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Appendix 1

List of all variables included in the analysis. Given are means, standard deviation as well as minimum and maximum values for each variable. Habitat structure is the mean value of canopy height, canopy closure and vegetation heterogeneity, each scaled to zero mean and unit variance. The number of available fruits was log-transformed prior to analyses. Fruit diversity was calculated as the Shannon index of fruits per species for each plot. We also provide the number of plots on which we were able to collect data or calculate the specific metric.

	Mean	SD	Minimum	Maximum	n plot
Temperature [°C]	15.6	4.1	9	21.6	50
Precipitation [mm]	1611.6	527.8	609	2653	50
Habitat structure	0	0.9	-1.8	1.9	50
Fruit availability [log N fruits]	4.27	1.14	1.84	7.08	50
Fruit diversity	0.69	0.54	0	1.94	50
Frugivore species	10.1	5.5	2	24	50
Plant species	5.8	3.5	1	15	50
Shannon interaction diversity	2.1	0.9	0.5	3.6	45
Interaction evenness	0.6	0.1	0.3	0.9	45
Network specialization	0.5	0.2	0.1	1	37

Appendix 2

List of all study plots and the predictor and response variables used in the linear models. For every study plot, we show the elevation above sea level (m asl), mean annual precipitation (prec [mm]), mean annual temperature (temp [°C]), habitat complexity (hab, mean of canopy height, canopy closure and vegetation heterogeneity per plot), fruit availability (N fruit [log]), fruit diversity (H fruit), species richness of plants (N plant) and birds (N bird), Shannon interaction diversity (H), interaction evenness (E_H) and network specialization (H_2'); H_2' could not be calculated for all plots. Abbreviations of study plots refer to the corresponding habitat type: Sav = savanna, Mai = maize field, Flm = lower montane forest, Hom = Chagga homegarden, Cof = coffee plantation, Gra = grassland, Foc = *Ocotea* forest, Fod = disturbed *Ocotea* forest, Fpo = *Podocarpus* forest, Fpd = disturbed *Podocarpus* forest.

Plot	m	Prec	Temp	Hab	N	H	N	N	H	E_H	H_2'
	a.s.l.				fruit	fruit	plant	bird			
Sav1	871	1063	21.5	-0.96	4.32	2.16	9	17	3.25	0.67	0.25
Sav2	906	1002	21.3	-1.20	4.52	1.37	5	9	1.61	0.42	0.74
Sav3	1153	811	20	-1.54	4.17	1.58	6	23	3.22	0.65	0.45
Sav4	984	616	20.8	-1.37	4.49	1.90	6	12	2.66	0.62	0.49
Sav5	951	609	21	-1.27	3.23	1.75	7	17	3.08	0.64	0.34
Mai1	1009	864	20.6	-1.30	2.79	0.00	1	2	0.64	0.92	NA
Mai2	866	910	21.6	-1.28	5.16	0.59	2	16	1.91	0.55	0.86
Mai5	920	652	21	-0.77	4.00	1.07	3	5	1.91	0.70	0.31
Flm1	1920	2653	15.5	0.53	5.66	2.15	10	16	3.42	0.66	0.27
Flm2	1800	2073	16.2	0.74	4.13	2.35	11	16	2.85	0.54	0.27
Flm3	1560	1867	17.2	1.44	4.68	1.38	5	13	2.42	0.58	0.39
Flm4	1623	2020	17	1.89	5.43	2.42	14	16	3.57	0.67	0.37
Flm6	2020	1956	14.8	0.63	4.04	2.52	12	24	3.41	0.61	0.26
Hom1	1647	2603	17	0.43	2.64	1.79	10	20	3.43	0.66	0.42
Hom3	1788	2140	15.9	0.18	1.85	0.68	2	4	0.93	0.45	0.88
Hom5	1560	1497	17.6	0.13	3.07	1.10	4	9	2.26	0.63	0.36
Cof1	1306	1641	19	0.20	2.68	0.69	3	3	0.73	0.41	0.94
Cof2	1345	1931	18.8	-0.10	7.08	0.56	3	8	1.49	0.47	0.79
Cof3	1305	1596	19	-0.12	6.11	1.04	4	14	2.38	0.59	0.32
Cof4	1124	1269	20	-0.15	3.78	0.68	1	10	0.95	0.41	NA
Cof6	1648	1596	19	-0.15	2.74	1.09	3	10	2.03	0.60	0.54

