreutidae	Primary	1.000	NA	1
Crambidae	Primary	0.991	0.005	3
Erebidae	Primary	0.757	0.061	21
Eupterotidae	Primary	0.681	0.183	3
Gelechiidae	Primary	0.991	NA	1
Geometridae	Primary	0.734	0.057	27
Immidae	Primary	0.610	0.085	2
Noctuidae	Primary	0.560	NA	1
Nolidae	Primary	0.990	0.002	2
Pyralidae	Primary	0.707	0.293	2
Thyrididae	Primary	0.839	0.080	6

Tortricidae	Primary	0.865	0.034	32

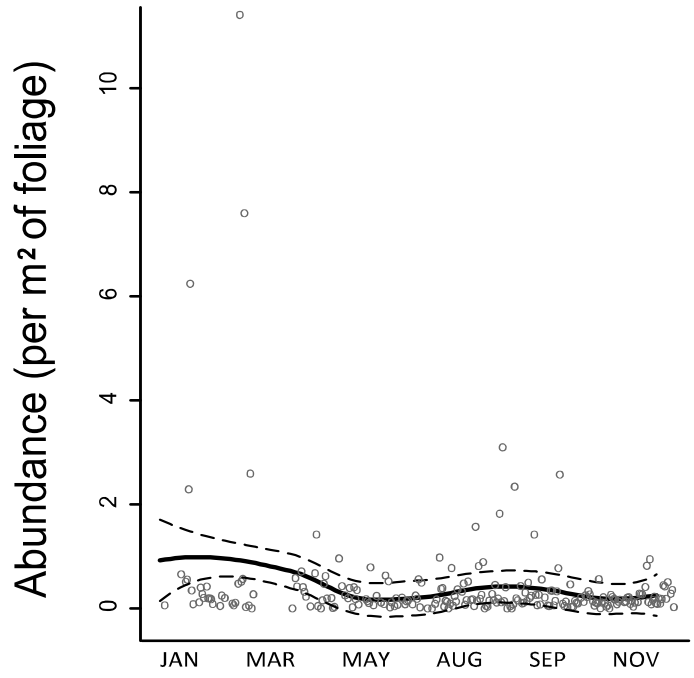

Figure A5. Seasonal trends in abundance of collected herbivores. The data points represent number of caterpillars per m2 of foliage on individual days of sampling. The seasonal trend was modelled with a loess smoother (solid line). Dashed lines show confidence intervals. The abundance was standardized by leaf area.

