

Appendix

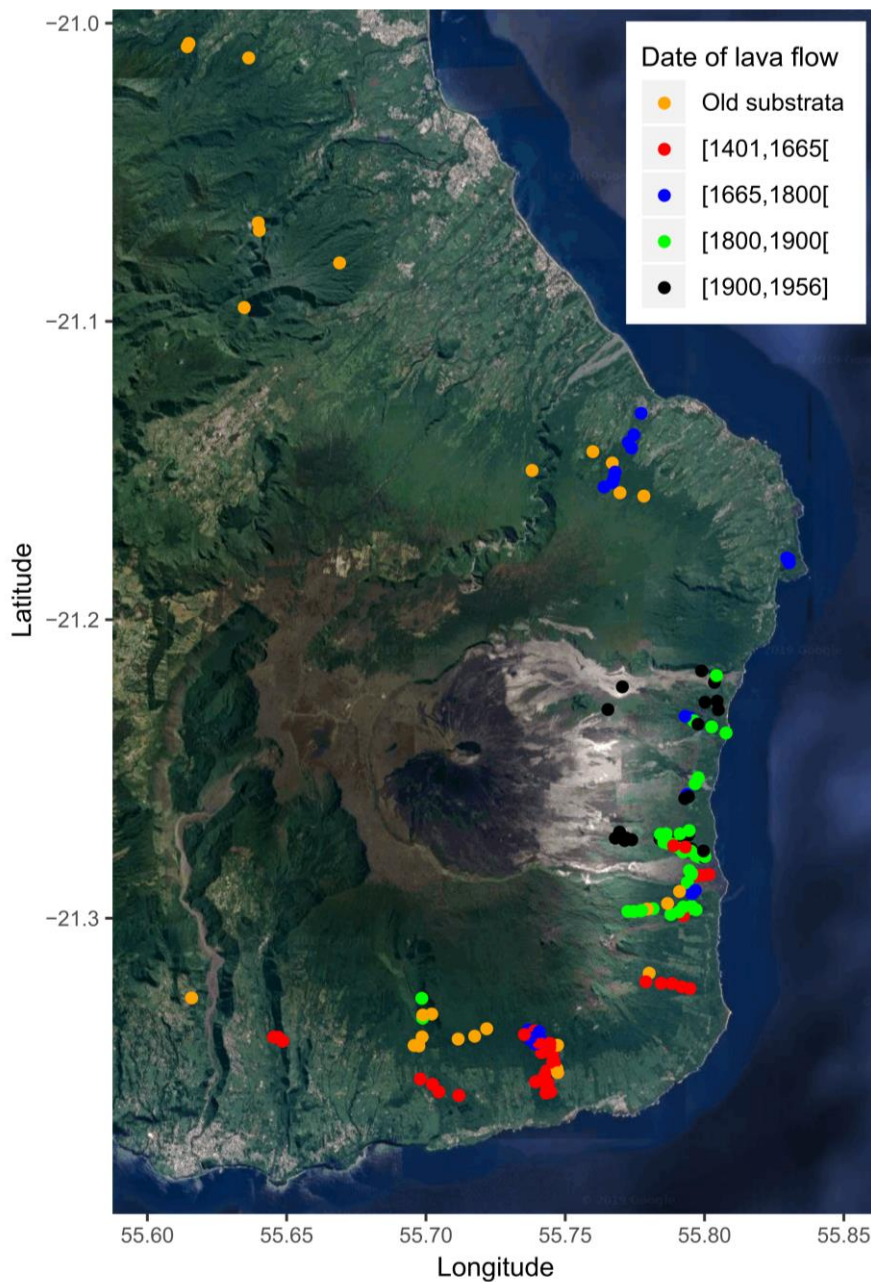


Fig. S1. Spatial distribution of the 151 vegetation plots in the Piton de la Fournaise area. On this satellite view, forests currently found below 500 m asl can be seen on recent lava flows that are not arable, while forests on old substrata no longer exist at very low elevations (see Fig. S2). Here, Cadet's historical sampling is projected on a recent satellite view (R package ggmap), which reveals the vegetation plots that have subsequently been destroyed. For example, numerous plots are now below the huge lava flow that occurred in 2007 (red, blue, green and black dots in the centre right ca 21.28S, 55.79E).

Reference

D. Kahle and H. Wickham. ggmap: Spatial Visualization with ggplot2. *The R Journal*, 5(1), 144-161. URL <http://journal.r-project.org/archive/2013-1/kahle-wickham.pdf>