Gra2	1748	2016	16.5	-1.78	4.90	1.58	4	8	1.90	0.55	0.13
Gra4	1312	1410	19	-1.58	4.38	1.37	3	5	1.96	0.72	0.17
Gra5	1303	1111	19	-1.82	3.51	1.38	3	7	2.23	0.73	0.16
Gra6	1485	1728	18	-1.67	3.43	1.37	4	5	1.45	0.48	0.02
Foc1	2120	2519	14.3	0.87	4.26	2.65	15	15	3.10	0.57	0.40
Foc2	2260	2453	13.6	0.86	5.58	1.99	9	12	2.77	0.59	0.31
Foc3	2540	1928	11.9	0.87	3.39	2.26	10	13	2.92	0.60	0.35
Foc4	2650	1769	11.3	0.83	3.73	2.26	9	10	2.56	0.56	0.40
Foc5	2750	1539	10.8	0.66	6.23	1.94	8	8	2.35	0.56	0.18
Fod1	2220	2508	13.8	0.74	4.95	1.74	5	8	1.37	0.37	0.54
Fod2	2470	1528	12.3	0.76	4.26	1.05	4	4	0.80	0.29	0.55
Fod3	2270	1991	13.5	0.68	3.52	1.56	5	6	1.24	0.47	0.92
Fod4	2560	1926	11.9	0.60	6.08	1.84	6	8	2.28	0.59	0.41
Fod5	2370	2021	12.9	0.77	4.24	1.36	5	6	0.91	0.27	0.56
Fpo1	2850	1713	10.2	0.64	6.18	1.39	6	8	1.93	0.50	0.24
Fpo2	2940	1301	9.6	0.48	4.01	2.32	11	12	1.91	0.39	0.35
Fpo3	2970	1189	9.5	0.68	3.88	0.95	4	8	1.17	0.34	0.60
Fpo4	2720	1434	10.9	0.53	5.34	1.62	7	11	2.53	0.56	0.13
Fpo5	2800	1732	10.5	0.60	4.74	1.85	8	15	2.97	0.62	0.38
Fpd1	3060	1507	9	-0.14	3.98	0.00	1	5	1.15	0.71	NA
Fpd2	2990	1147	9.3	0.32	3.52	0.58	1	3	0.54	0.49	NA
Fpd3	2880	1378	10	0.07	5.17	1.68	6	8	2.31	0.60	0.22
Fpd4	2820	1336	10.3	-0.01	4.04	0.62	2	2	1.04	0.75	0.81
Fpd5	2770	1764	10.6	-0.44	2.29	1.10	3	2	1.31	0.73	0.45

Appendix 3

List of models contained in the set of best linear models with $\Delta\text{AICc} < 2$ for (a) Shannon interaction diversity (H), (b) interaction evenness (E_H) and (c) network specialization (H_2'). In all cases, the full model included main and two-way interaction effects of temperature, precipitation, habitat complexity, fruit diversity (H fruits) and fruit availability (N fruits). All predictor variables were scaled to zero mean and unit variance before analysis. Shown are the standardized full model estimates for each predictor in the respective model.