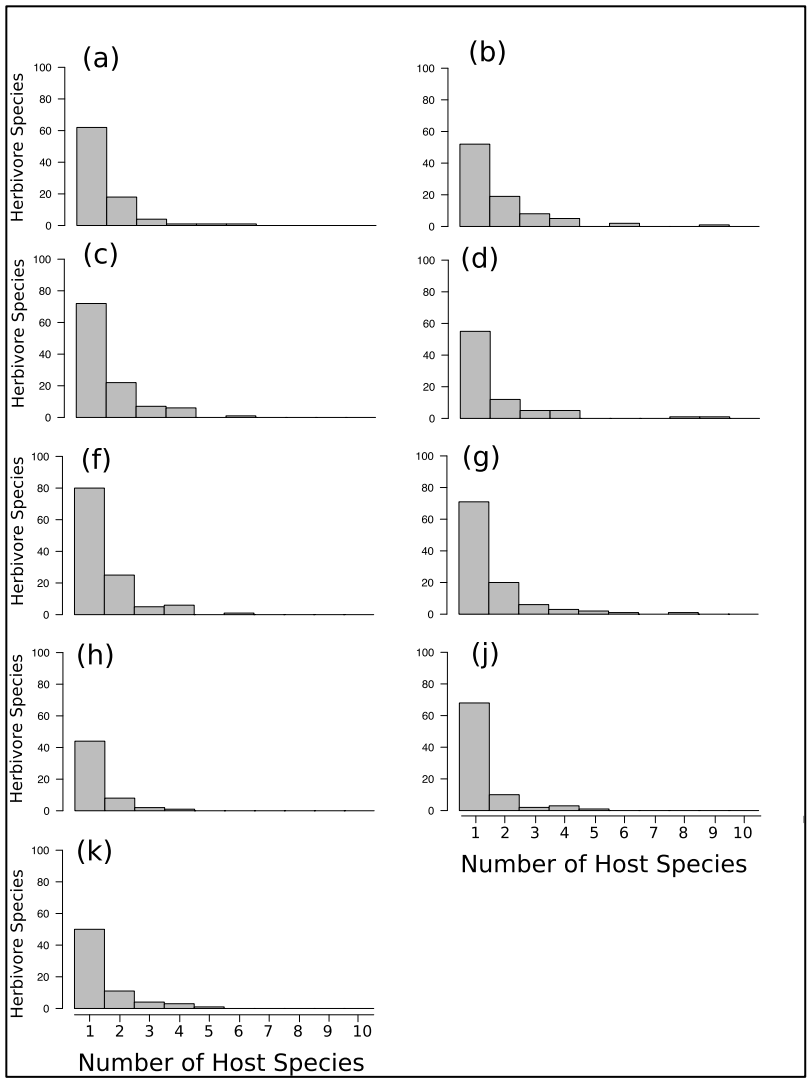

Figure A6. Degree distribution of Lepidopteran herbivores within each of the nine study plots showing the number of herbivore species that are associated with a given number of hosts. Primary forest plots (a,b,c,d), young secondary plots (f,g) and mature secondary plots (h,j,k).

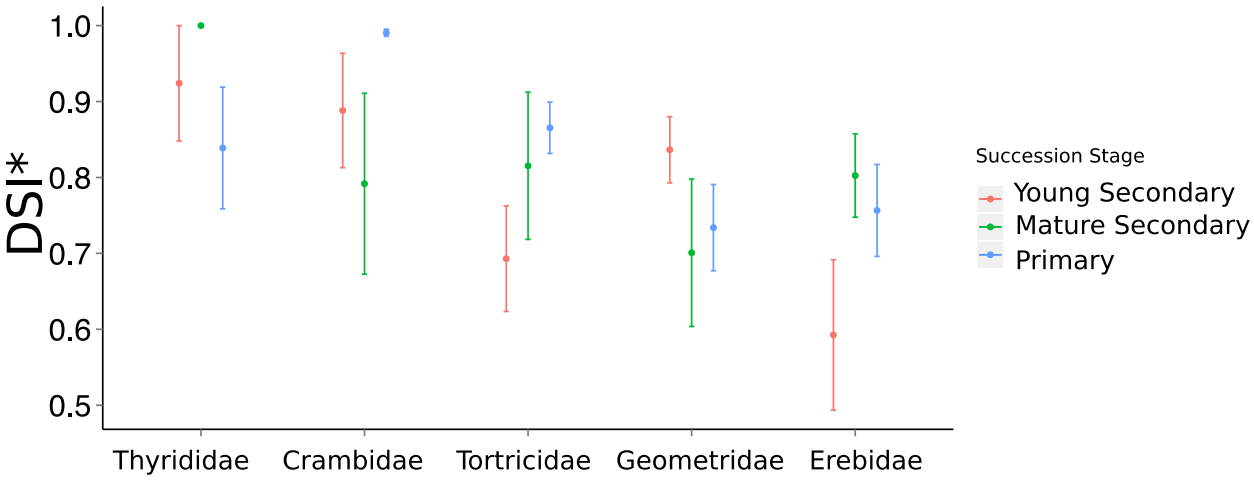

Figure A7. Mean Distance Based Specialisation Index (DSI*) +/- SE of the top five most speciose lepidopteran families (Tortricidae> Geometridae > Erebidae > Thyrididae > Crambidae), ordered by most to least specialized, across the successional chronosequence from young secondary (red) to mature secondary (green) and finally primary forest (blue).

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Appendix 2.

Identification of Lepidoptera

Adult specimens were sorted by morphospecies and confirmed using DNA barcoding and dissection of genitalia. Larval Lepidoptera were morphotyped within each host, and a subset barcoded in order to verify correct placement. Due to the large numbers of larval Lepidoptera, the lack of morphological characters in some taxa, and logistical constraints, not all individuals could be identified to species level. In total 12357 (65%) individuals, from 292 species across 29 families, were reliably identified.

Leucoma spp complex

We found two species of *Leucoma* (ACM4173 and ACM4174) that typically co-occurred on *Elaeocarpus* hosts, and were super abundant. They are two species based on male genitalia and DNA barcodes, and they are near *Leucoma sericea* Moore, but do not match any described species from New Guinea (Mackey 2016). Because they can only be distinguished by male genitalia or DNA, it was logistically impossible to sort over 4000 individuals to species.

Mackey, A. P. 2016. Two new species of *Leucoma* Hübner, 1822 (Lepidoptera: Erebidae, Lymantriinae) from Papua Indonesia.- Suara Serangga Papua **10**:8-12.

Appendix 3.

A) Descriptions and equations of quantitative network metrics.

