Ecography

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Supplementary material

SUPPORTING INFORMATION

Appendix 1 – Trait references

Literature sources for traits

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Appendix 2 - Results

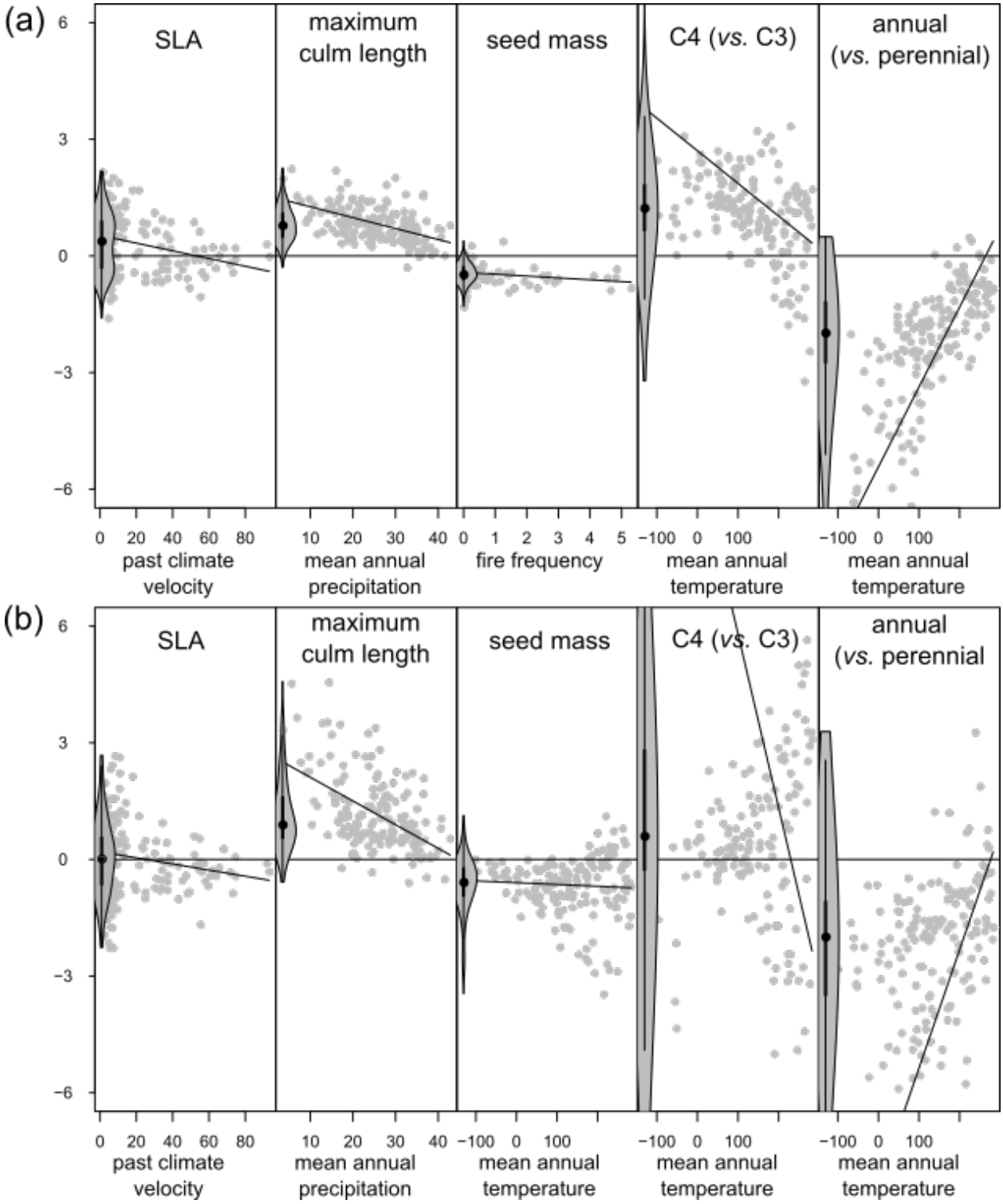


Figure A1: Same analysis than presented in Figure 3 but perfomed without the trait imputation procedure (see Methods).