(a)	Intercept	H fruits	Habitat	N fruits	Precipitation	Temperature	Habitat \times N fruits	N fruits \times Temperature	ΔAICc
	2.06	0.64	-	0.47	-	0.14	-	-	0.00
	2.06	0.65	-	0.46	-	-	-	-	0.17
	2.06	0.64	-	0.48	-	0.14	-	-0.12	1.11
	2.06	0.68	-	0.48	-0.10	-	-	-	1.62
(b)	0.55	0.03	-0.05	0.00	-	-	0.07	-	0.00
	0.55	-	-0.05	-0.01	-	-	0.07	-	0.40
(c)	0.49	-	0.11	-0.03	-	0.11	-0.12	-	0.00

Appendix 4

List of fleshy-fruited plant species recorded on 50 study plots between November 2013 and October 2015. Given is the frequency the respective species interacted with frugivores, pooled over all plots. Range gives the lowest elevation and the highest elevation a plant species was observed. Plants are ordered alphabetically within the respective taxonomic division.

Scientific name	Family	N interactions	Range [m a.s.l.]
Pinopsida			
<i>Podocarpus latifolius</i>	Podocarpaceae	56	2370–2990
Liliopsida			
<i>Dracaena afromontana</i>	Asparagaceae	1	1650
<i>Smilax anceps</i>	Smilacaceae	59	1300–1750
Magnoliopsida			
<i>Lannea schimperi</i>	Anacardiaceae	307	871–1130
<i>Ozoroa insignis</i>	Anacardiaceae	91	871–993
<i>Sclerocarya birrea</i>	Anacardiaceae	2	993
<i>Carissa edulis</i>	Apocynaceae	11	1300–1920
<i>Taberaemontana stapfiana</i>	Apocynaceae	4	1800–2040
<i>Ilex mitis</i>	Aquifoliaceae	24	2650–2940
<i>Schefflera myriantha</i>	Araliaceae	337	1920–2820
<i>Schefflera volkensii</i>	Araliaceae	2573	2040–2970
<i>Begonia meyeri-johannis</i>	Begoniaceae	16	1650–2540
<i>Commiphora africana</i>	Burseraceae	73	871–992
<i>Commiphora</i> sp.	Burseraceae	5	950
<i>Commiphora triphylla</i>	Burseraceae	35	992
<i>Trema orientalis</i>	Cannabaceae	434	1620–1920
<i>Maytenus acuminata</i>	Celastraceae	12	1920–2940
<i>Peponium vogelei</i>	Cucurbitaceae	4	1650
<i>Zehneria scabra</i>	Cucurbitaceae	65	2850–2940
<i>Euclea racemosa</i>	Ebenaceae	54	1300–1310
<i>Bridelia cathartica</i>	Euphorbiaceae	12	871–912

<i>Croton megalocarpus</i>	Euphorbiaceae	26	1560–1640
<i>Flueggea virosa</i>	Euphorbiaceae	29	962–993
<i>Macaranga capensis</i>	Euphorbiaceae	210	1650–2120
<i>Macaranga kilimandscharica</i>	Euphorbiaceae	258	1650–2270
<i>Ocotea usambarensis</i>	Lauraceae	89	1620–2750
<i>Emelianthe panganensis</i>	Loranthaceae	19	871–912
<i>Erianthemum dregei</i>	Loranthaceae	160	871–2560
<i>Helixanthera kirkii</i>	Loranthaceae	66	912
<i>Plicosepalus curviflorus</i>	Loranthaceae	52	993–1300
<i>Ekebergia capensis</i>	Meliaceae	23	1640
<i>Tiliacora funifera</i>	Menispermaceae	68	1650–2120
<i>Ficus lutea</i>	Moraceae	581	1120
<i>Ficus natalensis</i>	Moraceae	51	912
<i>Ficus sur</i>	Moraceae	98	1620–1650
<i>Ficus</i> sp.	Moraceae	26	2040
<i>Ficus thoningii</i>	Moraceae	98	1300
<i>Morus alba</i>	Moraceae	2	871
<i>Maesa lanceolata</i>	Myrsinaceae	118	1620–1650
<i>Syzygium cumini</i>	Myrtaceae	18	1020
<i>Strombosia scheffleri</i>	Olacaceae	80	2040
<i>Jasminum meyeri-johannis</i>	Oleaceae	15	1310
<i>Embelia schimperi</i>	Primulaceae	28	2370–2940
<i>Myrsine africana</i>	Primulaceae	33	2770–2940
<i>Maesopsis eminii</i>	Rhamnaceae	13	1150–1840
<i>Rhamnus prinoides</i>	Rhamnaceae	243	1300–1750
<i>Rhamnus staddo</i>	Rhamnaceae	52	1130
<i>Ziziphus mucronata</i>	Rhamnaceae	13	950
<i>Eriobotrya japonica</i>	Rosaceae	22	1640
<i>Prunus africana</i>	Rosaceae	210	2800–2940
<i>Rubus steudneri</i>	Rosaceae	50	1800–2880
<i>Rubus volkensii</i>	Rosaceae	12	2750–2940
<i>Galiniera saxifraga</i>	Rubiaceae	80	1800–2650
<i>Heinsenia diervilleoides</i>	Rubiaceae	10	1650
<i>Keetia gueinzii</i>	Rubiaceae	402	1650–1920
<i>Lasianthus kilimandscharicus</i>	Rubiaceae	47	1800–2260