The 'Bipartite' (version 2.05) R package (Dormann 2008, Dormann 2009) was used for the calculation of network metrics following and followed Bersier et al 2002, Blüthgen et al. 2006, Tylianakis, et al. 2007, and Dormann et al 2009). Hosts which had no herbivores present were accounted for using the empty.web=false argument.

The following terms are used in the equations presented below for the quantitative network metrics used in the analyses of our herbivore-host networks, namely Weighted quantitative generality (G_{qw}), Weighted quantitative vulnerability (V_{qw}), Weighted quantitative connectance (C_{qw}) and Weighted quantitative modularity (Q)

I number of species at the lower trophic level

J number of species at the higher trophic level

m total number of interactions for all species

a_{ij} number of interactions between species *i* from the lower trophic level and species *j* from the higher trophic level

A_i total number of interactions of species *i* from the lower trophic level

A_j total number of interactions of species *j* from the higher trophic level

H*i* the Shannon diversity of interactions for lower trophic level species:

$$H_i = -\sum_{j=1}^{J}\left(\frac{a_{ji}}{A_i}.\ln\frac{a_{ji}}{A_i}\right)$$

H*j* the Shannon diversity of interactions for higher trophic level species:

$$H_j = -\sum_{i=1}^{I}\left(\frac{a_{ij}}{A_j}.\ln\frac{a_{ij}}{A_j}\right)$$

Weighted quantitative generality (G_{qw})

Represents the mean effective number of hosts per herbivore species weighted by their marginal totals, calculated as:

$$G_{qw} = \sum_{j=1}^{J} \frac{A_j}{m} 2^{H_j}$$

Weighted quantitative vulnerability (V_{qw})

Represents mean effective number of herbivores per host plant species, weighted by their marginal totals, calculated as:

$$V_{qw} = \sum_{i=1}^{I} \frac{A_i}{m} 2^{H_i}$$

Weighted quantitative connectance (C_{qw})

Weighted realised proportion of all possible links, calculated as:

$$C_{qw} = \frac{LD_{qw}}{s}$$

where *LDq* is the weighted quantitative linkage density (i.e. diversity of interactions per species weighted by marginal totals), and *s* is the number of species in the network (including host species with no herbivores) (Tylianakis *et al.* 2007).

Weighted quantitative modularity (Q)

Reflects the extent to which a quantitative network can be partitioned into distinct modules within which species interact more strongly with each other than species from outside the module. Modules are determined using an algorithm based on hierarchical random graphs (Dormann & Strauss 2014). Calculated as:

$$Q = \frac{1}{2N} \sum_{ij} \left(A_{ij} - K_{ij}\right) \delta \left(m_i, m_j\right)$$

where N is the total number of observed interactions in the network and Aij is the normalised observed number of interactions between i and j. The expected value, based on an appropriate null model, is given in the matrix K. The module to which a species i or j is assigned is m_i, m_j. The indicator function δ (m_i;m_j) = 1 if $m_i = m_j$ and 0 if $m_i \neq m_j$. Q ranges from 0 to a maximum value of 1, where 0 represents a community with no more links within modules than expected by chance).

Modularity values were compared against a null distribution obtained from 100 runs of the r2d randomization method, which rearranges the interaction matrices keeping marginal sums fixed. These z-scores were then compared across networks.

B) Description of the qualitative network beta diversity methodology.

Differences in species composition between two communities X and Y can be described using three variables, namely the number of species shared in both X and Y (a), species present only in X (b) and species found only in Y (c). When applied to the complementary beta diversity (βcc) measure of the Jaccard similarity index, $\beta cc = 1 - \text{Jaccard index} = (b + c)/(a + b + c)$.

This principle can be expanded to differences in interaction networks where food webs X and Y can be described by the number of plant–herbivore interactions present in both X and Y, only in X, and only in Y (Novotny 2009).

Four additive partitions of network beta diversity can be partitioned within this framework. Considering networks b and c, plant–herbivore interactions present in only one of the two compared networks can be classified as interactions restricted to a single web due to the following four reasons (i) both the plant and the herbivore species are missing in both webs (bPH, cPH), (ii) only the plant species is absent from one of the webs (bP, cP), (iii) only the herbivore species is absent from one of the webs (bH, cH), and (iv) both the plant and the herbivore species are present in both webs, but the trophic interaction between them is not present (b0, c0) (Novotny 2009). Beta diversity can be then partitioned into these four components as follows:

$\beta cc = (bPH + cPH)/(a + b + c)+(bP + cP)/(a + b + c)+(bH + cH)/(a + b + c)+(b0 + c0)/(a + b + c) = \beta PH + \beta P + \beta H + \beta 0.$

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