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Data Article

Woody species diversity and land-use change legacy: Dataset across Uruguay

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ABSTRACT

The presented datasets relate to the research article entitled "Beyond the boundaries: Do spatio-temporal trajectories of land-use change and cross boundary effects shape the diversity of woody species in Uruguayan native forests?" [Ramírez and Säumel 10.1016/j.agee.2021.107646]. The datasets include field survey data on woody species diversity from 32 permanent plots of native forests across the Oriental Republic of Uruguay (South America). Based on land-use maps created with Landsat images we analysed the changes of percentage of cover, the landscape shape index and aggregation index of the different land-use types (i.e., native forest, grassland, timber plantation and crops) in a buffer of 3 km from the central point of each plot. Datasets were produced using ArcGIS and different R and Fragstat packages. Data on woody species diversity, land-use change history inform landscape planning, land-use management, policy and governance and can be used for further meta-analysis with other local, regional or global data sets.

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Specifications Table

Subject	Forest Ecology, Landscape Ecology
Specific subject area	Land-use mapping; Species diversity analysis; Land cover change
Type of data	Table; Image; Chart; Graph; Figure
How the data were acquired	Identification and mapping of woody species during two fieldwork campaigns in 2015/16 and in 2017 across 32 permanent plots inside native forest patches of Uruguay Calculation of abundance, species richness and the Shannon diversity index for adults, juveniles and all individuals using R (R Core Team, 2016).
Data format	Raw and analyzed data
Parameters for data collection	Site ID; age category and number of individuals; species richness; Shannon diversity index; percentage of cover per land-use type and year; landscape shape index per land-use type and year; aggregation index per land-use type and year; rate of change of the parameters (percentage of cover per land-use type; landscape shape index per land-use type; aggregation index per land-use type) across the years from 1987 to 2017
Description of data collection	We surveyed woody species diversity at 32 plots of native forests across Uruguay (South America). Based on land-use maps we calculated the changes of percentage of cover, the landscape shape index and aggregation index of the different land-use types in a buffer of 3 km from the central point of each plot.
Data source location	Oriental Republic of Uruguay (South America)
Data accessibility	*In Supplementary Material of this article and in* https://edoc.hu-berlin.de/handle/18452/24084.
Related research article	L.R. Ramirez, I. Säumel, Beyond the boundaries: Do spatio-temporal trajectories of land-use change and cross boundary effects shape the diversity of woody species in Uruguayan native forests? 10.1016/j.agee.2021.107646

Value of the Data

- Data on woody species diversity are crucial to describe the state of the art of local ecosystems and to evaluate the impact of land-use change on these ecosystems.
- Data on land-use change history using land-use metrics inform landscape planning, land-use management, policy and governance.
- Data can be used for example for comparison with data from other locations that suffer land-use change that focuses on woody species or for further meta-analysis with other local, regional or global data sets regarding changes of woody species diversity and trajectories of land-use change among others.

1. Data Description

The data described in this article are abundance, richness and Shannon diversity of adult and juvenile woody species at 32 plots in different native forests across Uruguay. We also present the slope trajectories of percentage of cover, the landscape shape index and the aggregation index of the different land-use types (i.e., native forest, grassland, timber plantation and crops) in a buffer of 3 km from the central point of each plot. The trajectories were represented as the slope of the fitting of the generalized linear model for each landscape metric (i.e. percentage of cover, the landscape shape index and the aggregation index of the different land-use types) over time (from 1987 to 2017).

In Fig. 1 we show the distribution of the 32 permanent plots (given by red dots) in different native forests across Uruguay, South America. The green coloured areas show the native forests, that are mostly gallery forests along the water courses, and park forests in the north western and central parts, and hill forests in the hills of the eastern parts of the country (e.g. Cuchilla de Heado, Cuchilla Grande or Cuchilla de las Averías). The numbers near the red dots are the identification numbers of the long-term monitoring sites (ID, see also tables). Native forests cover around 6% of the country's total surface area and are completely privately owned [1].

Figs. 2–5 show the fitting of generalized linear model for the percentage of native forests (Fig. 2), native grasslands (Fig. 3), timber plantations (Fig. 4) and crops (Fig. 5) from 1987 to 2017 in a 3 km radius around each plot's center. Numbers indicate identification number (ID) of landscapes. For ID number of the plot see Fig. 1.

Figs. 6–9 show the fitting of generalized linear model for the landscape shape index of native forests (Fig. 6), native grasslands (Fig. 7), timber plantations (Fig. 8) and crops (Fig. 9) from 1987 to 2017 in a 3 km radius around each plot's center. Numbers indicate identification number (ID) of landscapes.

Figs. 10–13 show the fitting of generalized linear model for the aggregation index of native forests (Fig. 10), native grasslands (Fig. 11), timber plantations (Fig. 12) and crops (Fig. 13) from 1987 to 2017 in a 3 km radius around each plot's center. Numbers indicate identification number (ID) of landscapes.

Figs. 14–16 show the slope of the trajectories of the area covered by the different land-uses (native forests, grassland, timber plantation and crops) given as percentage of the total area in a buffer zone of 3 km from the central point of each plot versus the diversity of all woody species (including both adults and juveniles, Fig. 14), versus the diversity of adult woody species with a dbh $\geq$ 5 cm (Fig. 15), versus the diversity of juvenile woody species with a dbh $<$ 5 cm (Fig. 16).

Figs. 17–19 show the slope of the trajectories of the landscape shape index by the different land-uses (native forests, grassland, timber plantation and crops) in a buffer zone of 3 km from the central point of each plot versus the diversity of all woody species (including both adults and juveniles, Fig. 17), versus the diversity of adult woody species with a dbh $\geq$ 5 cm (Fig. 18), versus the diversity of juvenile woody species with a dbh $<$ 5 cm (Fig. 19).

Figs. 20–22 show the slope of the trajectories of the aggregation index of the different land-uses (native forests, grassland, timber plantation and crops) in a buffer zone of 3 km from the central point of each plot versus the diversity of all woody species (including both adults and juveniles, Fig. 20), versus the diversity of adult woody species with a dbh $\geq$ 5 cm (Fig. 21), versus the diversity of juvenile woody species with a dbh $<$ 5 cm (Fig. 22).

Each dot in Figs. 14–22 stands for one of our 32 sites and represents the slope of the trajectories by land use type (i.e. green: native forests; yellow: grasslands; black: timber plantations and red: crops) in a buffer of 3 km from the central point of each plot.

Table 1 provides the data on abundance of woody species (i.e. number of individuals classified in the regeneration layer (juvenile individuals (dbh $<$ 5 cm) and adults with (dbh $\geq$ 5 cm). The calculated woody species richness per plot (ID) and Shannon diversity index by age classes per monitoring site is given. For ID number of the plot see Fig. 1.

Tables 2–4 provide the percentage of area covered (Table 2), the calculated landscape shape index (Table 3) and the calculated aggregation index (Table 4) by each land-use type in the landscape in a buffer of 3 km from the central point of each plot (ID) from 1987 to 2017. For ID number of the plots see Fig. 1.The landscape shape index is a measure for geometric complexity of a landscape. The aggregation index is a measure for the fragmentation of different uses across a landscape.

Table 5 provides the results of generalized linear model for percentage of cover by land use type. For ID number of the plot see Fig. 1.

Data of the Tables 1–4 are uploaded in the Open Access repository of the Humboldt Universität zu Berlin (https://edoc.hu-berlin.de) as Säumel, I. & Ramírez, L. 2021: Woody species diversity and legacy of land-use change in Uruguayan native forests. Tables 1–5 are also available in csv format in the Supplementary Material of this article.

2. Experimental Design, Materials and Methods

Woody diversity datasets were obtained from two fieldwork campaigns in 2015/16 and in 2017 across 32 permanent plots inside native forest patches of Uruguay (Fig. 1). Individual examples of woody species were identified, counted and classified based on the diameter at breast height (dbh) in adults (dbh $\geq$ 5 cm) and in juveniles (dbh $<$ 5 cm) [2].

We calculated abundance (number of individuals), species richness (number of species) and the Shannon diversity index for adults, juveniles and all individuals together independent of the age (Table 1) using package vegan [2] implemented in R [3]. We recorded 2349 individuals distributed in 589 adults and 1760 juveniles from 102 different woody species [4].

The Shannon diversity index is given by:

$$H = -\sum_{i=1}^{s} p_i \log_b p_i \quad (1)$$

Where p_i is the proportion of species i, s is the number of species so that $\sum_{i=1}^{s} p_i = 1$, and b is the base of the logarithm.

We created land-use maps within a buffer of 3 km from the central point of each of our permanent plots for the years 1986/1987, 1996/1997, 2006/2007 and 2016/2017 with ArcGis v.10.3.1 for desktop [5]. Land-use maps were created from Landsat images [6].

We calculated the percentage of cover, the landscape shape index and aggregation index of the different land-use types (i.e., native forest, grassland, timber plantation and crops, Tables 2–4) using Fragstat v.4 [7]. Furthermore, we analysed the percentage of cover, landscape shape index and aggregation index for each land-use type at each site for the years 1986/1987, 1996/1997, 2006/2007 and 2016/2017.

The percentage of landscape occupied by each land-use type is given by:

$$P_i = \frac{\sum_{j=1}^{n} a_{ij}}{A}(100) \quad (2)$$

Where P_i is the proportion of the landscape occupied by patches belonging to land-use i, a_{ij} is the area of patch ij, A is the total area of the landscape.

The landscape shape index (LSI) by land-use type is given by:

$$LSI = \frac{0.25 \sum_{k=1}^{m} e_{ik}^{*}}{\sqrt{A}} \quad (3)$$

Where e_{ik}^{*} is the total length of edges in the landscape between patches types of land-use type i and k, A is the total area of landscape and 0.25 is the factor of adjustment for raster format.

The aggregation index (AI) expressed in percentage is given by:

$$AI = \left\lfloor \frac{g_{ii}}{\max \rightarrow g_{ii}} \right\rfloor (100) \quad (4)$$

Where g_{ii} is the number of joins between pixel of patches belonging to land-use type i, $\max \rightarrow g_{ii}$ is the maximum number of joins between pixels of the same land-use type i.

We identified the trajectories of land-use change by land-use type for each site. We extracted the slope of the generalized linear model with Poisson distribution using the package glm2 [8] implemented in R [9] (Figs. 2–13). We used Poisson distribution as data are not normal distributed and to calculate regression coefficients we created a loop by landscape metric in R, given by:

```
for(i in 2:32) {
glmLandMet_k<-glm2(formula = LandMet_k[[i]] ~ year, family = poisson(link = "log"),
      data = LandMet_k)
  print(names(LandMet_k)[i])
  print(summary(glmLandMet_k))
  }
```

Where $glmLandMet_k$ is the output vector with coefficients and stats, $LandMet_k$ is the data base of the landscape metric k, *year* is the independent variable and *(link = "log")* is the link function based on natural logarithm, for more detail see [9].

We show the slopes of the trajectories and the data of woody diversity; see Trajectories of Figs. 14–22). The selected landscape metrics (i.e. percentage of cover, the landscape shape index and aggregation index of the different land-uses (i.e., native forest, grassland, timber plantation and crops) in a buffer of 3 km from the central point of each plot) are plotted versus woody species diversity parameters (i.e. abundance, richness and Shannon diversity of adult, juvenil woody species and of both age classes together).

Data

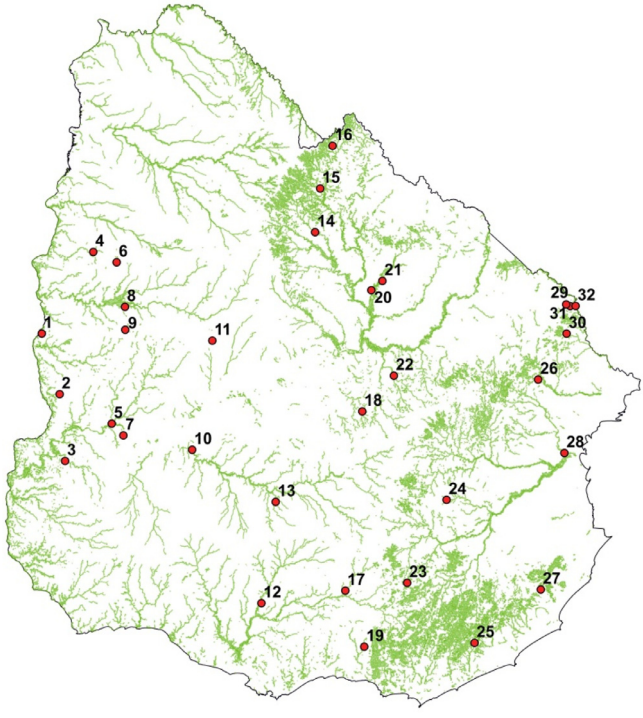

Fig. 1. Distribution of native forests and the 32 permanent plots in different native forests across Uruguay, South America.

Table 1
Abundance of woody species, woody species richness and Shannon diversity index by age classes across 32 plots in native forest of Uruguay, South America. id Identification number of the plot (see Fig. 1).