Variation in predictors of the probability that a grass species will leave its native range. For each trait (specific leaf area [SLA], maximum culm length, seed mass, photosynthetic pathway and lifespan), the violin plot shows the distribution of model coefficients across all 369 regional logistic regression models. Each violin plot visualizes the median and interquartile range of a distribution (black dot, heavy black line), with the width of the grey region showing the density of the distribution at any particular value. We then determined the regional characteristics that were most correlated with these coefficients and arrayed the distribution of coefficients along the x-axis according to that characteristic. Solid regression lines indicate a significant relationship with the regional characteristic named on the x-axis. For example, the importance of SLA declined with increasing climate velocity, while annual grasses were particularly likely to leave cool regions. Logistic regression coefficients were obtained (a) from pairwise regressions, or (b) from multiple regressions.

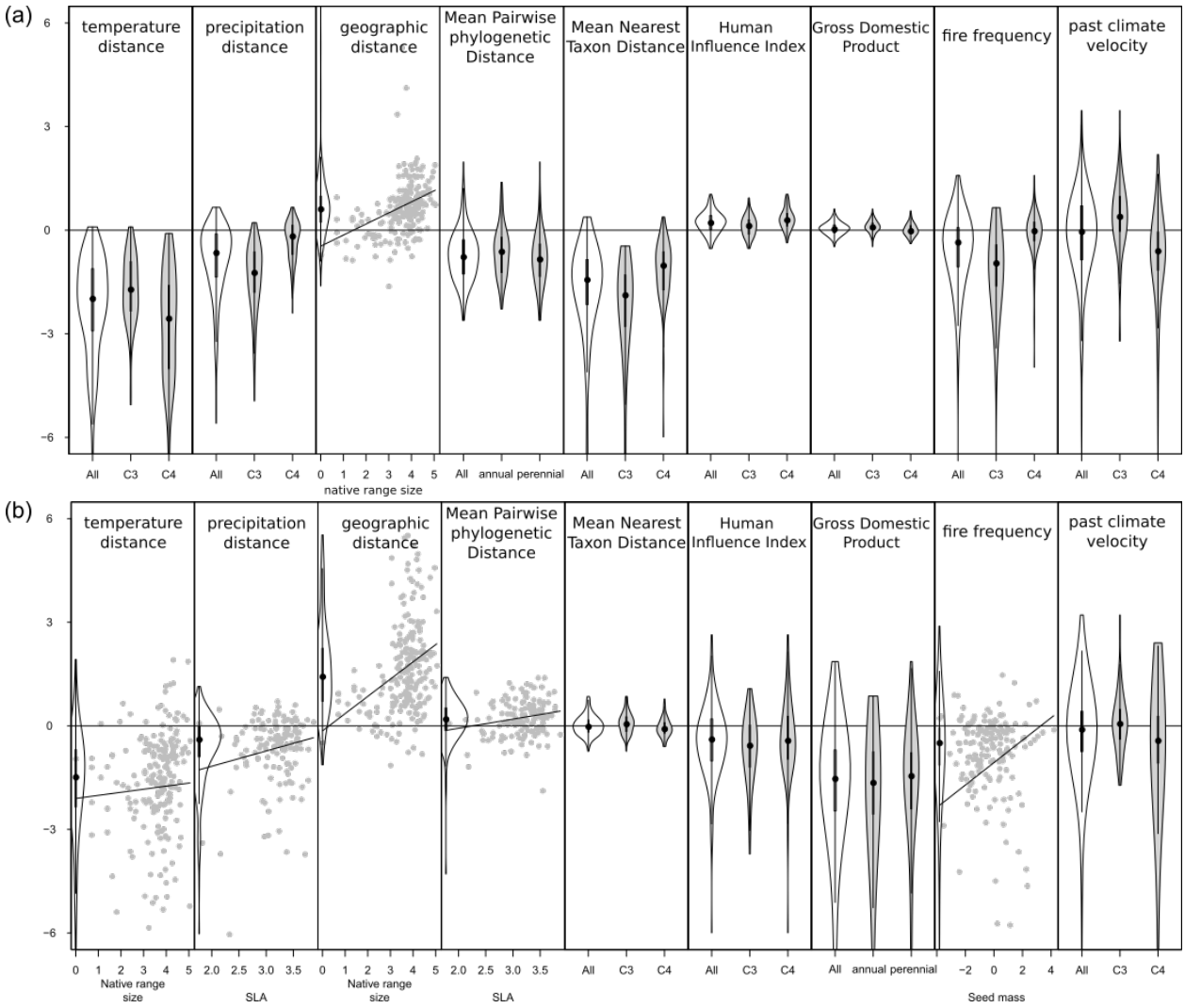


Figure A2: Same analysis than presented in Figure 4 but perfomed without the trait imputation procedure (see Methods).