<i>Pauridiantha paucinervis</i>	Rubiaceae	247	1650–2120
<i>Psychotria cyathicalyx</i>	Rubiaceae	248	1800–2800
<i>Psychotria fractinervata</i>	Rubiaceae	58	1800–2560
<i>Psychotria petiginosa</i>	Rubiaceae	16	2120–2650
<i>Rytigynia uhligii</i>	Rubiaceae	5	1920
<i>Harrisonia abyssinica</i>	Rutaceae	9	1130
<i>Allophyllus ferrugineus</i>	Sapindaceae	4	2040
<i>Discopodium penninervum</i>	Solanaceae	34	2120–2990
<i>Solanum nigrum</i>	Solanaceae	8	1300–1840
<i>Lantana camara</i>	Verbenaceae	885	871–1750
<i>Cissus oliveri</i>	Vitaceae	18	1307–1800
<i>Cissus quadrangularis</i>	Vitaceae	24	950–1130
<i>Cyphostemma kilimandscharica</i>	Vitaceae	1	1300
<i>Cyphostemma serpens</i>	Vitaceae	11	871
<i>Cyphostemma</i> sp.	Vitaceae	9	871

Appendix 5

List of the fruit-eating bird and mammal species observed on 50 study plots during the study period (November 2013–October 2015). Given is the number of individual visits from the respective species that have been observed legitimately dispersing seeds, pooled over all study plots. The range gives the lowest elevation and the highest elevation a species has been observed at. Birds are named and ordered taxonomically following Zimmerman et al. (1999), mammals following Kingdon et al. (1997).

Scientific name	Family	N interactions	Range [m a.s.l.]
Aves			
<i>Coturnix coturnix</i>	Phasianidae	13	993
<i>Francolinus sephaena</i>	Phasianidae	2	871
<i>Francolinus squamatus</i>	Phasianidae	1	2800
<i>Aplopelia larvata</i>	Columbidae	1	1800
<i>Columba arquatrix</i>	Columbidae	62	1640–2970
<i>Columba delegorguei</i>	Columbidae	4	2040
<i>Streptopelia semitorquata</i>	Columbidae	1	950
<i>Treron calva</i>	Columbidae	15	871–1640
<i>Poicephalus rufiventris</i>	Psittacidae	7	950
<i>Criniferoides leucogaster</i>	Musophagidae	31	950–1130
<i>Tauraco hartlaubi</i>	Musophagidae	630	1250–3060
<i>Chrysococcyx klaas</i>	Cuculidae	5	1300
<i>Colius striatus</i>	Coliidae	398	871–1750
<i>Urocolius macrourus</i>	Coliidae	35	871–1130
<i>Apaloderma vittatum</i>	Trogonidae	16	2040–2750
<i>Bycanistes brevis</i>	Bucerotidae	210	1120–2040
<i>Tockus alboterminatus</i>	Bucerotidae	13	1250–1840
<i>Tockus deckeni</i>	Bucerotidae	19	950–1130
<i>Tockus erythrorhynchus</i>	Bucerotidae	1	993
<i>Tockus nasutus</i>	Bucerotidae	41	871–1130
<i>Lybius leucocephalus</i>	Capitonidae	27	871–912
<i>Lybius melanopterus</i>	Capitonidae	15	871–1640
<i>Pogoniulus leucomystax</i>	Capitonidae	49	1250–2040
<i>Pogoniulus pusillus</i>	Capitonidae	12	871–950