	Number of individuals			Species richness			Shannon diversity index		
id	Juveniles & Adults	Adults	Juveniles	Juveniles & Adults	Adults	Juveniles	Juveniles & Adults	Adults	Juveniles
1	34	5	29	13	12	4	2.27	1.33	2.24
2	31	12	19	9	9	5	2.02	1.55	2.06
3	47	13	34	11	9	8	2.08	1.99	1.94
4	37	11	26	11	11	5	2.13	1.47	2.16
5	65	17	48	11	10	8	2.29	1.98	2.18
6	27	8	19	11	9	5	2.17	1.49	2.07
7	53	15	38	13	12	8	2.34	1.96	2.23
8	80	15	65	18	16	11	2.52	2.34	2.4
9	67	14	53	15	14	10	2.41	2.21	2.35
10	53	13	40	7	7	6	1.88	1.7	1.83
11	72	26	46	15	12	10	2.51	2.16	2.3
12	38	11	27	11	9	6	2.04	1.72	1.84
13	61	21	40	16	10	11	2.41	2.28	1.97
14	44	15	29	12	9	8	2.25	1.96	1.96
15	48	15	33	15	8	11	2.37	2.3	1.94
16	86	20	66	16	12	11	2.5	2.29	2.26
17	25	18	7	11	6	8	2.27	2	1.75
18	70	17	53	16	15	11	2.53	2.28	2.4
19	74	25	49	16	11	12	2.48	2.39	2.21
20	99	20	79	17	16	12	2.68	2.36	2.58
21	89	26	63	20	18	15	2.78	2.63	2.7
22	68	14	54	13	13	7	2.33	1.83	2.3
23	55	20	35	12	8	9	2.17	2.13	1.87
24	86	20	66	17	14	11	2.58	2.29	2.49
25	79	19	60	13	12	9	2.36	2.1	2.28
26	191	29	162	31	30	14	3.25	2.54	3.24
27	80	27	53	17	12	15	2.53	2.58	2.31
28	114	22	92	24	20	14	2.95	2.52	2.78
29	58	26	32	17	10	14	2.6	2.56	2.07
30	77	25	52	24	17	14	2.88	2.55	2.56
31	180	27	153	38	36	16	3.43	2.67	3.42
32	161	23	138	34	31	15	3.21	2.56	3.17

Table 2
Percentage of cover occupied by each land-use type in the landscape from 1987 to 2017 in a buffer of 3 km from the central point of each plot ($N = 32$; Uruguay, South America). id Identification number of the plot (see Fig. 1).

	Native forests				Grassland				Timber plantations				Crops			
Id/year	1987	1997	2007	2017	1987	1997	2007	2017	1987	1997	2007	2017	1987	1997	2007	2017
1	20.3	16.9	18.9	10.1	70.1	45.6	47.5	19.4	0.4	0.0	0.3	0.0	8.2	36.4	32.1	67.9
2	1.9	9.2	8.2	13.7	91.7	54.9	53.4	56.9	0.4	33.0	36.6	18.7	6.0	2.9	1.8	10.7
3	5.4	6.9	7.8	9.4	90.2	49.4	69.0	61.1	0.2	6.9	3.6	13.4	4.1	36.6	19.5	16.1
4	12.2	5.5	6.8	14.4	87.3	92.8	65.6	40.9	0.1	0.0	27.3	36.1	0.5	1.6	0.3	8.6
5	18.5	25.8	21.8	26.6	73.7	49.4	48.4	46.3	0.3	11.2	18.2	12.7	1.9	8.3	6.7	8.5
6	6.7	6.4	0.9	7.4	87.9	71.4	53.9	35.7	3.8	7.4	43.2	54.3	1.6	14.9	2.0	2.6
7	0.0	1.3	2.9	0.7	46.6	36.8	30.7	23.8	0.8	2.7	7.4	18.5	0.1	0.9	2.0	0.7
8	58.8	51.4	58.6	56.6	40.9	47.7	36.3	34.5	0.0	0.0	0.1	0.1	0.2	0.2	5.0	7.5
9	5.2	2.1	4.1	8.5	94.4	79.9	62.9	52.6	0.1	18.0	31.3	38.5	0.4	0.0	1.7	0.3
10	9.6	15.0	10.5	14.9	86.7	81.7	85.6	63.1	0.3	0.1	0.1	11.3	0.0	0.1	0.1	7.1
11	1.1	3.2	1.0	12.1	98.3	93.7	95.0	54.4	0.6	2.9	3.7	31.0	0.0	0.1	0.1	2.3
12	16.4	19.0	17.9	18.0	59.2	47.8	47.9	32.5	0.0	0.0	0.0	0.0	24.2	23.3	23.7	38.7
13	4.8	5.1	6.0	8.1	93.7	83.7	81.2	67.2	0.0	0.0	0.0	0.2	1.1	11.2	12.3	24.2
14	14.2	13.2	14.3	11.5	69.1	86.4	69.0	72.0	0.2	0.1	16.7	16.3	0.0	0.1	0.0	0.0
15	21.1	7.4	15.5	13.8	70.7	87.8	84.4	49.3	0.0	0.1	0.1	36.7	0.0	4.6	0.0	0.2
16	15.1	32.5	23.3	15.0	61.9	41.3	24.4	28.5	0.0	26.2	52.2	51.9	0.0	0.0	0.0	4.2
17	10.0	7.8	7.4	5.8	48.7	73.7	81.5	66.4	0.0	0.2	0.0	0.0	41.0	18.2	10.8	27.6
18	3.8	7.5	3.7	9.2	95.8	91.9	95.8	79.5	0.2	0.1	0.2	11.0	0.2	0.4	0.3	0.3
19	11.0	4.5	6.1	6.7	65.8	66.0	55.5	25.3	0.1	13.3	10.2	11.1	23.1	16.2	28.2	56.8
20	17.5	19.6	22.2	46.8	65.6	79.7	68.1	36.1	16.9	0.0	3.7	0.1	0.0	0.7	5.9	13.0
21	20.9	25.0	25.5	45.7	67.6	61.3	55.0	40.5	7.3	0.0	2.9	0.4	1.2	10.2	14.5	7.4
22	16.1	20.2	10.9	11.4	81.7	70.4	74.7	76.8	0.0	7.0	12.4	9.8	0.0	0.2	0.0	0.3
23	10.9	20.8	20.9	22.3	88.9	79.2	62.4	61.3	0.1	0.0	16.7	16.4	0.0	0.0	0.0	0.0
24	6.9	13.5	8.5	13.5	60.2	85.9	72.8	67.7	32.8	0.6	18.6	18.7	0.0	0.0	0.0	0.1
25	4.6	3.1	7.0	7.3	95.3	96.4	51.0	63.9	0.1	0.0	42.0	26.6	0.0	0.6	0.0	2.2
26	6.4	6.1	7.9	9.9	93.6	93.1	91.8	61.6	0.0	0.1	0.0	27.5	0.0	0.0	0.1	0.4
27	3.9	7.2	8.8	7.4	96.1	91.4	79.4	79.0	0.0	0.1	10.0	11.5	0.0	1.4	1.6	2.1
28	19.2	34.1	37.9	36.8	70.6	35.4	53.2	21.5	0.0	0.1	0.0	0.0	3.6	24.7	5.2	39.6
29	3.1	1.6	1.8	5.6	96.5	97.7	98.2	83.9	0.3	0.0	0.0	10.0	0.0	0.7	0.0	0.4
30	7.1	7.6	10.2	15.7	92.8	92.4	89.8	80.4	0.1	0.0	0.0	3.9	0.0	0.0	0.0	0.0
31	2.8	1.6	1.1	2.7	96.9	97.5	98.9	96.0	0.2	0.0	0.0	1.0	0.0	0.9	0.0	0.4
32	11.4	10.8	11.4	15.6	87.4	86.8	86.9	82.0	0.2	0.0	0.0	0.0	0.0	0.6	0.7	0.1

Table 3
Landscape shape index by each land-use type in the landscape from 1987 to 2017 in a buffer of 3 km from the central point of each plot ($N = 32$; Uruguay, South America). id Identification number of the plot (see Fig. 1).

	Native forests				Grassland				Timber plantations				Croplands			
Id/year	1987	1997	2007	2017	1987	1997	2007	2017	1987	1997	2007	2017	1987	1997	2007	2017
1	12.7	10.4	11.8	10.0	9.5	14.9	18.3	22.3	2.3		3.7		10.6	16.3	17.1	10.9
2	8.9	14.3	11.7	15.4	3.4	9.4	11.6	13.1	2.5	6.8	8.2	8.3	4.4	4.7	6.3	5.8
3	8.3	9.7	8.9	9.5	4.3	17.7	9.7	12.5	2.2	6.6	5.8	6.0	7.1	14.2	9.3	13.8
4	11.8	8.4	13.4	17.2	5.4	3.6	10.3	13.4	2.7		11.6	9.0	4.1	4.9	3.8	2.9
5	9.4	11.2	11.1	11.3	5.9	13.8	14.2	13.9	2.7	11.5	9.0	10.0	9.3	5.3	9.8	7.0
6	15.9	13.6	8.4	19.3	6.0	10.1	13.7	18.0	2.8	5.6	14.6	13.2	4.9	10.8	5.0	5.1
7	1.2	5.3	13.7	7.6	4.4	6.9	9.5	14.5	5.1	7.0	7.3	13.8	2.1	3.1	4.5	4.9
8	8.9	7.0	7.5	8.8	10.3	6.8	9.7	10.2	2.8		1.6	2.6	4.6	2.6	2.5	4.1
9	13.6	8.2	10.8	14.8	4.2	4.7	11.4	16.9	2.6	5.2	12.0	16.0	4.0		4.0	2.7
10	13.7	12.7	12.8	15.7	5.0	5.5	4.5	9.8	3.7	1.1	1.2	8.4	1.0	2.8	2.4	3.8
11	8.3	12.1	7.5	23.9	2.2	2.6	2.1	16.0	2.1	5.1	3.4	14.7		2.4	2.7	5.4
12	14.7	15.3	13.7	13.0	10.2	16.2	16.3	20.3					16.3	18.6	13.4	13.5
13	7.7	7.1	9.2	9.0	3.2	6.4	6.2	9.1	1.0		1.6	4.7	3.6	10.4	7.9	9.4
14	16.0	11.7	14.1	15.4	4.9	5.5	6.5	8.5	3.5	2.5	6.2	7.6		1.6	1.0	1.3
15	8.7	8.0	10.7	11.1	4.2	3.7	5.5	7.1		2.3	1.6	4.8		2.7		2.7
16	9.4	24.6	15.5	12.2	7.6	10.3	8.5	12.3		16.8	7.5	7.5				3.4
17	12.1	10.0	10.0	9.4	14.0	9.0	8.9	8.2		2.1			11.7	10.8	14.6	8.2
18	11.8	13.2	11.9	20.9	3.7	5.0	3.6	8.3	1.9	3.1	2.6	11.7	4.1	2.9	2.7	3.9
19	14.6	8.3	11.7	12.0	12.3	12.3	18.3	20.9	1.0	8.3	6.7	7.5	15.3	13.1	18.2	12.7
20	12.2	10.9	11.1	8.8	6.4	5.8	7.4	9.6	2.8		1.7	3.5	2.1	1.8	4.2	6.3
21	10.4	9.4	8.6	7.4	7.4	7.9	7.5	8.6	2.6		2.1	5.0	4.7	3.8	5.4	8.8
22	10.4	16.1	12.6	13.8	5.4	10.9	7.7	8.3		7.9	7.9	10.9		4.5	1.9	4.8
23	15.3	18.3	18.3	23.3	6.3	10.1	12.2	14.2	1.1		5.8	9.5				
24	10.8	15.5	10.7	12.4	3.5	7.5	6.4	10.9	3.3	3.6	7.3	11.0				2.4
25	14.2	13.5	17.6	15.0	4.3	3.4	12.9	16.8	2.6	1.8	11.5	19.3		1.8		4.6
26	8.3	9.6	9.2	10.5	2.9	2.9	3.4	8.0		2.7		6.2			3.1	5.3
27	10.9	11.3	13.2	12.3	3.3	4.9	7.7	8.4		1.3	7.5	7.7		6.0	7.9	6.7
28	13.8	9.7	8.5	11.1	12.4	7.0	7.4	25.8		2.9			8.1	4.4	8.0	12.1
29	12.1	8.4	8.8	14.9	3.4	2.7	2.3	5.5	3.2			6.1		6.1		6.0
30	13.5	12.7	14.2	16.1	4.8	4.7	5.9	7.1	2.6			6.6				1.6
31	12.9	9.4	8.1	11.7	3.3	2.9	2.0	3.4	2.9			3.6		5.9		6.0
32	15.8	16.1	14.7	16.2	5.7	6.2	6.2	7.5	4.6					5.1	4.5	2.3

Table 4
Aggregation index by each land-use type in the landscape from 1987 to 2017 in a buffer of 3 km from the central point of each plot ($N = 32$; Uruguay, South America). Ididentification number of the plot (see Fig. 1).