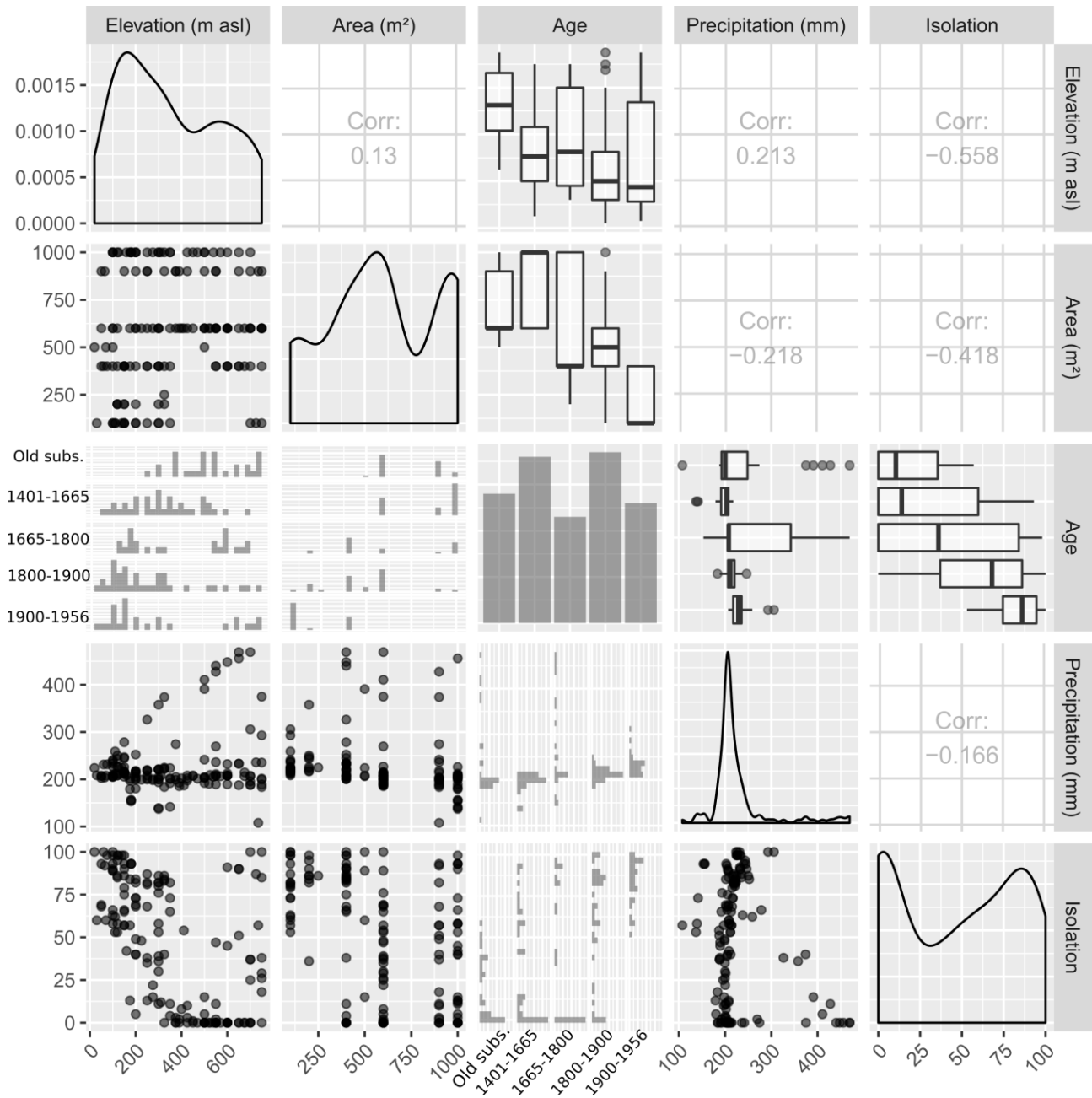


Fig. S2. Scatterplot showing the univariate and bivariate distributions of “age of lava flow”, “elevation”, “area”, “precipitation of driest month” and “isolation”.

Tab. S1. Overview of the frugivore vertebrate fauna on pristine Réunion, showing body mass (g) and conservation IUCN status (EX: extinct, EN: endangered, LC: least concern). ¹ Data on extinct frugivore species for which there were no available measurements were inferred from subfossil archives and/or closely related extant species; ² A small population has been found in the East of Réunion since the beginning of the 21st century.

Class	Order	Species name	Body mass (g)	IUCN status	Source
Mammalia	Chiroptera	<i>Pteropus niger</i> Black-spined Flying-fox	540	² EX	1
		<i>Pteropus subniger</i> Rougette	¹ 250	EX	1,2
Aves	Columbiformes	<i>Alectroenas</i> sp Blue Pigeon	¹ 170	EX	3-5
		<i>Nesoenas mayeri duboisi</i> Pink Pigeon	315	EX	6
	Passeriformes	<i>Fregilupus varius</i> Hoopoe Starling	110	EX	7
		<i>Hypsipetes borbonicus</i> Reunion Bulbul	55	LC	6
		<i>Zosterops borbonicus</i> Grey White-eye	9	LC	6
		<i>Zosterops olivaceus</i> Olive White-eye	10	LC	6
		<i>Mascarinus mascarin</i> Mascarin Parrot	¹ 250	EX	8,9
	Psittaciformes	<i>Necropsittacus (?) borbonicus</i> Leguat's Parrot	¹ 180	EX	8,9
		<i>Psittacula eques</i> Réunion ring-necked parakeet	¹ 180	EX	8,9
<i>Psittacula cf. bensoni</i> Thirioux's Grey Parrot		¹ 250	EX	8,9	
Reptilia	Chelonii	<i>Cylindraspis indica</i> Reunion Tortoise	¹ 50 000	EX	10
	Squamata	<i>Leiopisma borbonica</i> Arnold's Skink	¹ 70	EX	11
		<i>Phelsuma borbonica</i> Reunion day gecko	10	EN	12

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Tab. S2. Summary of Poisson GLMs for woody plants overall and each dispersal trait group. The species richness is estimated according to five variables, i.e. age of lava flow (factor with five levels), sampling area, elevation, precipitation of driest month, isolation, and several interaction terms, e.g. age : isolation. Moran eigenvectors are used to control spatial autocorrelation.