Variation in predictors of the probability that a grass species will establish in a region outside its native range. For each characteristic of a region, the white violin plots show the distribution of model coefficients across all 214 species logistic regression models. Each violin plot visualizes the median and interquartile range of a distribution (black dot, heavy black line), with the width of the grey region showing the density of the distribution at any particular value. These coefficients are then arrayed along the x-axis according to the species trait most related to them. Solid regression lines represents the relationship with continous traits, while grey violin plots represent the relationship with the states of categorical trait variable. For example, across all 214 species, fire frequency tended to be a negative predictor of grass establishment, but this was particularly true for C3 species. Logistic regression coefficients were obtained from (a) pairwise regressions, or (b) from multiple regressions.

Table A1: Sources of the GDP data.

Geographic unit		Year	Source
National level		2016	The World Fact Book, CIA.
Subnational level	Canada	2015	Government of Canada, Statistics. Retrieved 27 December 2016.
	China	2015	China National Bureau of Statistics (NBS), National Data.
	Siberia	2009	National Human Development Report 2011 for the Russian Federation, UNDP in Russia, 2011, 142 pp.
	South Africa	2010	Statistics South Africa, 2011, Report, 31 pp. Retrieved 1 March 2012.
	USA	2015	Bureau of Economic Analysis. U.S. Department of Commerce. Retrieved 6 June 2017.