	Native forests				Grassland				Timber plantations				Croplands			
Id/year	1986	1996	2007	2017	1986	1996	2007	2017	1986	1996	2007	2017	1986	1996	2007	2017
1	85	87	86	84	94	88	86	72	87		68		81	86	84	93
2	66	75	78	78	99	94	92	91	85	94	93	90	92	87	76	92
3	81	81	84	84	98	86	94	92	84	88	85	92	82	88	89	82
4	82	82	72	76	97	98	93	89	58		88	92	72	82	67	96
5	89	89	88	89	97	90	89	89	80	82	89	85	64	91	80	88
6	67	71	52	61	97	94	90	84	95	90	88	91	82	85	84	85
7	86	77	56	53	97	94	91	84	71	78	87	83	75	87	85	70
8	95	95	95	94	92	95	92	91	36		79	60	56	77	96	93
9	68	70	72	73	98	98	93	87	48	94	89	86	69		86	79
10	76	83	79	78	98	97	98	94	66	97	95	87	100	64	52	94
11	59	63	60	62	99	99	99	88	91	86	93	86		52	53	83
12	81	81	83	84	93	87	87	81					82	79	85	89
13	82	84	81	84	99	97	97	94	100		57	34	85	84	89	90
14	77	83	80	76	97	97	96	95	60	65	93	91		80	100	
15	90	85	86	84	98	98	97	95		78	87	96		95		71
16	88	76	83	83	95	92	91	88		82	95	95				93
17	80	81	81	80	89	95	95	95		83			90	87	76	92
18	68	74	67	62	98	98	98	95	88	63	77	81	55	82	81	65
19	76	80	75	75	92	92	87	77	100	89	90	89	83	83	81	91
20	85	87	88	93	96	97	96	92	97		98	52	50	94	92	92
21	88	90	91	95	96	95	95	93	97		96	61	80	95	93	83
22	87	81	80	78	97	93	96	95		85	89	82		50	54	53
23	75	78	78	73	97	94	92	90	98		93	88				
24	78	77	81	82	98	96	96	93	98	78	92	87				54
25	64	58	64	70	98	99	90	89	67	25	91	80		94		85
26	83	80	83	83	99	99	99	95		44		94			57	56
27	71	78	76	76	99	98	96	95		95	88	89		74	68	77
28	83	92	93	90	92	94	95	69		51			78	96	82	90
29	63	65	65	66	99	99	99	97	75			91		61		48
30	73	75	76	78	98	98	97	96	44			83				40
31	58	60	59	62	99	99	99	99	75			84		68		50
32	75	74	77	78	97	97	97	96	41					67	75	52

Table 5
Results of generalized linear model for percentage of cover by land use type [5]. Where id: Identification number of the plot (see Fig. 1), Est.: slope, SE: standandard error, *z*-value: *z* value, Pr(>|z|): *p*-value and AIC: Akaike Information Criterion

	Native forests					Grassland					Timber plantation					Crops				
id	Est.	SE	z-value	Pr(>|z|)	AIC	Est.	SE	z-value	Pr(>|z|)	AIC	Est.	SE	z-value	Pr(>|z|)	AIC	Est.	SE	z-value	Pr(>|z|)	AIC
1	-0.016	0.011	-1.491	0.136	24.3	-0.034	0.007	-4.906	0.000	31.5	-0.042	0.068	-0.617	0.537	10.4	0.051	0.008	6.245	0.000	34.6
2	0.039	0.016	2.518	0.012	21.8	-0.017	0.006	-2.951	0.003	33.9	0.027	0.010	2.801	0.005	64.5	0.022	0.018	1.220	0.223	24.1
3	0.016	0.016	1.008	0.313	19.9	-0.010	0.005	-1.811	0.070	37.7	0.056	0.019	2.917	0.004	22.6	0.009	0.010	0.943	0.346	51.1
4	0.007	0.014	0.477	0.633	24.7	-0.023	0.005	-4.294	0.000	34.0	0.106	0.016	6.531	0.000	37.4	0.077	0.029	2.671	0.008	19.2
5	0.010	0.009	1.043	0.297	25.1	-0.015	0.006	-2.548	0.011	29.7	0.042	0.014	2.960	0.003	30.9	0.024	0.017	1.401	0.161	21.1
6	-0.008	0.018	-0.447	0.655	23.0	-0.028	0.006	-4.811	0.000	28.2	0.077	0.011	7.278	0.000	33.4	-0.015	0.018	-0.874	0.382	32.8
7	0.023	0.030	0.740	0.459	16.0	-0.021	0.008	-2.787	0.005	25.6	0.080	0.019	4.097	0.000	18.8	0.020	0.032	0.629	0.529	14.9
8	0.000	0.006	0.059	0.953	28.3	-0.008	0.007	-1.155	0.248	27.6	0.013	0.052	0.258	0.797	11.7	0.080	0.028	2.897	0.004	16.9
9	0.024	0.019	1.268	0.205	20.9	-0.019	0.005	-3.632	0.000	28.5	0.063	0.011	5.753	0.000	34.9	0.024	0.041	0.595	0.552	15.0
10	0.007	0.012	0.608	0.543	23.2	-0.008	0.005	-1.693	0.090	30.9	0.120	0.037	3.227	0.001	17.6	0.094	0.037	2.536	0.011	16.1
11	0.066	0.023	2.855	0.004	20.9	-0.015	0.005	-3.144	0.002	35.8	0.111	0.021	5.354	0.000	22.5	0.086	0.053	1.638	0.101	11.8
12	0.003	0.010	0.258	0.796	23.3	-0.016	0.007	-2.508	0.012	27.8	0.016	0.008	1.920	0.055	23.3	0.016	0.008	1.920	0.055	26.7
13	0.014	0.017	0.843	0.399	19.3	-0.010	0.005	-2.065	0.039	29.3	0.013	0.052	0.258	0.797	11.7	0.059	0.014	4.143	0.000	24.0
14	-0.004	0.012	-0.296	0.767	22.1	-0.001	0.005	-0.207	0.836	31.1	0.083	0.019	4.374	0.000	28.4	0.042	0.056	0.756	0.450	11.1
15	-0.008	0.011	-0.681	0.496	28.6	-0.009	0.005	-1.817	0.069	38.4	0.266	0.056	4.772	0.000	16.6	-0.017	0.034	-0.505	0.614	23.1
16	-0.004	0.009	-0.427	0.670	32.0	-0.031	0.007	-4.165	0.000	29.0	0.061	0.009	6.821	0.000	54.4	2.374	3877	0.001	1.000	7.5
17	-0.015	0.015	-0.980	0.327	20.1	0.009	0.005	1.589	0.112	34.7	-0.042	0.096	-0.436	0.662	8.6	-0.018	0.009	-2.027	0.043	39.9
18	0.015	0.017	0.910	0.363	21.2	-0.005	0.005	-1.025	0.305	30.3	0.120	0.037	3.227	0.001	17.6	0.000	0.045	0.000	1.000	12.0
19	-0.013	0.016	-0.789	0.430	22.1	-0.025	0.006	-4.003	0.000	34.6	0.033	0.015	2.145	0.032	29.5	0.037	0.008	4.422	0.000	32.1
20	0.035	0.009	3.858	0.000	27.3	-0.016	0.006	-2.852	0.004	37.7	-0.095	0.025	-3.756	0.000	28.9	0.088	0.024	3.638	0.000	17.2
21	0.025	0.008	3.022	0.003	27.1	-0.016	0.006	-2.656	0.008	28.1	-0.057	0.028	-2.018	0.044	22.3	0.025	0.015	1.676	0.094	29.4
22	-0.016	0.011	-1.358	0.174	24.0	-0.001	0.005	-0.255	0.799	29.6	0.051	0.018	2.900	0.004	26.9	0.042	0.056	0.756	0.450	11.1
23	0.017	0.010	1.654	0.098	25.0	-0.014	0.005	-2.623	0.009	29.1	0.088	0.020	4.456	0.000	31.2	-0.003	0.005	-0.720	0.472	23.1
24	0.013	0.013	1.030	0.303	23.4	0.002	0.005	0.288	0.773	33.2	-0.013	0.010	-1.228	0.219	54.8	2.272	5195	0.000	1.000	6.0
25	0.015	0.018	0.874	0.382	19.8	-0.018	0.005	-3.489	0.000	36.6	0.079	0.013	5.945	0.000	60.3	0.062	0.047	1.330	0.183	14.7
26	0.017	0.016	1.070	0.285	20.0	-0.011	0.005	-2.331	0.020	32.6	0.274	0.068	4.001	0.000	17.3	0.101	0.091	1.116	0.264	9.0
27	0.014	0.016	0.881	0.378	20.5	-0.007	0.005	-1.507	0.132	29.5	0.095	0.025	3.756	0.000	21.5	0.054	0.036	1.520	0.129	14.9
28	0.018	0.008	2.248	0.025	27.9	-0.029	0.007	-4.193	0.000	38.5	-0.042	0.096	-0.436	0.662	8.6	0.048	0.011	4.318	0.000	49.5
29	0.021	0.022	0.970	0.332	18.4	-0.004	0.005	-0.893	0.372	30.3	0.159	0.053	2.987	0.003	18.3	0.013	0.052	0.258	0.797	13.0
30	0.026	0.014	1.915	0.056	21.2	-0.005	0.005	-0.967	0.333	29.6	0.101	0.052	1.933	0.053	15.4	2.272	5195	0.000	1.000	6.0
31	-0.003	0.025	-0.124	0.901	17.0	0.000	0.005	-0.045	0.964	29.8	0.042	0.056	0.756	0.450	12.5	0.013	0.052	0.258	0.797	13.0
32	0.011	0.012	0.920	0.358	22.2	-0.002	0.005	-0.360	0.719	29.3	-2.272	5195	0.000	1.000	6.0	0.024	0.041	0.595	0.552	14.2

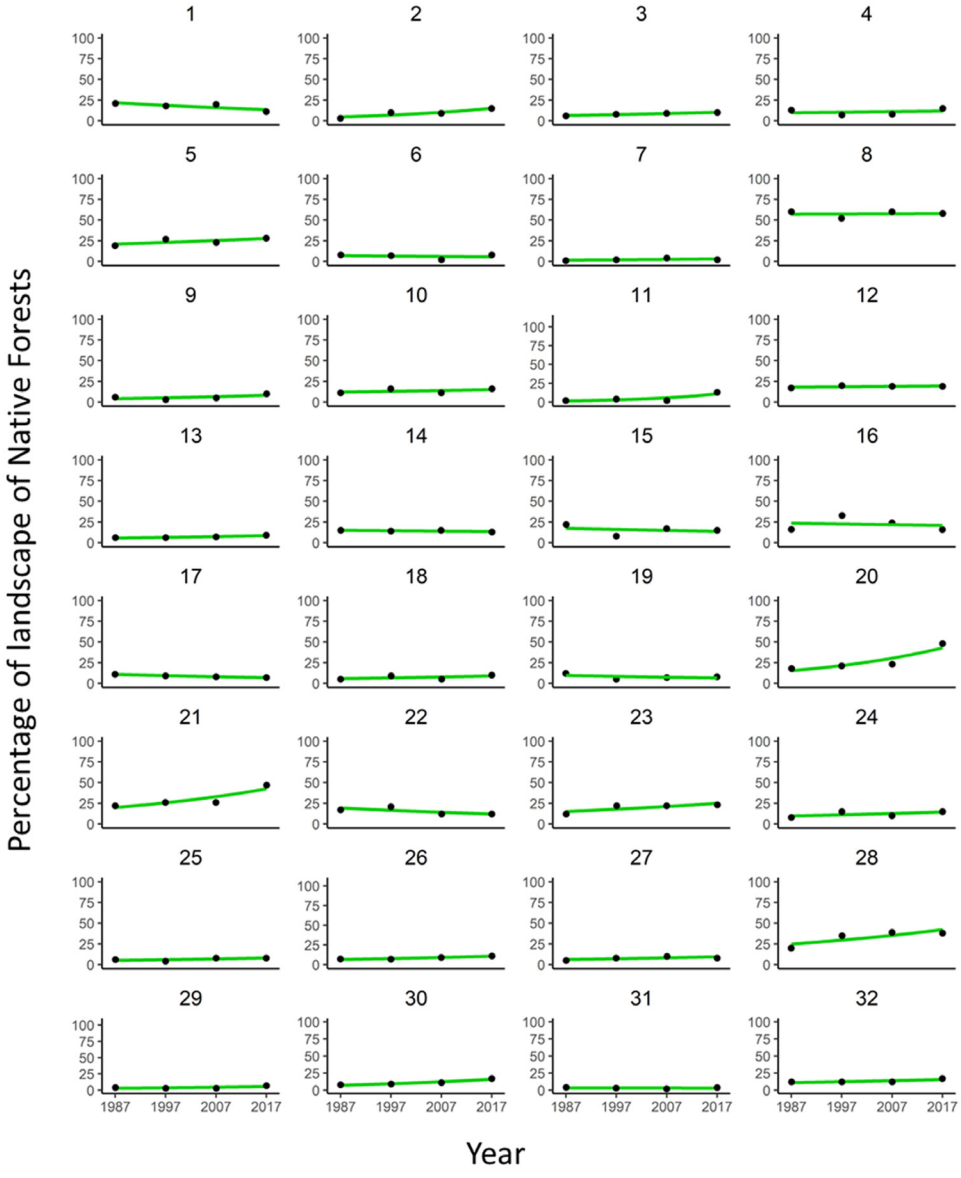

Fig. 2. Regression of generalized linear model for percentage of native forest. Numbers indicate identification number of landscapes.