Dispersal trait group	Variable	Estimate	Std Error	Z value	P value
All woody plants	(Intercept)	2.98E+00	1.05E-01	2.85E+01	4.41E-178
All woody plants	Elevation	8.37E-04	1.25E-04	6.68E+00	2.38E-11
All woody plants	Area	5.28E-04	8.54E-05	6.19E+00	6.20E-10
All woody plants	Age [1401,1665[	-7.16E-02	5.45E-02	-1.31E+00	1.90E-01
All woody plants	Age [1665,1800[	-3.22E-01	6.67E-02	-4.83E+00	1.39E-06
All woody plants	Age [1800,1900[	-4.53E-01	7.88E-02	-5.75E+00	8.81E-09
All woody plants	Age [1900,1956[	-6.29E-01	5.00E-01	-1.26E+00	2.09E-01
All woody plants	Age Old substrata : isolation	-1.99E-03	1.52E-03	-1.31E+00	1.91E-01
All woody plants	Age [1401,1665[: isolation	1.15E-03	9.22E-04	1.24E+00	2.14E-01
All woody plants	Age [1665,1800[: isolation	-8.50E-03	1.44E-03	-5.89E+00	3.88E-09
All woody plants	Age [1800,1900[: isolation	-5.65E-03	1.32E-03	-4.28E+00	1.91E-05
All woody plants	Age [1900,1956[: isolation	-1.11E-02	5.85E-03	-1.89E+00	5.84E-02
Anemochorous dry-fruited plants	(Intercept)	1.72E+00	1.35E-01	1.27E+01	3.52E-37
Anemochorous dry-fruited plants	Elevation	1.01E-03	2.25E-04	4.51E+00	6.58E-06
Anemochorous dry-fruited plants	Isolation	-8.24E-03	1.52E-03	-5.42E+00	5.89E-08
Anemochorous dry-fruited plants	Moran Eigenvec20	-6.83E-01	3.97E-01	-1.72E+00	8.57E-02
Anemochorous dry-fruited plants	Age [1401,1665[: Elevation	-3.69E-04	2.26E-04	-1.64E+00	1.02E-01
Anemochorous dry-fruited plants	Age [1665,1800[: Elevation	2.08E-05	1.89E-04	1.10E-01	9.12E-01
Anemochorous dry-fruited plants	Age [1800,1900[: Elevation	1.12E-04	2.11E-04	5.32E-01	5.95E-01
Anemochorous dry-fruited plants	Age [1900,1956[: Elevation	3.84E-04	2.91E-04	1.32E+00	1.86E-01
Small fleshy-fruited plants	(Intercept)	2.47E+00	1.36E-01	1.82E+01	1.20E-73
Small fleshy-fruited plants	Elevation	7.09E-04	1.65E-04	4.30E+00	1.72E-05
Small fleshy-fruited plants	Area	6.46E-04	1.09E-04	5.92E+00	3.20E-09
Small fleshy-fruited plants	Age [1401,1665[	-3.96E-02	6.85E-02	-5.78E-01	5.63E-01
Small fleshy-fruited plants	Age [1665,1800[	-4.02E-01	8.75E-02	-4.59E+00	4.39E-06
Small fleshy-fruited plants	Age [1800,1900[	-5.09E-01	1.02E-01	-4.98E+00	6.23E-07
Small fleshy-fruited plants	Age [1900,1956[	-3.14E-01	8.48E-01	-3.70E-01	7.11E-01
Small fleshy-fruited plants	Age Old substrata : isolation	-1.38E-03	1.92E-03	-7.16E-01	4.74E-01
Small fleshy-fruited plants	Age [1401,1665[: isolation	1.03E-03	1.15E-03	8.98E-01	3.69E-01
Small fleshy-fruited plants	Age [1665,1800[: isolation	-6.98E-03	1.81E-03	-3.85E+00	1.20E-04
Small fleshy-fruited plants	Age [1800,1900[: isolation	-3.63E-03	1.68E-03	-2.16E+00	3.10E-02
Small fleshy-fruited plants	Age [1900,1956[: isolation	-2.39E-02	1.03E-02	-2.32E+00	2.03E-02
Large fleshy-fruited plants	(Intercept)	1.29E+00	3.66E-01	3.52E+00	4.35E-04
Large fleshy-fruited plants	Area	6.21E-04	4.53E-04	1.37E+00	1.70E-01
Large fleshy-fruited plants	Age [1401,1665[	7.42E-01	4.82E-01	1.54E+00	1.24E-01
Large fleshy-fruited plants	Age [1665,1800[	-1.38E+00	5.79E-01	-2.38E+00	1.72E-02
Large fleshy-fruited plants	Age [1800,1900[	-4.50E+00	1.13E+00	-3.99E+00	6.60E-05
Large fleshy-fruited plants	Age [1900,1956[	-2.06E+01	1.11E+04	-1.85E-03	9.99E-01
Large fleshy-fruited plants	Age [1401,1665[: Area	-8.38E-04	5.82E-04	-1.44E+00	1.50E-01
Large fleshy-fruited plants	Age [1665,1800[: Area	9.04E-04	7.39E-04	1.22E+00	2.21E-01
Large fleshy-fruited plants	Age [1800,1900[: Area	3.55E-03	1.38E-03	2.57E+00	1.01E-02
Large fleshy-fruited plants	Age [1900,1956[: Area	-6.21E-04	1.41E+01	-4.41E-05	1.00E+00
Large fleshy-fruited plants	Age Old substrata : isolation	3.22E-03	3.92E-03	8.21E-01	4.12E-01
Large fleshy-fruited plants	Age [1401,1665[: isolation	2.12E-03	1.96E-03	1.08E+00	2.80E-01
Large fleshy-fruited plants	Age [1665,1800[: isolation	-1.59E-02	4.98E-03	-3.19E+00	1.43E-03