<i>Stactolaema leucotis</i>	Capitonidae	48	950–1620
<i>Trachyphonus erythrocephalus</i>	Capitonidae	16	912–1130
<i>Tricholaema lacrymosa</i>	Capitonidae	23	871–1560
<i>Andropadus importunus</i>	Pycnonotidae	15	950–1130
<i>Andropadus milanjensis</i>	Pycnonotidae	73	1640–2540
<i>Andropadus nigriceps</i>	Pycnonotidae	1545	1650–3060
<i>Phyllastrephus cabanisi</i>	Pycnonotidae	392	1650–2850
<i>Phyllastrephus strepitans</i>	Pycnonotidae	60	950–2040
<i>Pycnonotus barbatus</i>	Pycnonotidae	980	871–1750
<i>Pseudoalcippe abyssinica</i>	Timaliidae	1	2040
<i>Turdoides rubiginosa</i>	Timaliidae	34	993–1130
<i>Cichladusa guttata</i>	Turdidae	9	871–1130
<i>Cossypha caffra</i>	Turdidae	1	1750
<i>Irania gutturalis</i>	Turdidae	5	1130
<i>Monticola saxatilis</i>	Turdidae	4	871–1020
<i>Oenanthe oenanthe</i>	Turdidae	4	1130
<i>Oenanthe pleschanka</i>	Turdidae	3	871
<i>Pogonocichla stellata</i>	Turdidae	15	1840–2800
<i>Turdus olivaceus</i>	Turdidae	283	1620–3060
<i>Zootheria piaggiae</i>	Turdidae	21	2120–2970
<i>Melaenornis fischeri</i>	Muscicapidae	5	1300
<i>Apalis flavida</i>	Sylviidae	1	1310
<i>Bradypterus cinnamomeus</i>	Sylviidae	1	2040
<i>Bradypterus lopezi</i>	Sylviidae	3	2040–2260
<i>Cloroptera similis</i>	Sylviidae	1	2800
<i>Hippolais languida</i>	Sylviidae	2	1130
<i>Phylloscopus umbrovirens</i>	Sylviidae	5	1920–2260
<i>Sylvia atricapilla</i>	Sylviidae	159	1130–1920
<i>Sylvia borin</i>	Sylviidae	10	1020–1307
<i>Sylvia communis</i>	Sylviidae	63	962–1310
<i>Zosterops abyssinicus</i>	Zosteropidae	31	871–1120
<i>Zosterops poliogaster</i>	Zosteropidae	1926	1620–3060
<i>Batis molitor</i>	Platysteridae	2	1130–1640
<i>Corvus albicollis</i>	Corvidae	4	2800–2940
<i>Cinnyricinclus femoralis</i>	Sturnidae	66	2040–3060