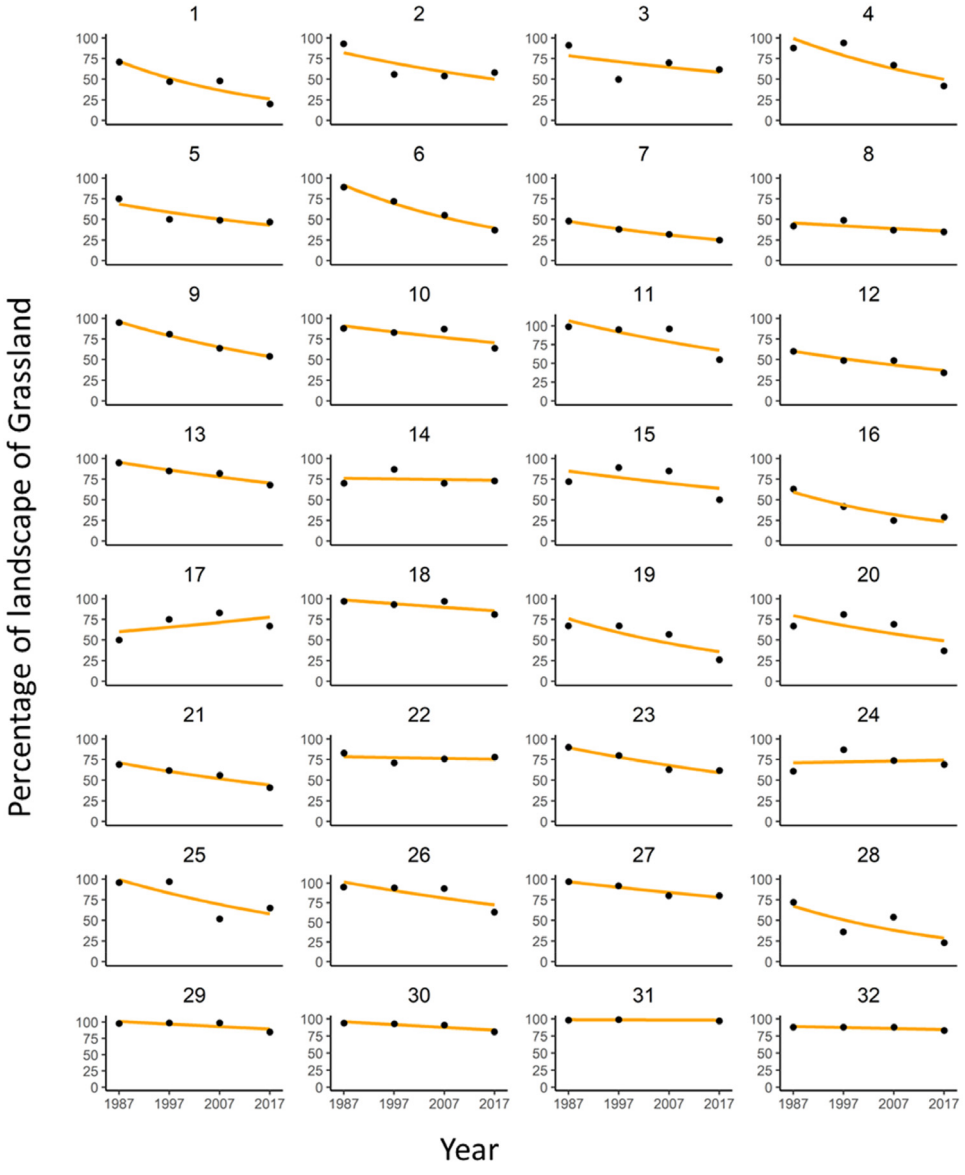

Fig. 3. Regression of generalized linear model for percentage of grassland. Numbers indicate identification number of landscapes.

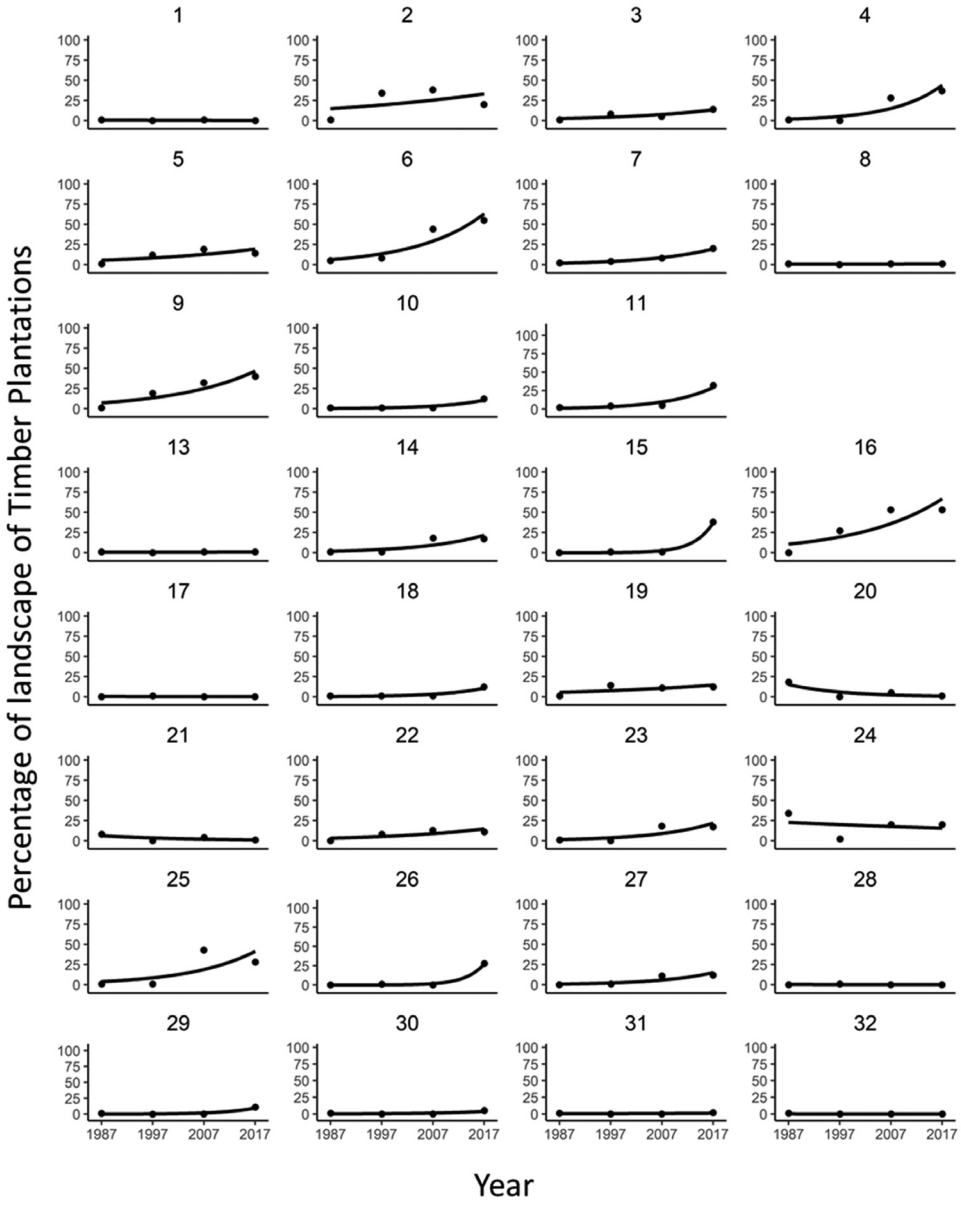

Fig. 4. Regression of generalized linear model for percentage of timber plantations. Numbers indicate identification number of landscapes.

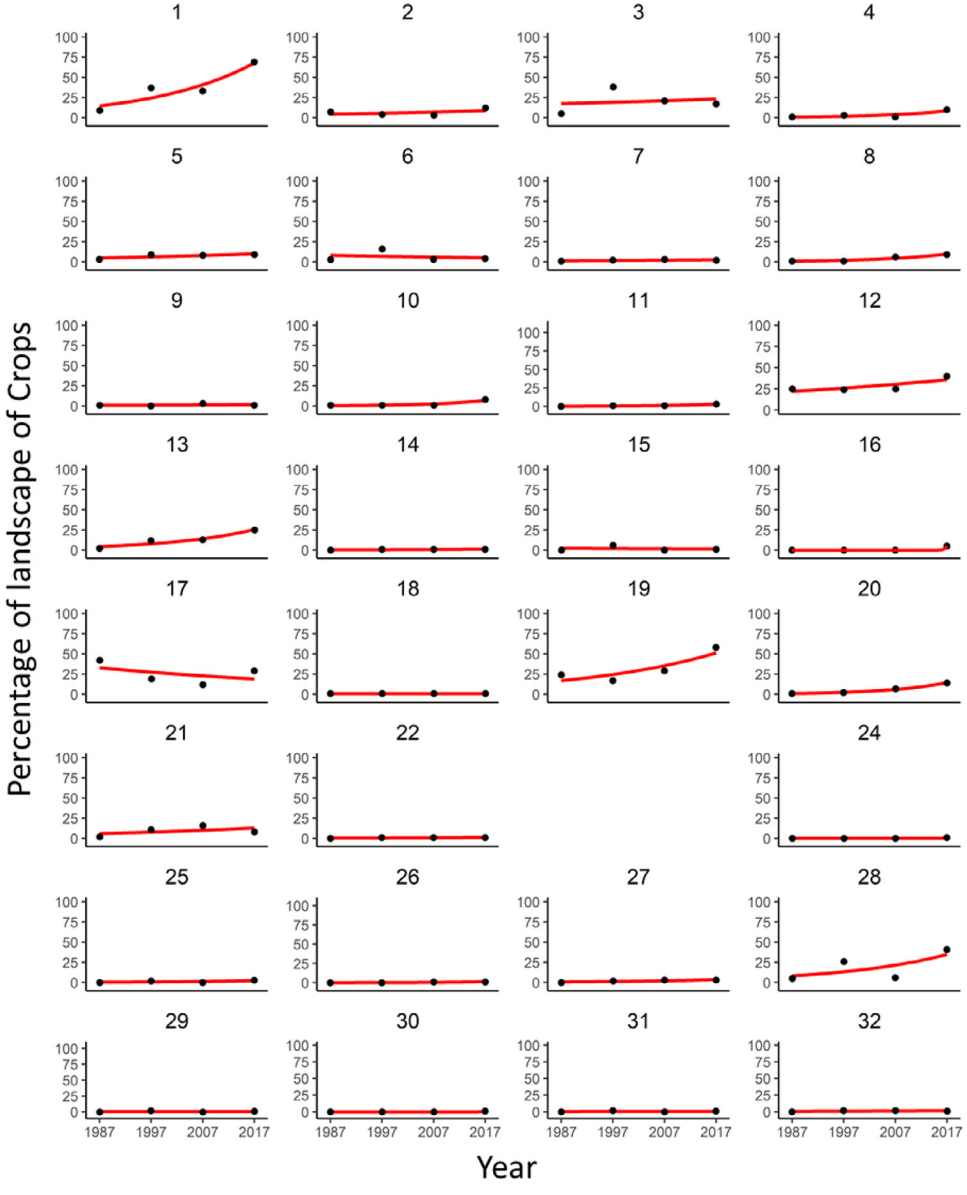

Fig. 5. Regression of generalized linear model for percentage of crops. Numbers indicate identification number of landscapes.

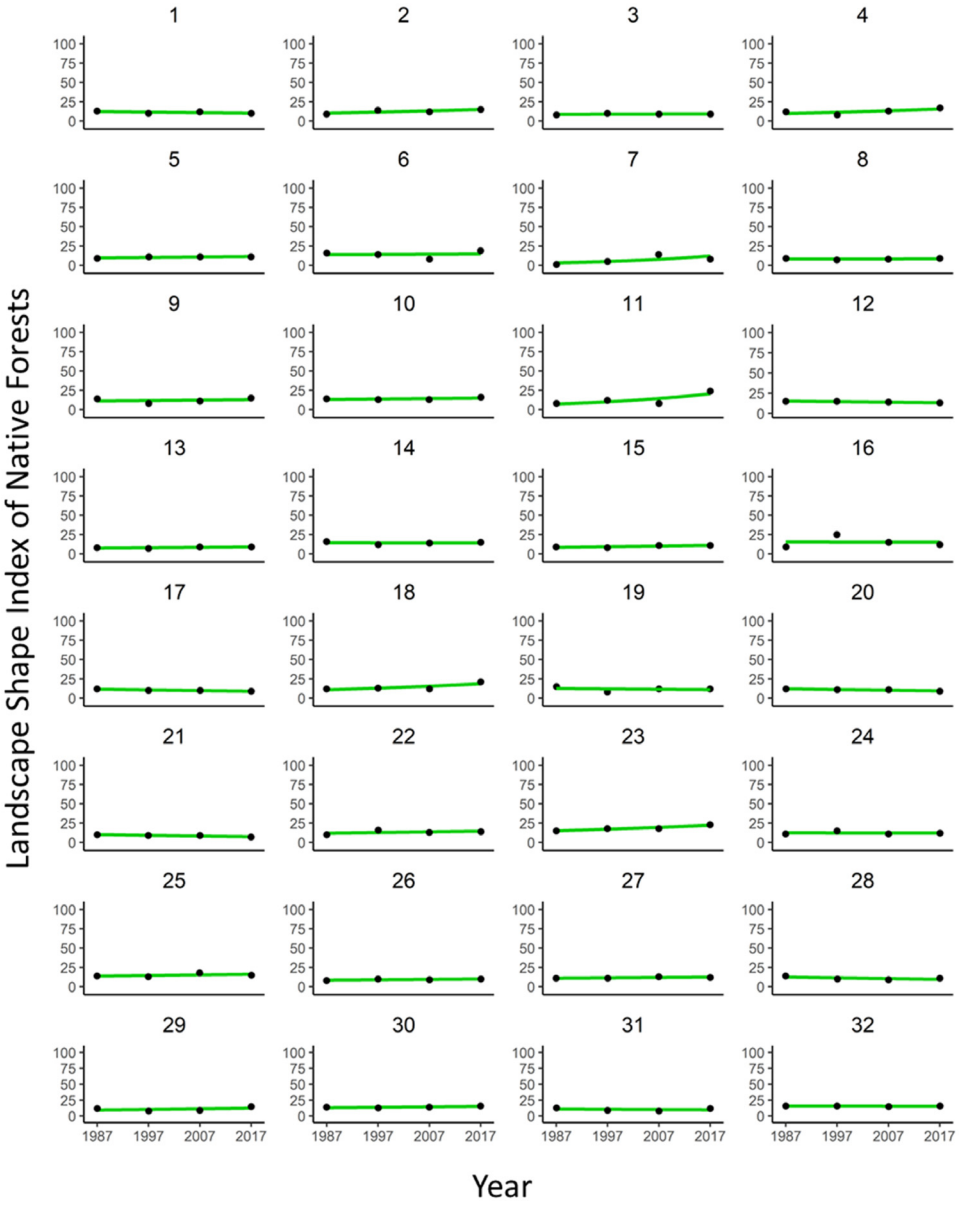

Fig. 6. Regression of generalized linear model for landscape shape index of native forest. Numbers indicate identification number of landscapes.