Appendix of <https://doi.org/10.1111/1365-2745.13359>

Large fleshy-fruited plants	Age [1800,1900[: isolation	-5.39E-03	9.05E-03	-5.96E-01	5.51E-01
Large fleshy-fruited plants	Age [1900,1956[: isolation	7.57E-13	1.39E+02	5.44E-15	1.00E+00
Not-assigned plants	(Intercept)	-2.97E+00	6.55E-01	-4.54E+00	5.67E-06
Not-assigned plants	Elevation	3.61E-03	6.03E-04	5.98E+00	2.21E-09
Not-assigned plants	Age [1401,1665[	-1.31E-01	2.61E-01	-5.01E-01	6.16E-01
Not-assigned plants	Age [1665,1800[	-7.38E-01	2.84E-01	-2.60E+00	9.43E-03
Not-assigned plants	Age [1800,1900[	-9.17E-01	3.72E-01	-2.47E+00	1.36E-02
Not-assigned plants	Age [1900,1956[	-1.86E+01	1.52E+03	-1.23E-02	9.90E-01
Not-assigned plants	Area	1.20E-03	4.80E-04	2.50E+00	1.23E-02
Not-assigned plants	Precipitation of driest month	3.17E-03	1.04E-03	3.06E+00	2.21E-03
Not-assigned plants	Moran Eigenvec7	1.94E+00	8.95E-01	2.16E+00	3.04E-02

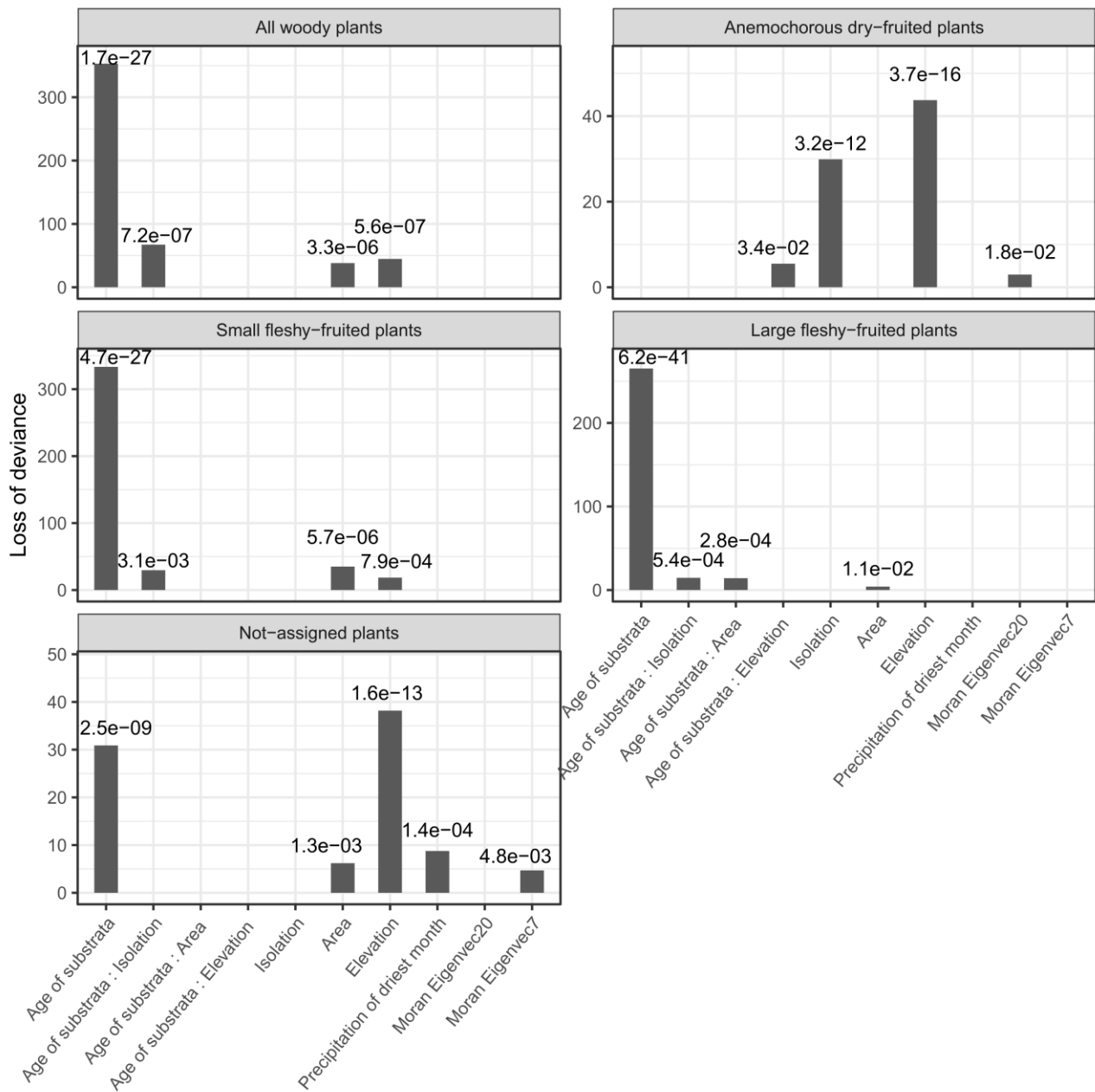


Fig. S3. Loss of GLM deviance when each variable is removed from the full model (including interaction terms and Moran eigenvectors used to control spatial autocorrelation). Significance of anova type-II test is given for each variable.