<i>Cinnyricinclus leucogaster</i>	Sturnidae	283	871–1560
<i>Cinnyricinclus sharpii</i>	Sturnidae	58	1640–2940
<i>Lamprotornis chalybaeus</i>	Sturnidae	51	871–1130
<i>Lamprotornis corruscus</i>	Sturnidae	4	871
<i>Lamprotornis superbus</i>	Sturnidae	24	950
<i>Onychognathus morio</i>	Sturnidae	17	871–1360
<i>Onychognathus walleri</i>	Sturnidae	290	1650–2940
<i>Poeoptera kenricki</i>	Sturnidae	189	1300–2720
<i>Passer griseus</i>	Passeridae	3	871
<i>Petronia pyrgita</i>	Passeridae	30	871–1130
<i>Anaplectes rubriceps</i>	Ploceidae	44	871–1560
<i>Euplectes capensis</i>	Ploceidae	2	1130–1300
<i>Ploceus baglafecht</i>	Ploceidae	162	871–1750
<i>Ploceus intermedius</i>	Ploceidae	3	871–950
<i>Ploceus nigricollis</i>	Ploceidae	3	912–1130
<i>Ploceus ocularis</i>	Ploceidae	7	1120–2040
<i>Ploceus rubiginosus</i>	Ploceidae	5	993
<i>Ploceus velatus</i>	Ploceidae	1	871
<i>Amadina fasciata</i>	Estrildidae	4	1300
<i>Lonchura bicolor</i>	Estrildidae	12	1150–1660
<i>Nigrita canicapilla</i>	Estrildidae	37	1620–2120
<i>Linurgus olivaceus</i>	Fringillidae	66	1620–2970
<i>Serinus citrinelloides</i>	Fringillidae	30	1620
<i>Serinus striolatus</i>	Fringillidae	2	871–1750
<i>Sernus mozambicus</i>	Fringillidae	18	871–1300
<i>Emberiza flaviventris</i>	Emberizidae	3	871–1300
<i>Emberiza tahapisi</i>	Emberizidae	1	1300
<hr/> Mammalia <hr/>			
<i>Colobus guereza</i>	Colobidae	15	2260–2800
<i>Cercopithecus mitis</i>	Cercopithecidae	209	1560–2940
<i>Papio cynocephalus</i>	Cercopithecidae	4	951–984
<i>Paraxerus ochraceus</i>	Sciuridae	41	1124
<i>Paraxerus lucifer</i>	Sciuridae	21	1560–2120