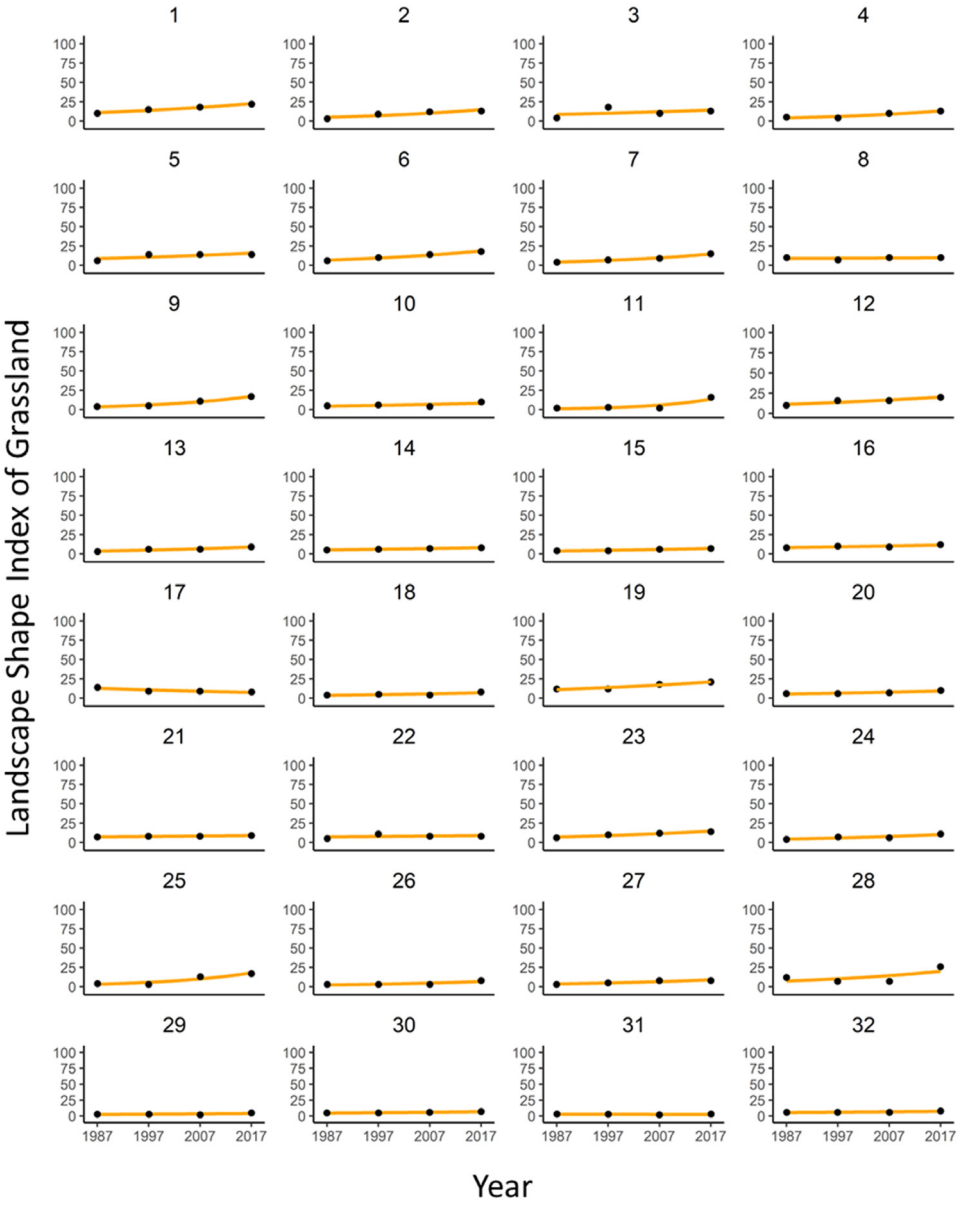

Fig. 7. Regression of generalized linear model for landscape shape index of grassland. Numbers indicate identification number of landscapes.

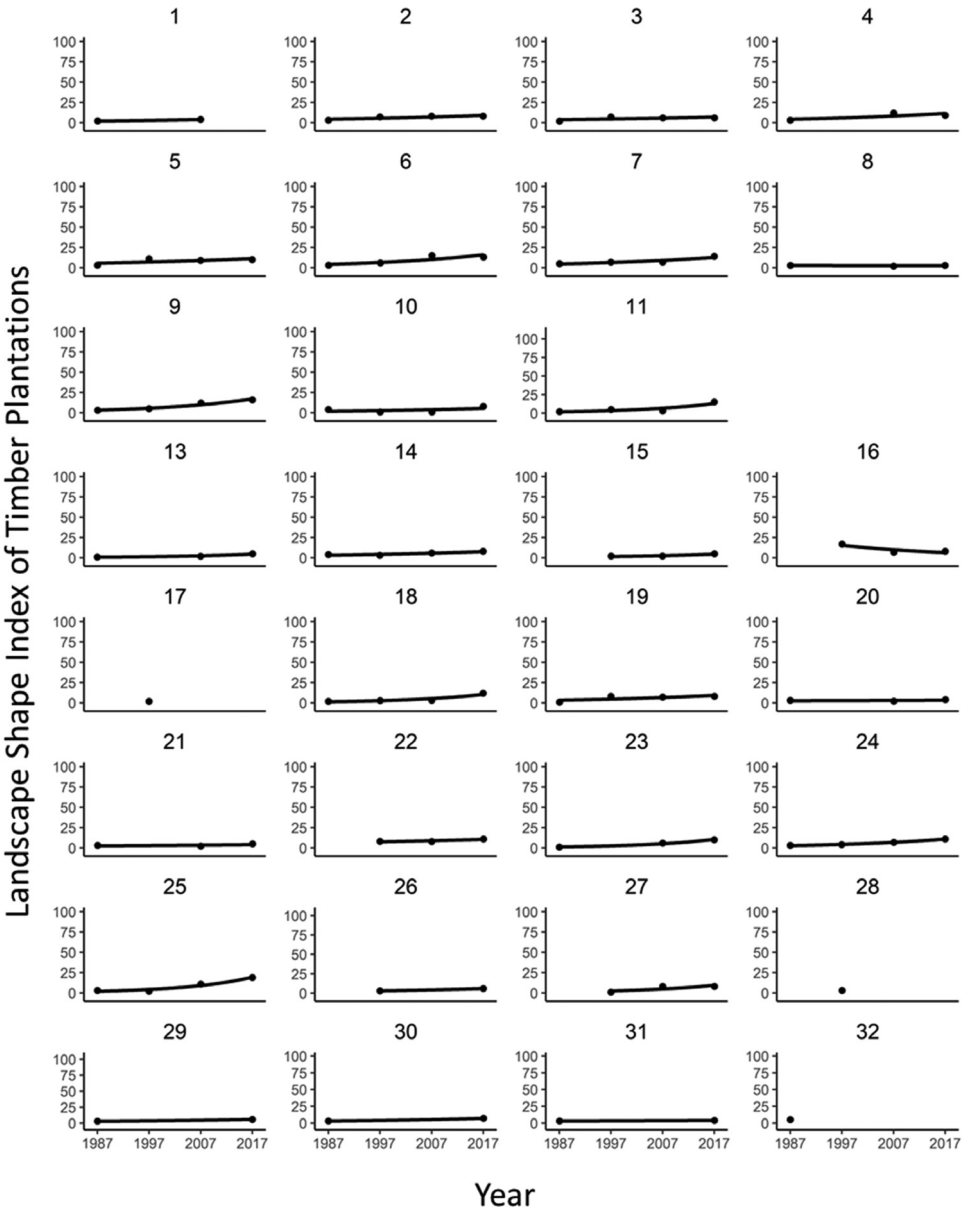

Fig. 8. Regression of generalized linear model landscape for shape index of timber plantations. Numbers indicate identification number of landscapes.

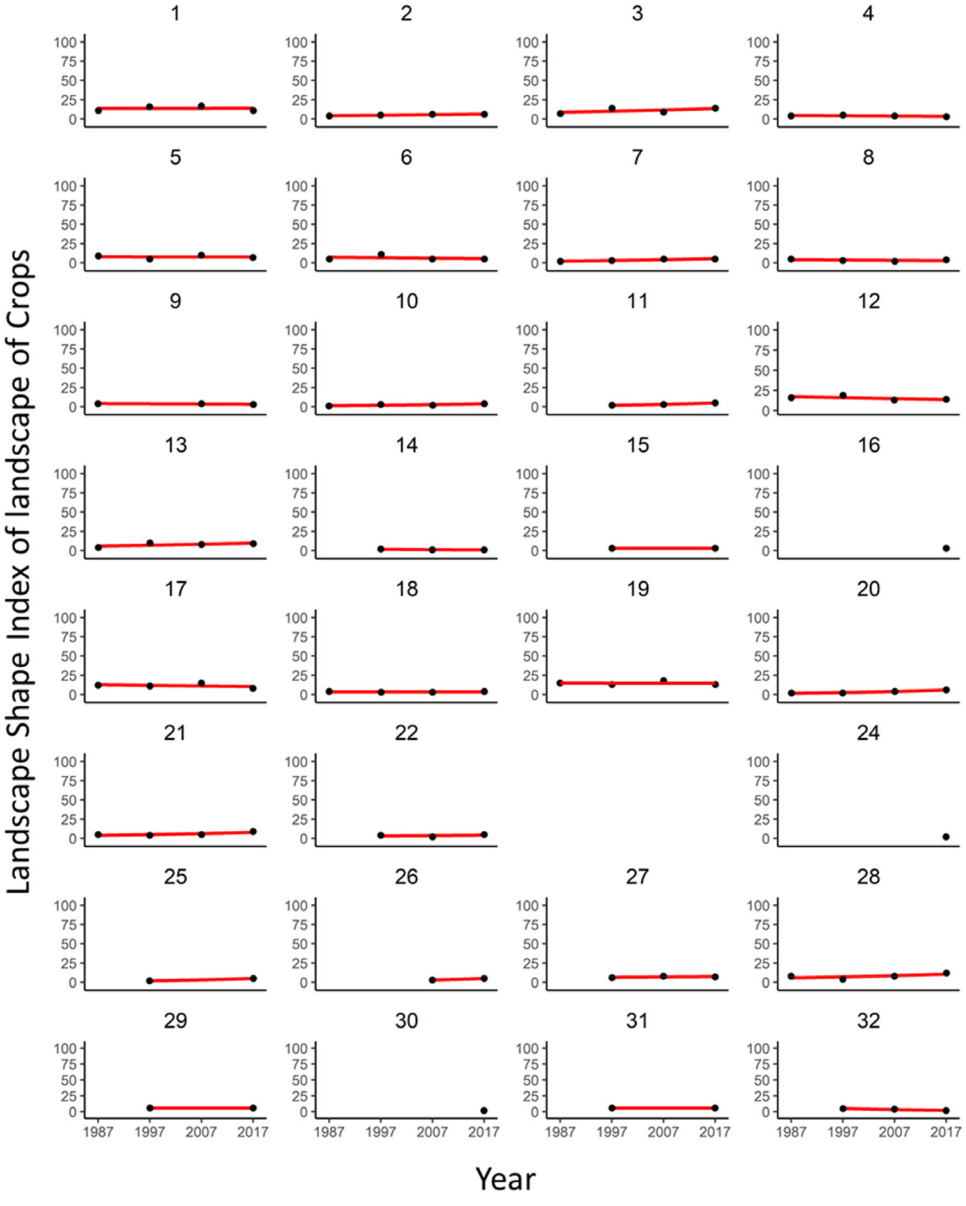

Fig. 9. Regression of generalized linear model for landscape shape index of crops. Numbers indicate identification number of landscapes.

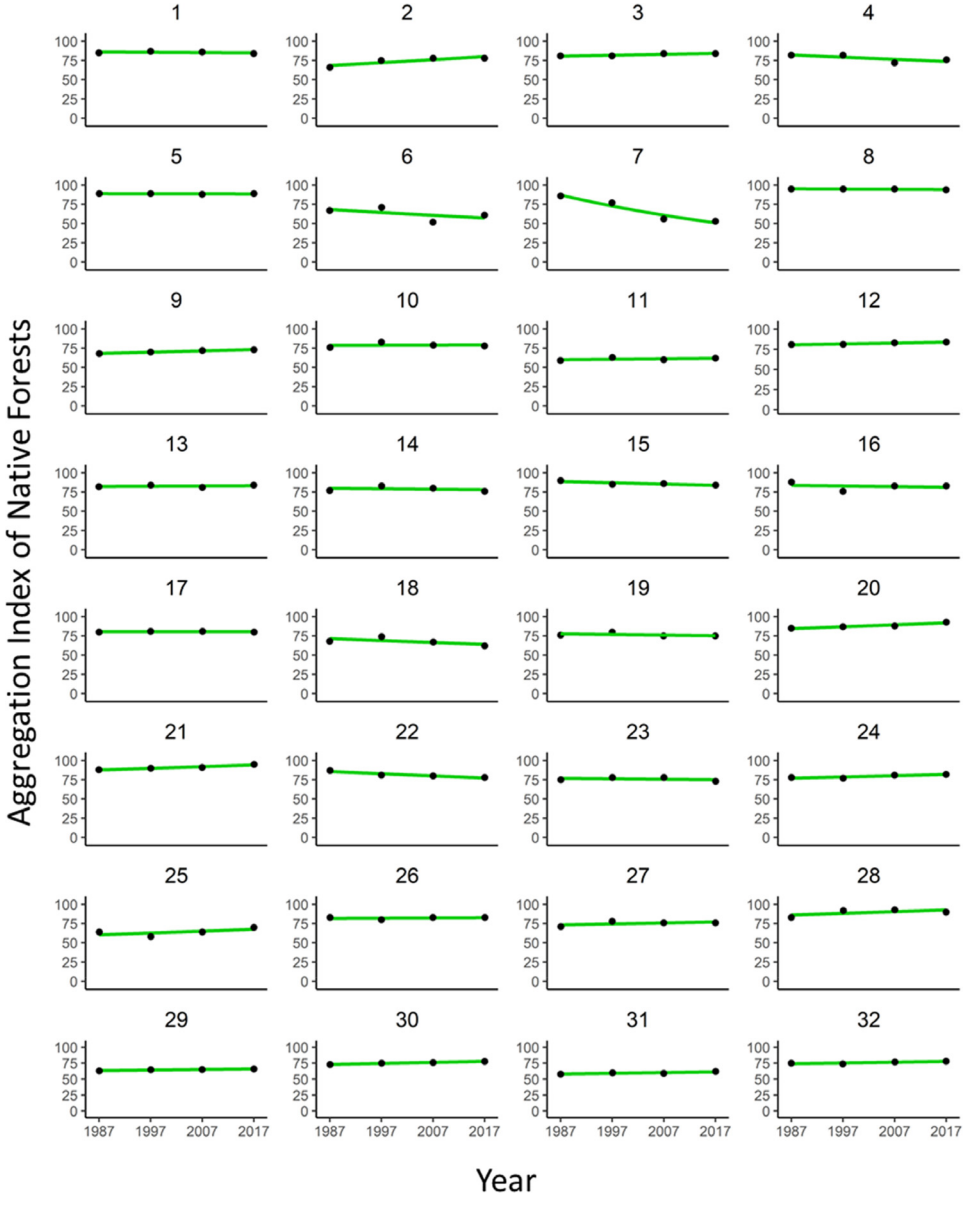

Fig. 10. Regression of generalized linear model for aggregation index of native forest. Numbers indicate identification number of landscapes.