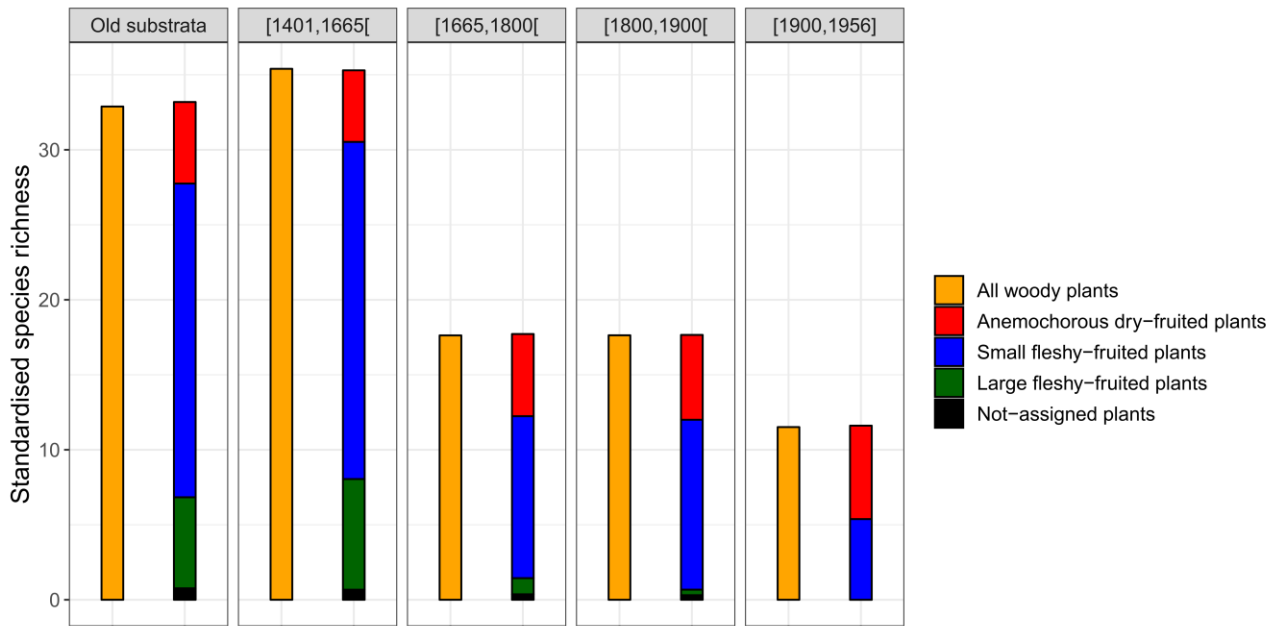


Fig. S4. Comparison of total standardised richness (“All woody plants”) with the sum of standardised richness estimated separately for each dispersal trait group. Note that we include here plants that were not assigned to a specific group because their dispersal strategy is unclear. The standardised richness of not-assigned plants was estimated with the same methods. Overall the sum of separate values provides a similar estimate to the total standardised richness, with a low average relative difference of 0.5%.