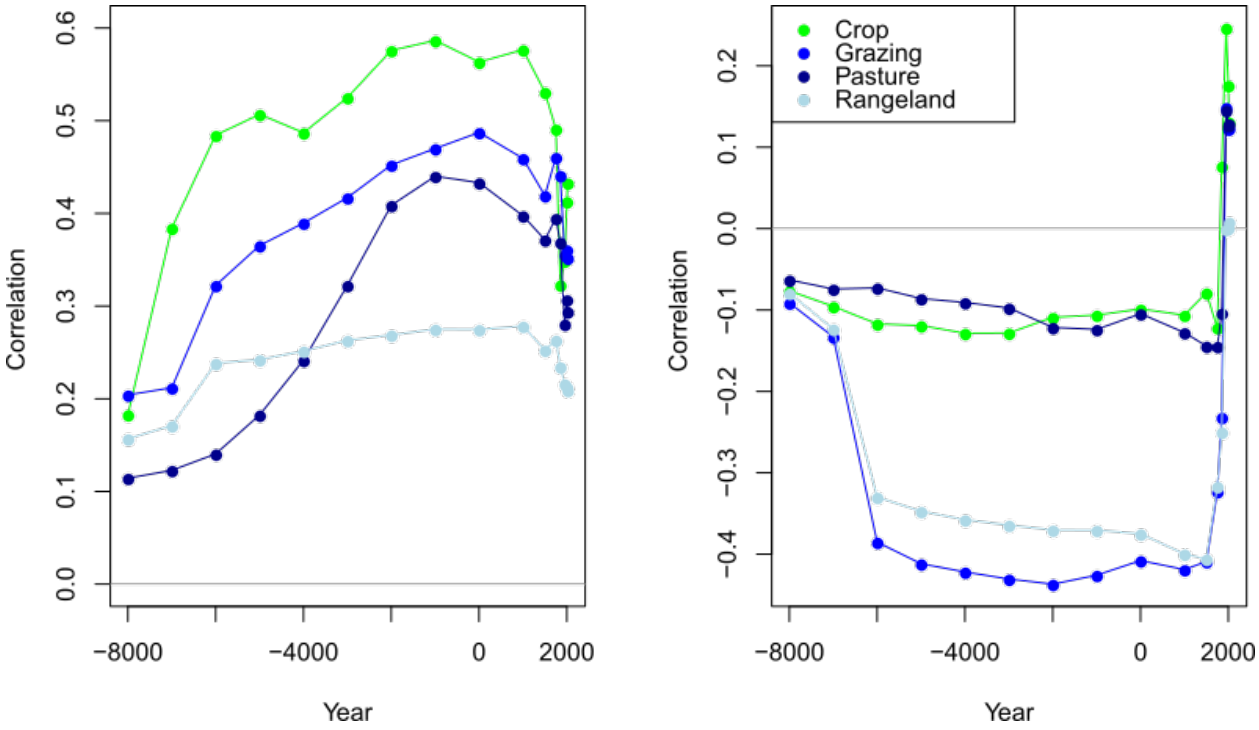
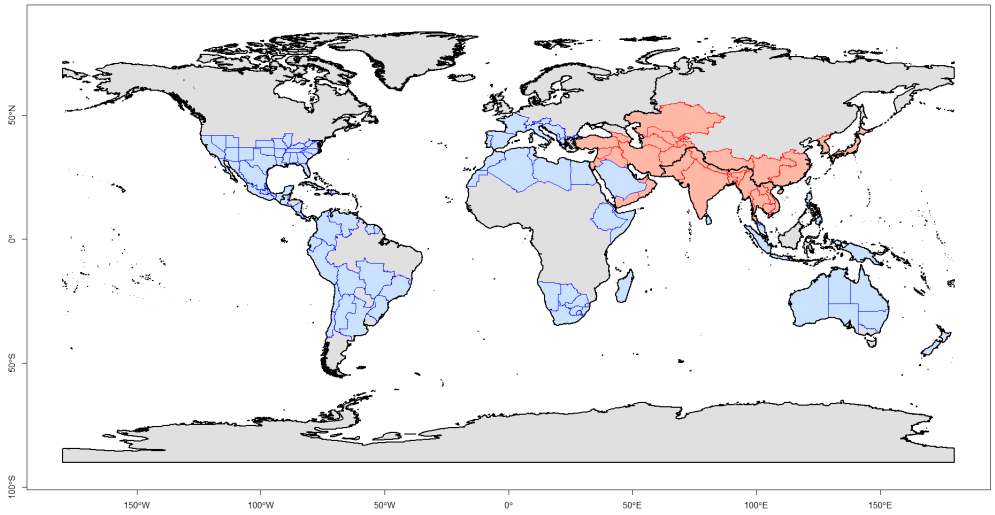


Figure A3: Correlation between the percentages of land in crops or grazing (divided into intensively used pasture and extensively managed rangeland) **across different time points** (from 8000 BCE to 2017 CE) **and the current number of native grass species that have left each region** (left panel) **or the current number of grass species exotic in each region** (right panel).

Figure A4: Example of distribution. Native (in red) and exotic (in blue) distributions of *Arundo donax* L. in TDWG regions. The black borders delimit the nine TDWG continents: North & South America, Europe, Africa, Antarctica, temperate and tropical Asia, Pacific and Australasia (Brummitt, 2001).