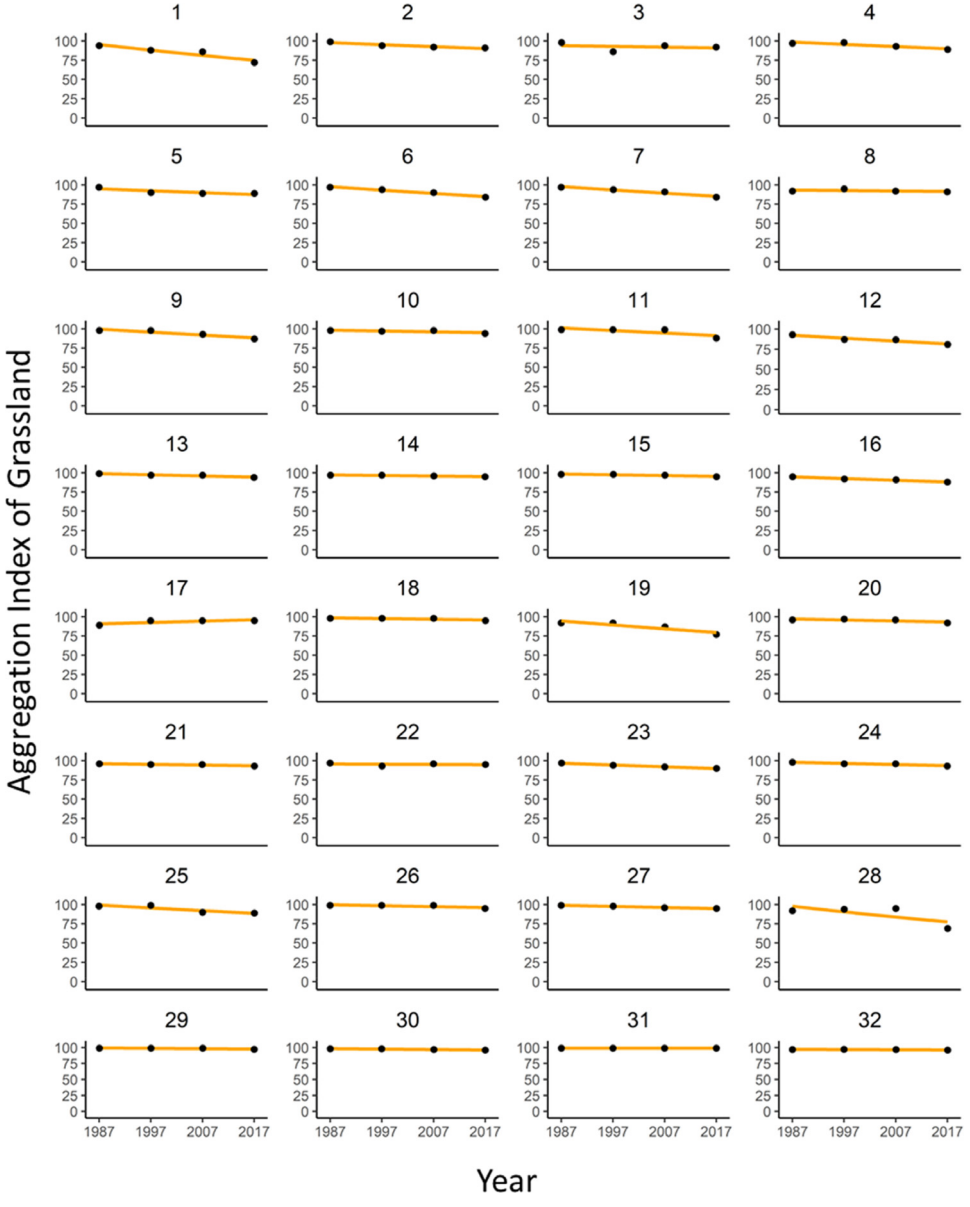

Fig. 11. Regression of generalized linear model for aggregation index of grassland. Numbers indicate identification number of landscapes.

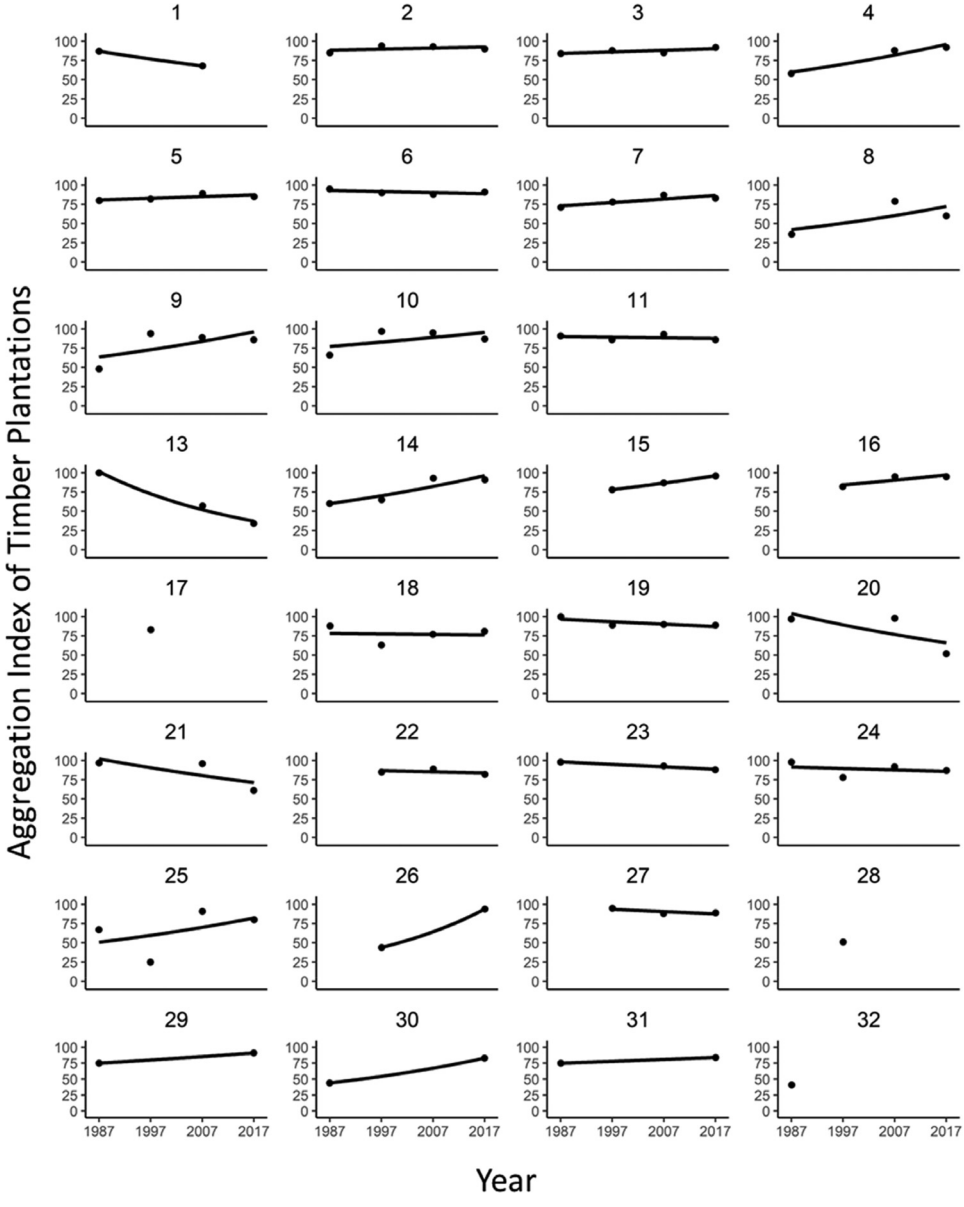

Fig. 12. Regression of generalized linear model for aggregation index of timber plantations. Numbers indicate identification number of landscapes.

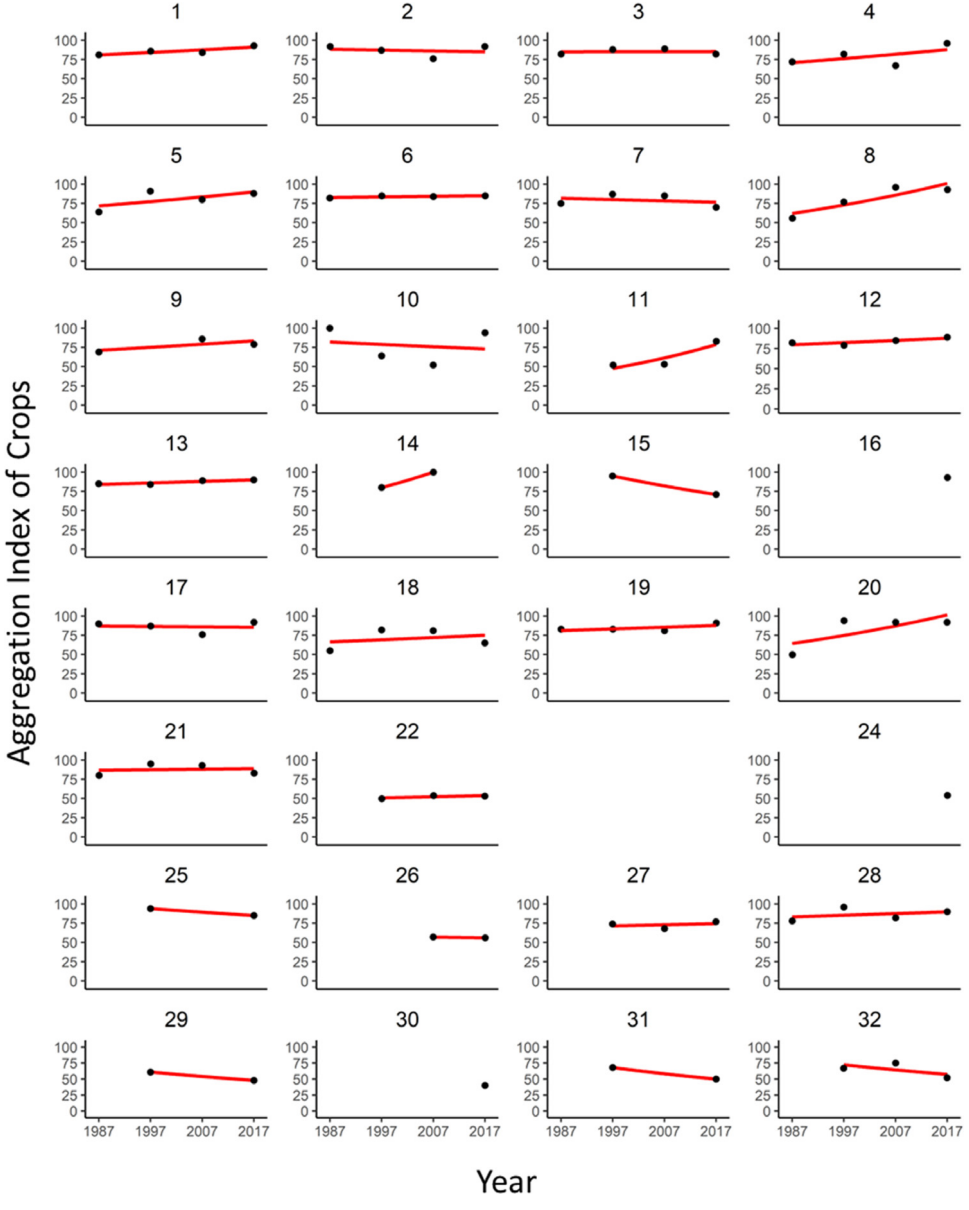

Fig. 13. Regression of generalized linear model for aggregation index crops. Numbers indicate identification number of landscapes.