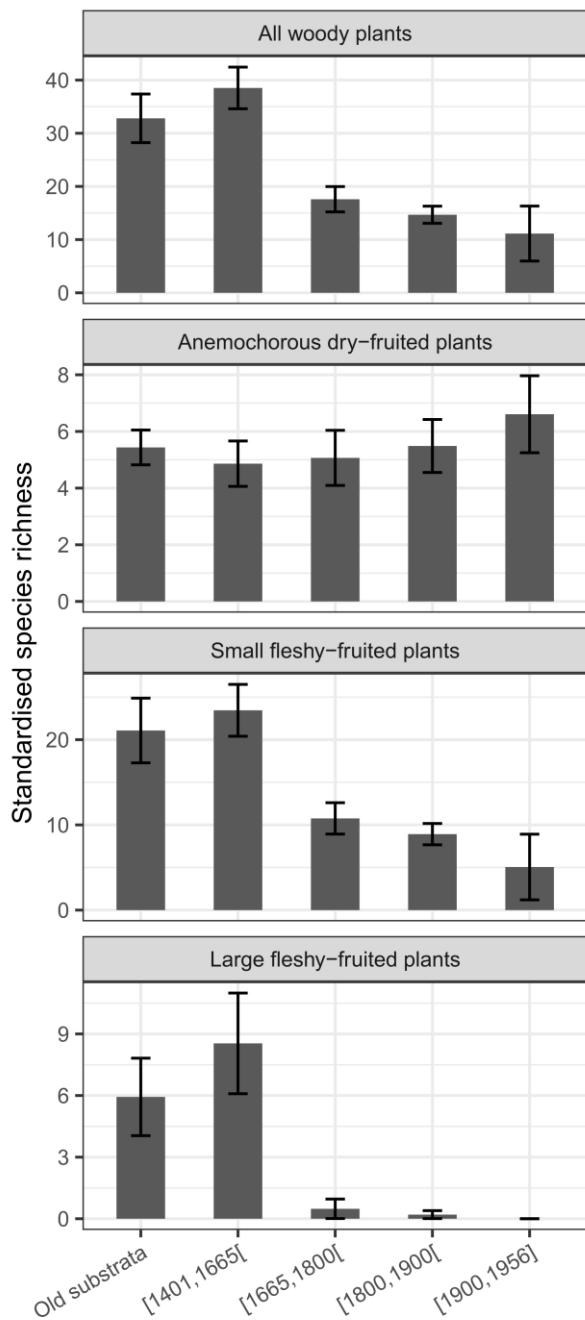


Fig. S5. Estimated standardised richness of native woody plants across the chronosequence based on a limited sampling. Here, we only kept 119 plots that were on historical lava flows or dated with radiocarbon method, and removed 32 vegetation plots on eight lava flows that were dated based on the size distribution of long-lived pioneer trees (see Strasberg, Michon, Daux, & Muro, 2012).

With a more limited set of plots, trends were similar with an even sharper collapse of large fleshy-fruited plant richness on lava flows that occurred after human colonisation. Note that explanatory variables showed a stronger collinearity (max. VIF = 5.3 vs max. VIF = 3.9) and that the precision of the estimated richness for the separated functional groups was lesser (3%, see Fig. S4).



Fig. S6. Results of simple (red) and partial (blue) Mantel tests on relationships between six environmental and spatial distance matrices (age of lava flow, sampling area, precipitation of driest month, elevation, Euclidean distance, isolation) and pairwise dissimilarities (Sorensen, turnover and nestedness) for each dispersal trait group. The significance of tests is presented in shades of grey.

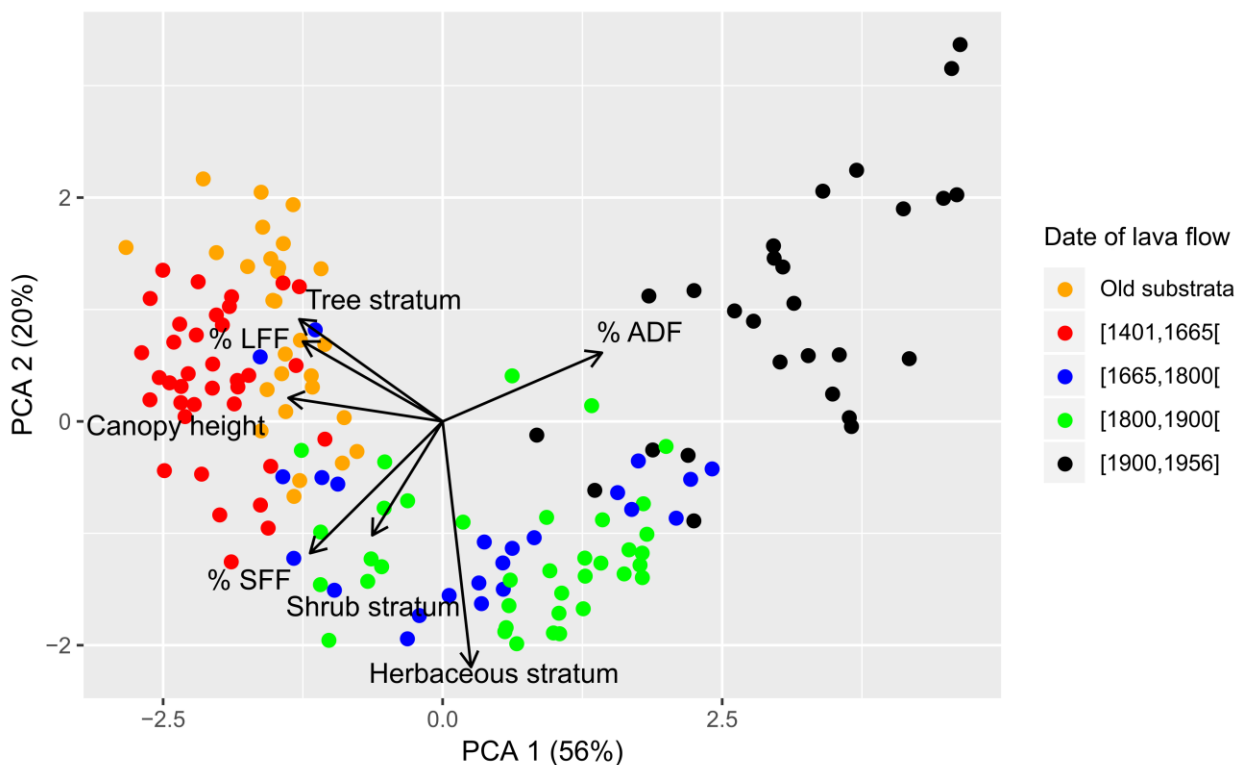


Fig. S7. PCA ordination plot showing the distribution of 151 historical plots along major PCA components and their association with four descriptors of vegetation structure and three descriptors of dispersal trait diversity. Tree, shrub and herbaceous stratum cover (%) and maximum canopy height (m) were assessed for each plot. Dispersal trait diversity is here based on dispersal trait proportions: % ADF = number of anemochorous dry-fruited species / number of woody plant species; % LFF = number of large fleshy-fruited species / number of woody plant species; % SFF = number of small fleshy-fruited species / number of woody plant species. Proportions account for the strong heterogeneity of plot area. Age class of vegetation plots is shown in different colours. The proportion of explained variance is given for each component.