Single-predictor GLMs describing the variation of the environmental predictors across the exotic distribution of *Arundo donax*.

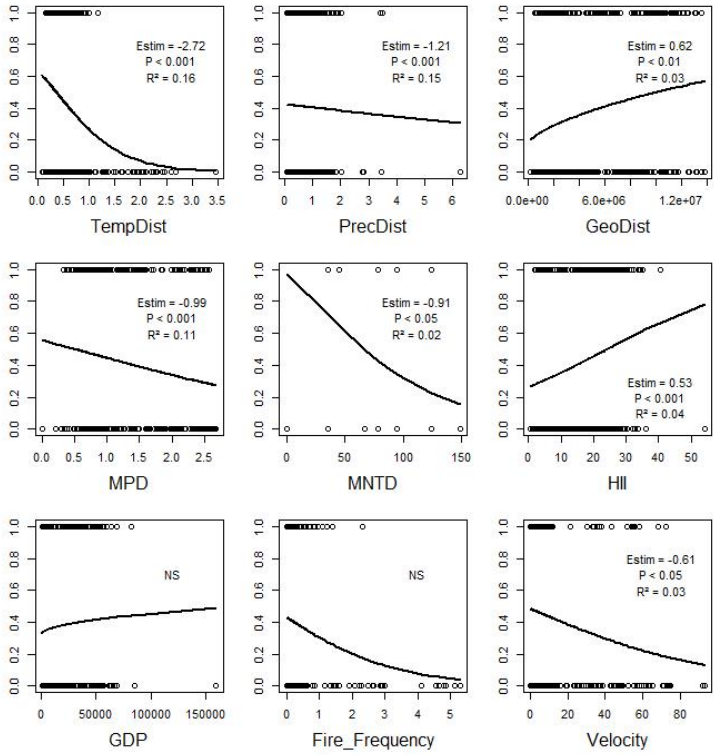


Table A2: Variation in predictors of the probability that a grass species will establish in a region outside its native range: results of t-tests on the mean of coefficients. The table presents: 1) the results of t-tests on the mean of coefficients (tvalue and pvalue) from the multiple regressions ("Full") or the pairwise regressions ("Single"), and 2) the mean and the 95 % interval around the mean of the regressions coefficients. Model coefficients were obtained from all 214 species logistic regression models. These results are illustrated in the main text in Figure 4.

Predictors	GLM	mean	interval	tvalue	pvalue
Temperature distances	Full	-1.78	[-1.52 , -2.03]	-13.74	0
	Single	-2.22	[-2.02 , -2.43]	-21.74	0
Precipitation distances	Full	-0.64	[-0.5 , -0.77]	-9.36	0
	Single	-0.88	[-0.74 , -1.02]	-12.27	0
Geographic distances	Full	1.64	[1.82 , 1.46]	18.41	0
	Single	0.68	[0.81 , 0.55]	10.4	0
GDP	Full	-4.36	[-1.73 , -7]	-3.26	0.001
	Single	0.05	[0.07 , 0.02]	3.66	0
Human Influence Index	Full	-0.44	[-0.3 , -0.59]	-6.1	0
	Single	0.22	[0.26 , 0.18]	10.38	0
MNTD	Full	0.01	[0.05 , -0.03]	0.62	0.534
	Single	-2.85	[-1.37 , -4.34]	-3.79	0
MPD	Full	0.17	[0.25 , 0.09]	3.97	0
	Single	-0.73	[-0.63 , -0.83]	-14.26	0
Fire Frequency	Full	-1.16	[-0.66 , -1.66]	-4.56	0
	Single	-0.76	[-0.49 , -1.03]	-5.46	0
Past climate velocity	Full	-0.52	[-0.07 , -0.96]	-2.28	0.024
	Single	-0.19	[0 , -0.38]	-1.92	0.056