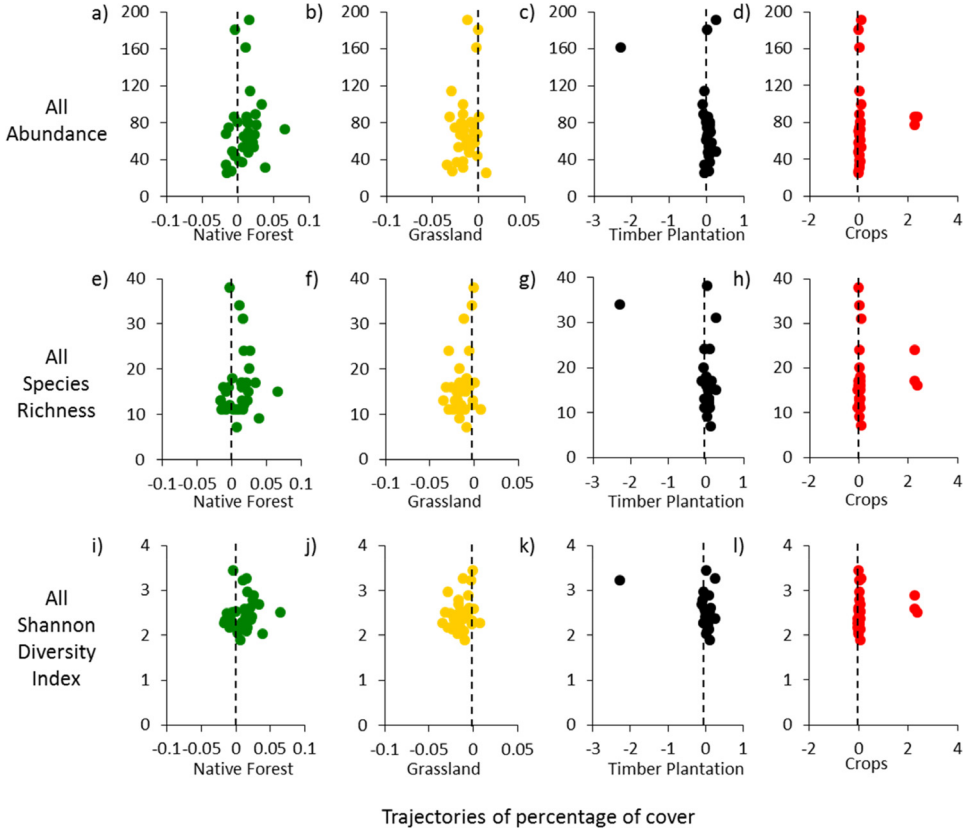

Fig. 14. Trajectories of percentage of cover versus all woody species diversity (adults and juveniles). Each dot stands for one of our 32 sites and represents the slope of the trajectories by land use type (i.e. green: native forests; yellow: grasslands; black: timber plantations and red: crops) in a buffer of 3 km from the central point of each plot.

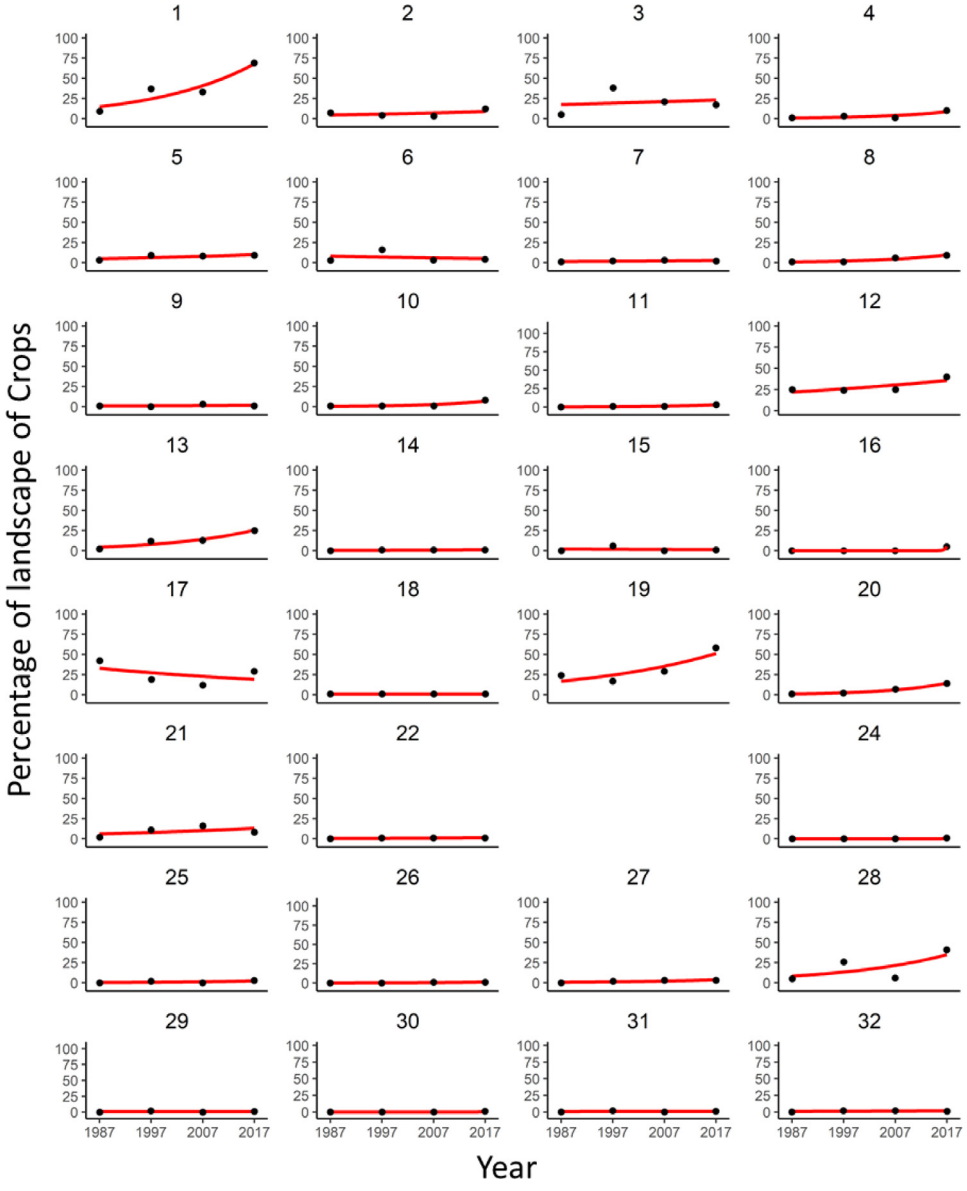

Fig. 15. Trajectories of percentage of cover versus adult woody species diversity. Each dot stands for one of our 32 sites and represents the slope of the trajectories by land use type (i.e. green: native forests; yellow: grasslands; black: timber plantations and red: crops) in a buffer of 3 km from the central point of each plot.

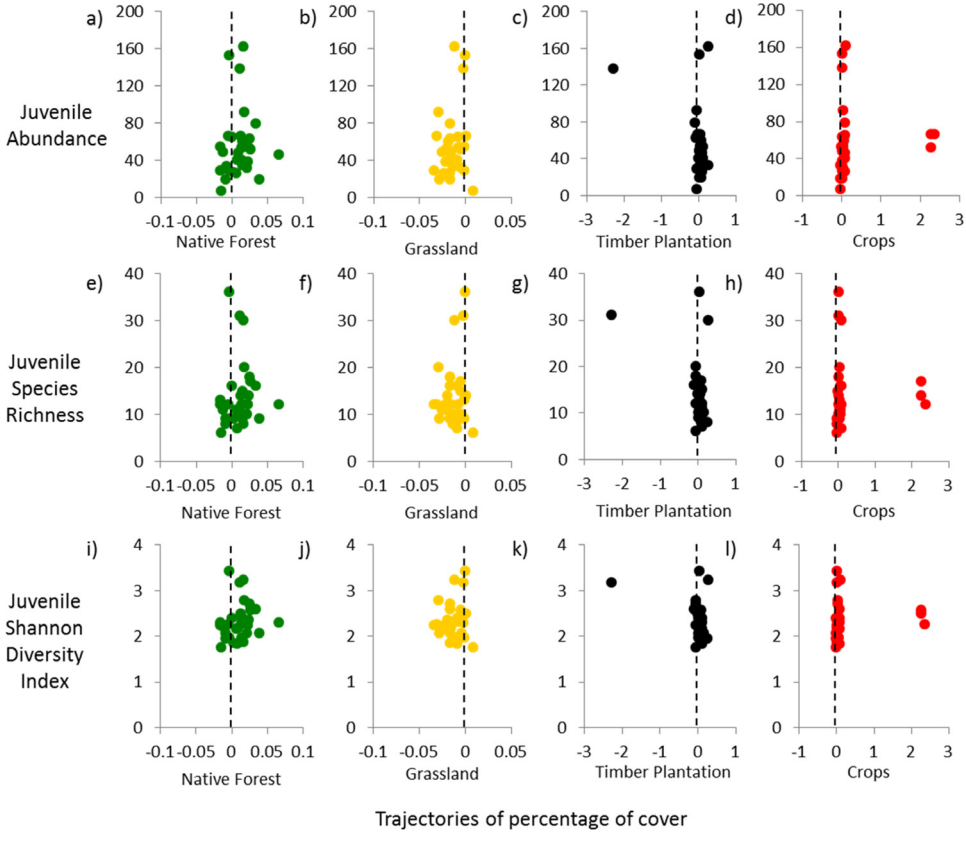

Fig. 16. Trajectories of percentage of cover versus juvenile woody species diversity. Each dot stands for one of our 32 sites and represents the slope of the trajectories by land use type (i.e. green: native forests; yellow: grasslands; black: timber plantations and red: crops) in a buffer of 3 km from the central point of each plot.

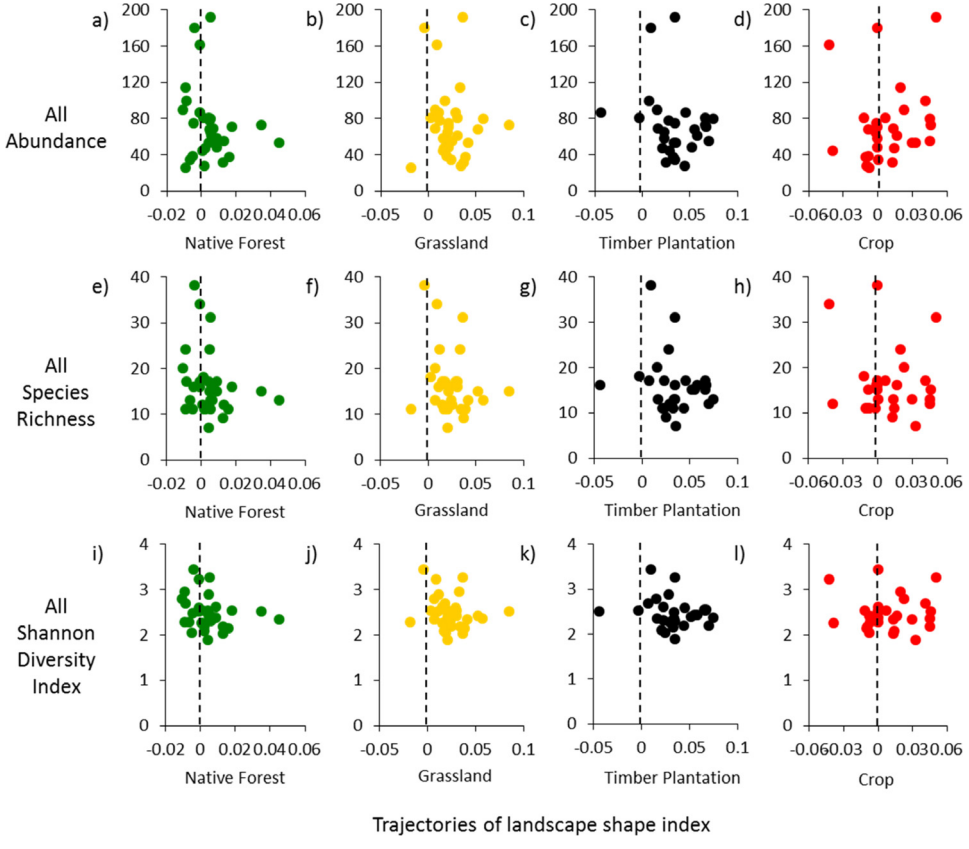

Fig. 17. Trajectories of landscape shape index versus all woody species diversity (adult and juvenile). Each dot stands for one of our 32 sites and represents the slope of the trajectories by land use type (i.e. green: native forests; yellow: grasslands; black: timber plantations and red: crops) in a buffer of 3 km from the central point of each plot.