A high proportion of total variance (76%) is explained. There is a strong relationship between dispersal trait diversity and vegetation structure across the chronosequence (temporal gradient is clearly visible). Plots on lava flows that occurred before 1665 usually show a high proportion of large and small fleshy-fruited species, in addition to a well closed tree stratum with tall trees. Plots on lava flows that occurred between 1665 and 1800 show a more heterogeneous distribution: several plots have well-structured vegetation, while many have an open canopy, like most plots on lava flows after 1800.

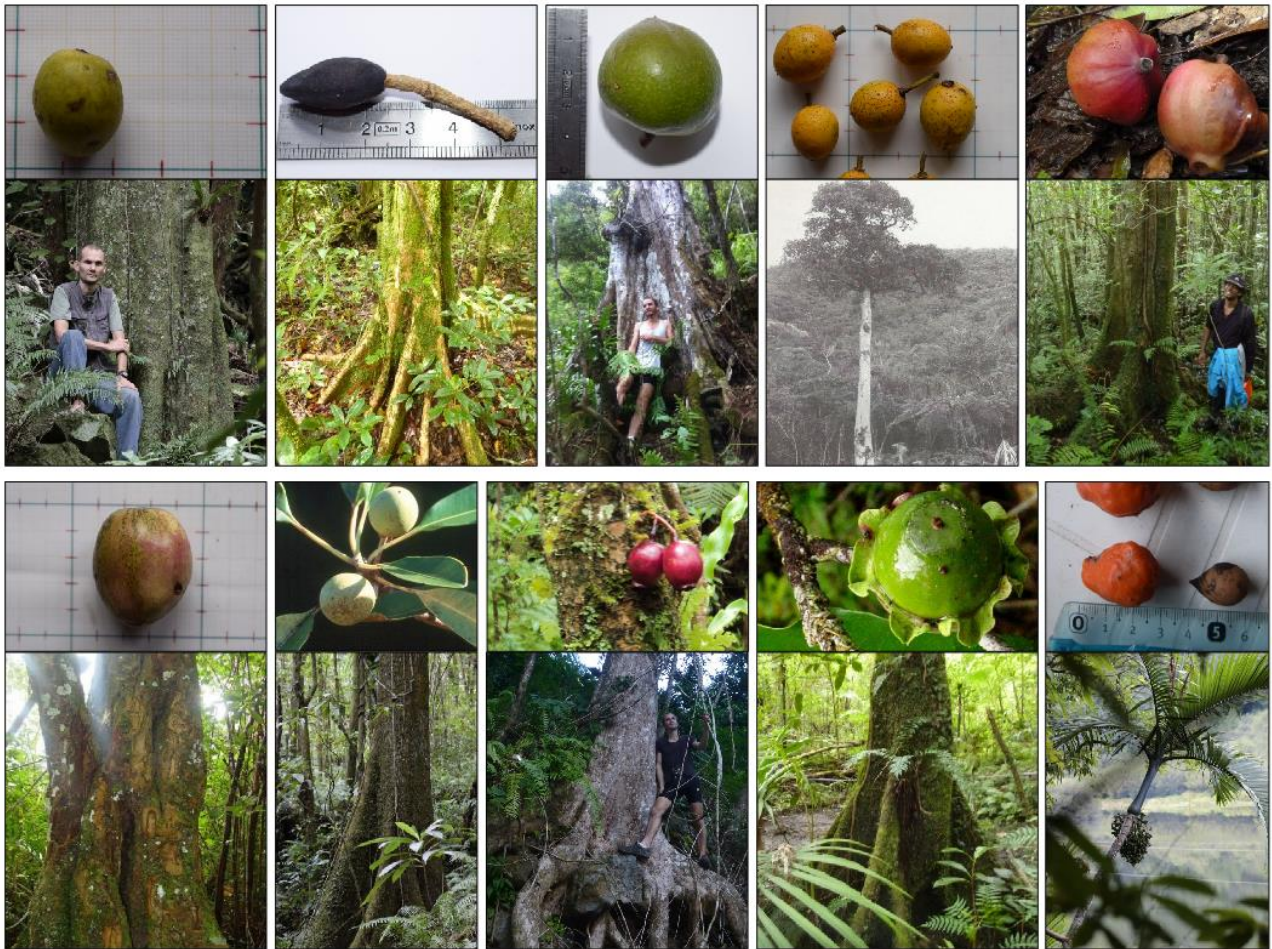


Fig. S8. Examples of native large fleshy-fruited trees that play a structural role in canopies of tropical rainforests on Réunion. Top, from left to right: *Cassine orientalis* (Celastraceae), *Chionanthus broomeana* (Oleaceae), *Sideroxylon majus* (Sapotaceae), *Drypetes caustica* (Putranjivaceae), *Hernandia mascarensis* (Hernandiaceae). Bottom, from left to right: *Ochrosia borbonica* (Apocynaceae), *Labourdonnaisia calophylloides* (Sapotaceae), *Syzygium cymosum* (Myrtaceae), *Diospyros borbonica* (Ebenaceae), *Hyophorbe indica* (Arecaceae). Photo montage: S. Albert