Appendix 6

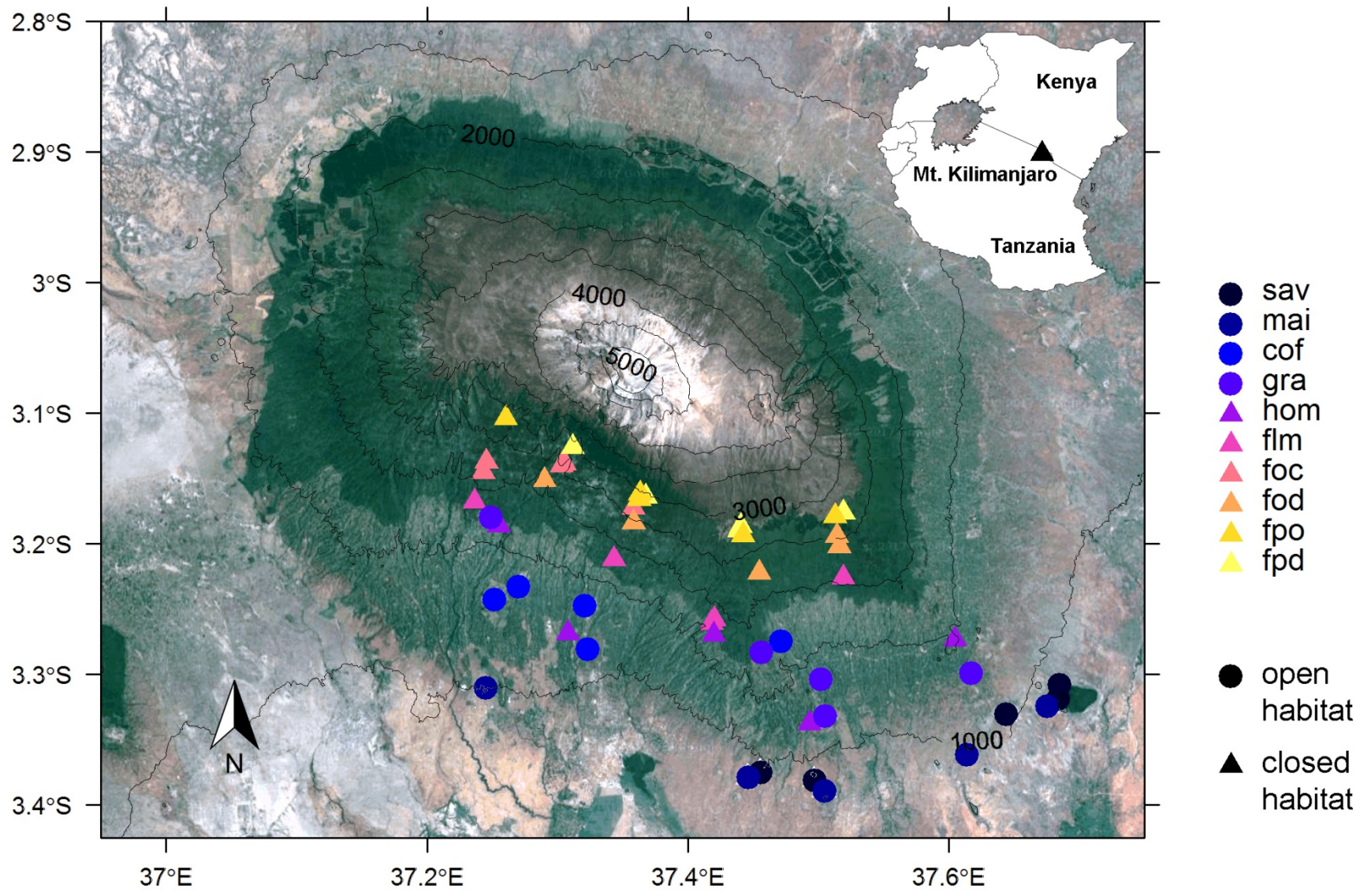
Location of the study plots on the southern slopes of Mt Kilimanjaro, Tanzania. We worked on 50 study plots, covering ten habitat types each with five replicate plots. We excluded 15 plots in the alpine zones, since no frugivore activity could be observed at these elevations. Different habitat types are indicated by different colors. Open habitats refer to study plots with 0 to – 1 standard deviation units of habitat complexity (circles), while closed habitats refer to study plots with 0 to 1 standard deviation units of habitat complexity (triangles).

Sources:

Map Data:

Google TerraMetrics. Available online: <<http://maps.googleapis.com/maps/api/staticmap?center=-3.123553240247,37.366348380164&zoom=10&size=640x497&maptype=satellite&format=gif&sensor=false&scale=2>> (accessed on 24 August 2017).

Digital elevation model: <<https://lta.cr.usgs.gov/SRTM1Arc>>



Appendix 7

Accumulation curves showing the relationship between link richness and the number of observed interaction events for each plot, separately plotted for the plots of each habitat type. We used a sample-based rarefaction method to calculate plot-specific accumulation curves and computed means (points) and the corresponding standard deviations (error bars) across plots of the same habitat type. In order to account for variability in frugivore activity per plot, link richness and the number of observed interaction events were divided by the respective plot maximum. Open habitats (habitat complexity: 0 to -1 standard deviation units) are shown with points and closed habitats (habitat complexity: 0 to 1 standard deviation units) are shown with triangles. Habitat types are ordered from lower to high elevations: savanna (sav), maize field (mai), lower montane forest (flm), Chagga homegarden (hom), coffee plantation (cof), sun coffee (sun), grassland plots (gra), *Ocotea* forest (foc), disturbed *Ocotea* forest (fod), *Podocarpus* forest (fpo), disturbed *Podocarpus* forest (fpd). Sampling effort per habitat corresponds to five plots with an observation time of 25 h on each plot.