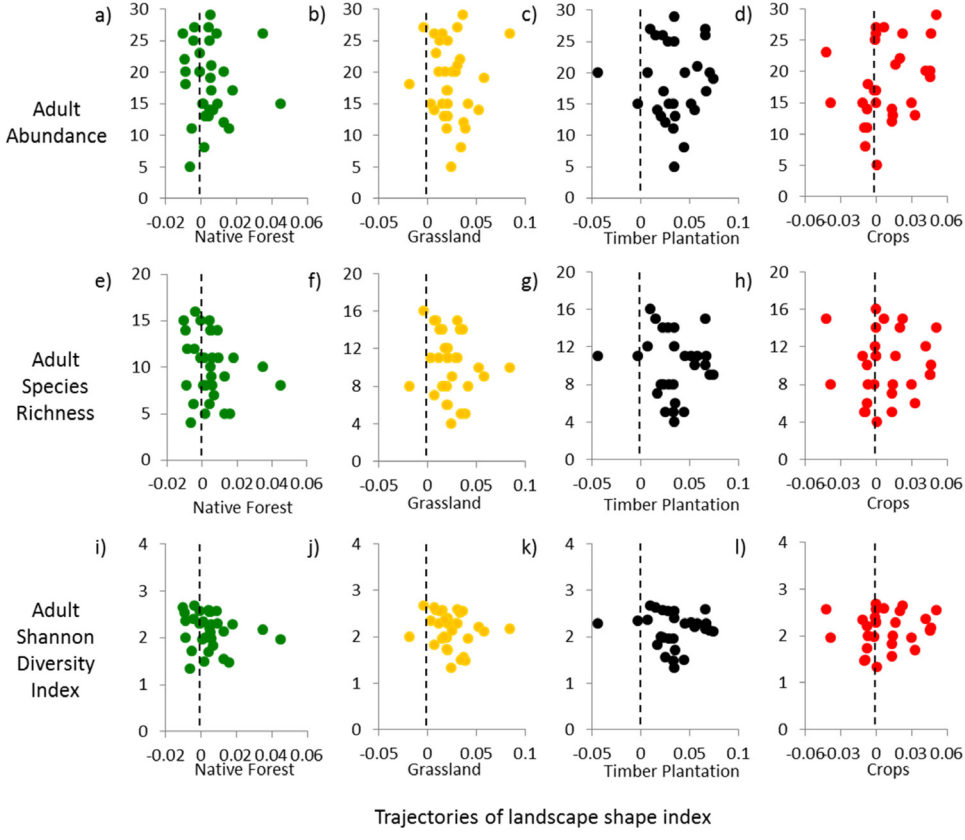

Fig. 18. Trajectories of landscape shape index versus adult woody species diversity. Each dot stands for one of our 32 sites and represents the slope of the trajectories by land use type (i.e. green: native forests; yellow: grasslands; black: timber plantations and red: crops) in a buffer of 3 km from the central point of each plot.

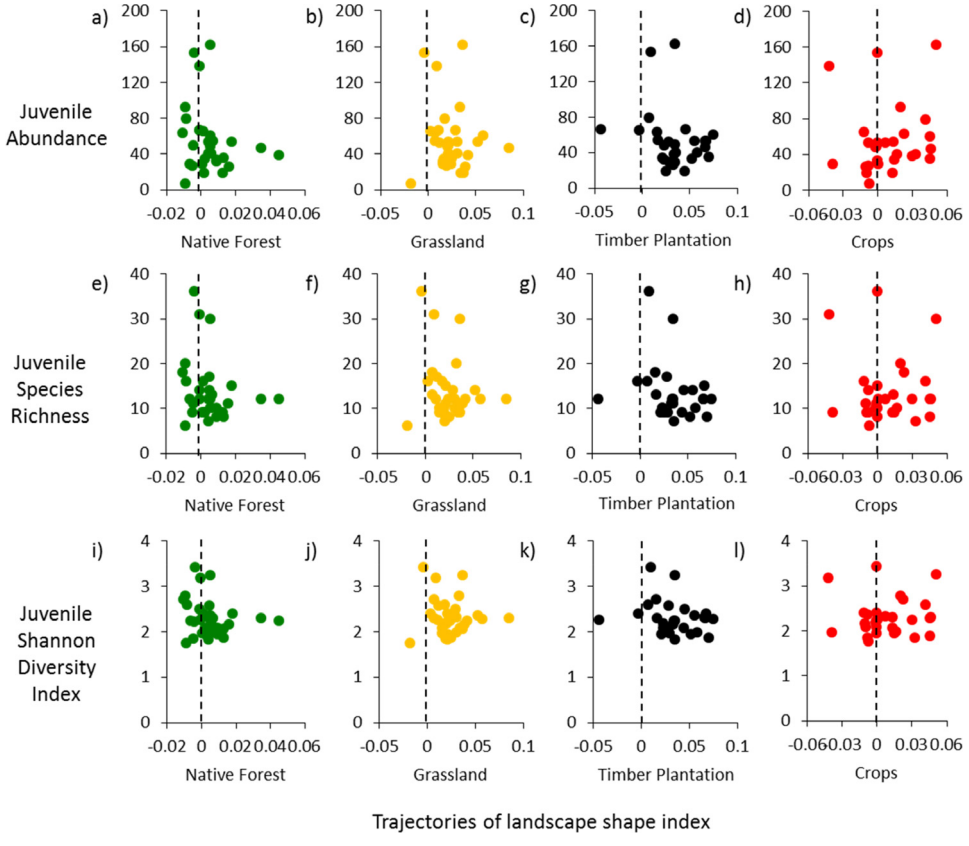

Fig. 19. Trajectories of landscape shape index versus juvenile woody species diversity. Each dot stands for one of our 32 sites and represents the slope of the trajectories by land use type (i.e. green: native forests; yellow: grasslands; black: timber plantations and red: crops) in a buffer of 3 km from the central point of each plot.

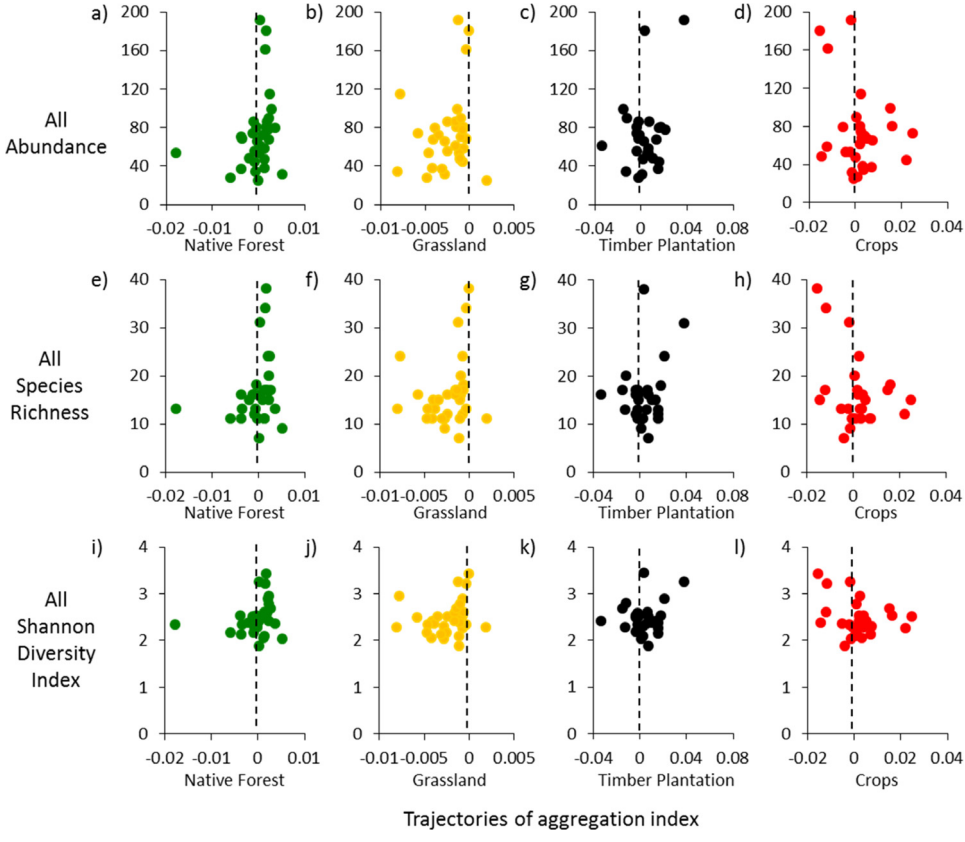

Fig. 20. Trajectories of aggregation index versus all woody species diversity (adult and juvenile). Each dot stands for one of our 32 sites and represents the slope of the trajectories by land use type (i.e. green: native forests; yellow: grasslands; black: timber plantations and red: crops) in a buffer of 3km from the central point of each plot.

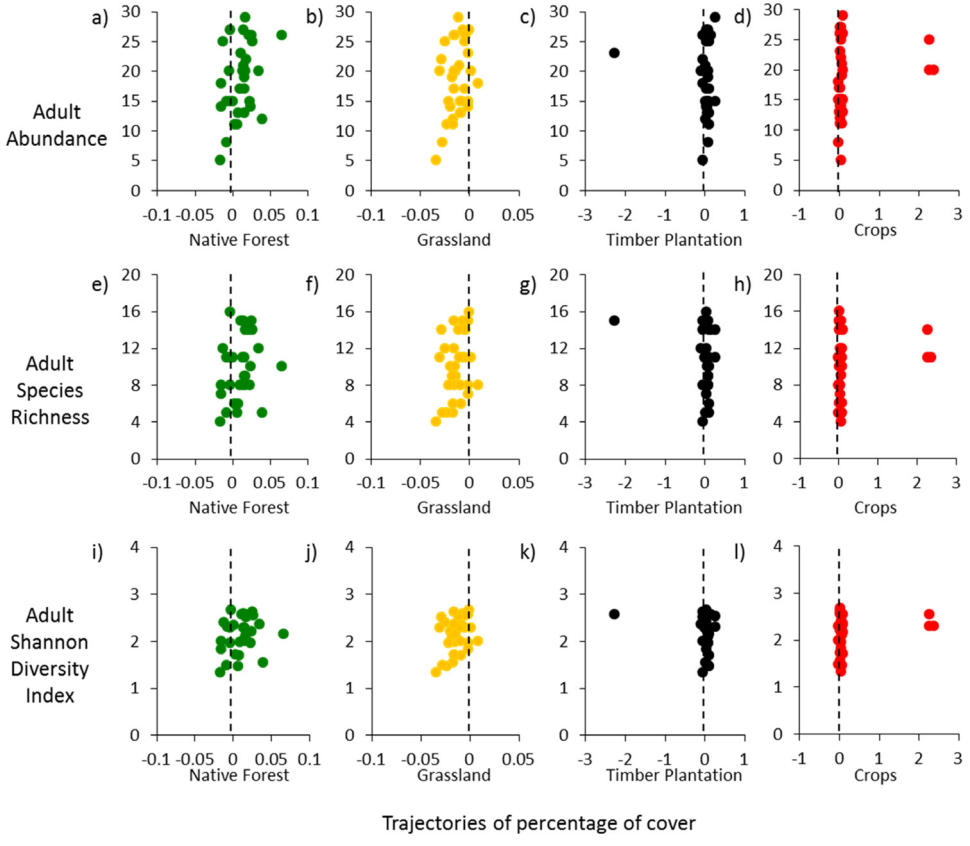

Fig. 21. Trajectories of aggregation index versus adult woody species diversity. Each dot stands for one of our 32 sites and represents the slope of the trajectories by land use type (i.e. green: native forests; yellow: grasslands; black: timber plantations and red: crops) in a buffer of 3 km from the central point of each plot.

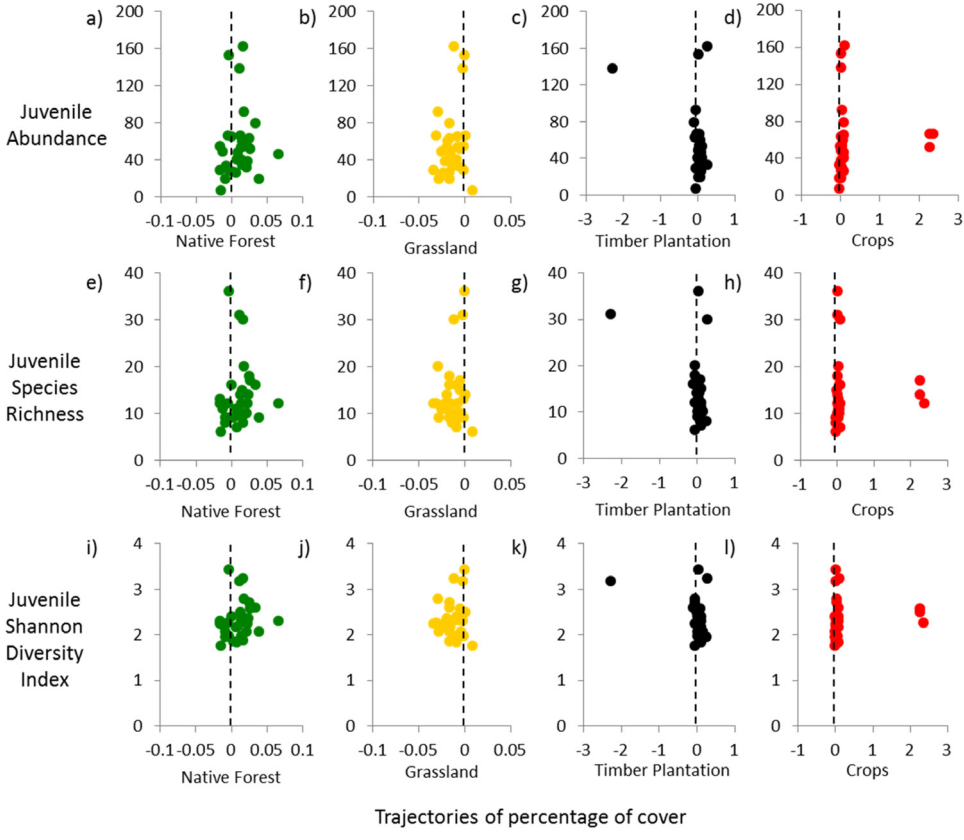

Fig. 22. Trajectories of aggregation index versus juvenile woody species diversity. Each dot stands for one of our 32 sites and represents the slope of the trajectories by land use type (i.e. green: native forests; yellow: grasslands; black: timber plantations and red: crops) in a buffer of 3 km from the central point of each plot.

Ethics Statements

The authors comply with the ethical guidelines of the journal. Humans, animals or data from social media are not involved in this research.

CRediT Author Statement

Ina Säumel: Conceptualization, Methodology, Investigation, Visualization, Writing – original draft, Validation; **Leonardo R. Ramirez:** Conceptualization, Methodology, Data curation, Writing – original draft, Visualization, Investigation, Validation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.dib.2021.107545.

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