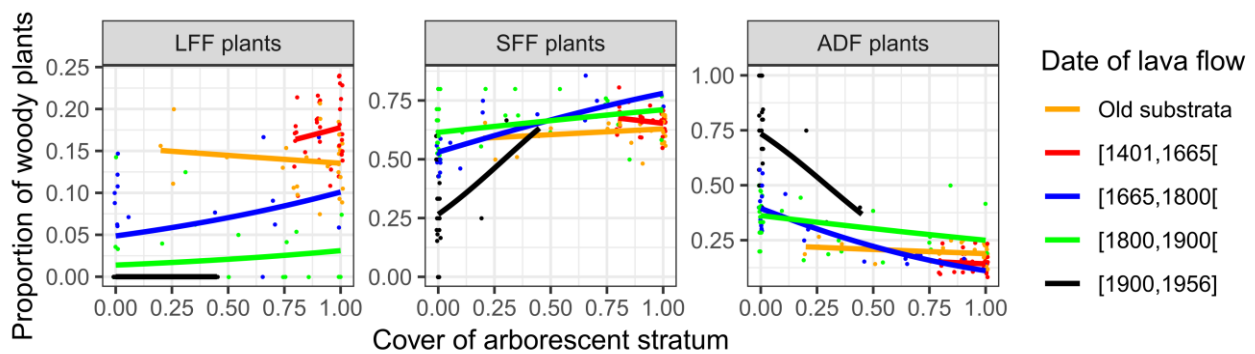


Fig. S9. Relationship across the chronosequence between the cover of arborescent stratum and the proportion of large fleshy-fruited (LFF), small fleshy-fruited (SFF) and anemochorous dry-fruited (ADF) plants among woody plants. Points and lines, respectively, display vegetation plots and predicted probabilities as fit by binomial glm. The proportions used account for the strong heterogeneity of plot area.

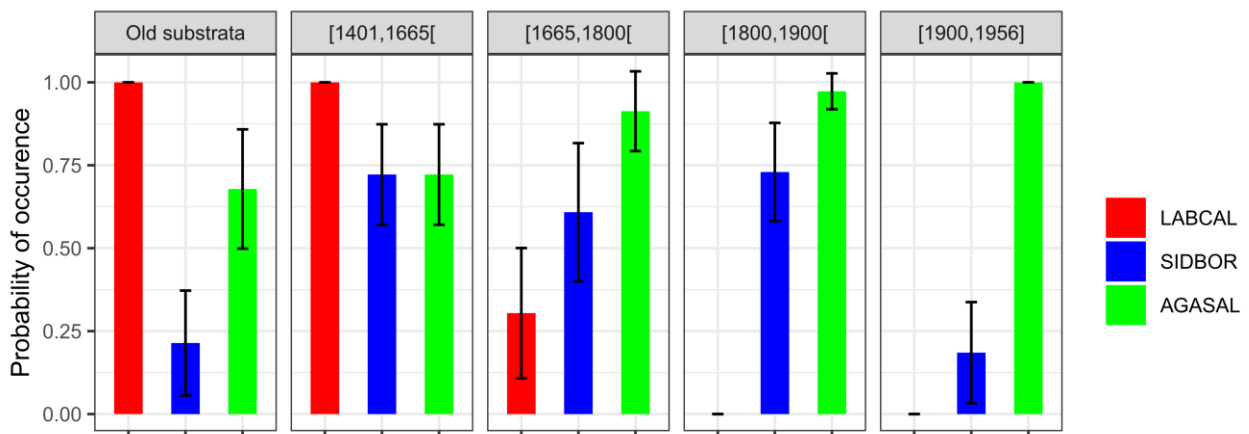


Fig. S10. Probability of occurrence across the chronosequence of three large common tree species: AGASAL, *Agarista salicifolia* (Ericaceae), an anemochorous long-lived pioneer tree; SIDBOR, *Sideroxylon borbonicum* (Sapotaceae), a small fleshy-fruited long-lived pioneer tree; LABCAL, *Labourdonnaisia calophylloides* (Sapotaceae), a large fleshy-fruited shade-tolerant tree. Bars and error bars, respectively, display mean of occurrence within plots and confidence intervals. The presence of a single seedling is enough to consider that a species is found in a vegetation plot. Long-lived pioneer trees live over 500 years.

LABCAL is always present on substrata before 1665, generally absent in lava flows dating from [1665,1800] and totally absent on lava flows that occurred after the extinction of every large-bodied frugivore, regardless of the level of canopy closure (see Fig.S7). SIDBOR is well represented on lava flows until 1900, but is rare on lava flows that occurred in the 20th century, despite the fact that it should be able to grow there. On the contrary, AGASAL is always present on recent lava flows. Hence, by taking into account the differences in the shade tolerance of common plant species, we show the same strong correlation between the age of lava flow as a proxy of disperser availability and the presence of plants in vegetation plots.



Fig. S11. Examples of large fleshy-fruited tree species settled on lava flows of the 16th century at Marelongue. These trees can have buttresses and reach 20 m high despite the hyperskeletal abruptic Leptosol on continuous rock (see Meunier et al., 2010). On each photo, *Labourdonnaisia calophylloides* (Sapotaceae) and *Syzygium borbonicum* (Myrtaceae) are respectively to the left and to the right. Photos: Alexis Gorissen.