APPENDIX S2: Comparison of Huisman-Olff-Fresco, generalised linear and generalised additive models

In the presented study we fitted response curves for species' occurrences along climatic gradients with Huisman-Olff-Fresco models (HOF), generalised linear models (GLMs), and generalised additive models (GAMs). In the article we focus on the shape of the response curves estimated with the HOF-models because these provide an objective evaluation of different response curve types. However, because GLMs and GAMs are often used in species distribution modelling, we here provide a comparison of the response curves obtained from HOF models with those obtained from GLMs and GAMs.

The GLMs and GAMs with highest flexibility, i.e. third degree polynomial and 5 degrees of freedom, were selected as the best in most of the cases in both Europe (GLM: 81-95%; GAM 69-83%) and the Swiss Alps (GLM: 94-95%; GAM 51-70%; Table S2.1). Comparing the GLMs and GAMs selected when a specific type of HOF model was selected, showed that the most flexible model was selected more or less independently of the HOF model complexity (Table S2.1). One exception was that a linear GLM in general was selected when a monotonically increasing curve (HOF II) was selected among the HOF models. However, visually comparison of the response curves from the HOF models with those from GLMs and GAMs (Fig. 2 in the article), showed great similarity in response curve shapes among methods, even though spurious responses, as obtained for *Alnus glutinosa* with GLM, could be observed (Fig. 2 in the article). In addition, the median differences between optimum, minimum and maximum of species responses obtained with HOF models compared to those obtained with GLMs and GAMs, respectively, were generally similar (Table S2.1). In line with this, linear regressions between pairs of optimum, minimum or maximum obtained with the different methods (Fig. S2.1) generally showed slopes relatively close to one and a large amount of variation explained (Table S2.1). However, exceptions e.g. for the water balance gradient at the European scale, were observed. The exceptions mainly resulted from large differences in the optimum, minimum and maximum towards the end of the gradients, where GLMs and GAMs for some species in contrast to the HOF models provide estimates at the very end of the gradient (Table S2.1, Fig. S2.1), resulting in the lines of points in Fig. S2.1.

Table S2.1: Model complexity of species responses along three climatic gradients obtained with Huisman-Olff-Fresco (HOF) models (I-V), generalised linear models (GLMs; degree of polynomial (poly); 1/2/3), and generalised additive models (GAMs; degrees of freedom (df); 3/4/5) at European and Swiss scales. N indicates the number of species for which a given type of HOF model was selected. For each type of HOF model we report the percentage of GLMs and GAMs of a given complexity. In addition, we report the median (minimum; maximum) difference between the optimum, minimum, and maximum estimated with the HOF models and the GLMs and GAMs, respectively, as well as the estimate of the slope and the R^2 (in brackets) for linear regression of pairs of the optimum, minimum and maximum obtained with the different methods.

	Minimum temperature			**Growing-degree-days**			**Water balance**		
	N	**GLM**	**GAM**	**N**	**GLM**	**GAM**	**N**	**GLM**	**GAM**
	(#)	poly(1/2/3)	df(3/4/5)	(#)	poly(1/2/3)	df(3/4/5)	(#)	poly(1/2/3)	df(3/4/5)
Europe									
I	0			0			26	58/0/42	4/0/91
II	65	51/0/49	6/18/75	107	39/0/61	6/2/93	246	50/3/47	5/4/91
III	177	2/2/96	36/6/58	222	2/2/96	23/8/68	145	10/2/88	6/1/92
IV	579	2/1/98	38/3/59	548	3/2/94	17/1/81	505	4/2/94	6/3/91
V	756	2/1/97	18/3/79	700	3/1/96	11/1/88	655	13/2/85	4/1/95
Total	1577	4/1/95	27/4/69	1577	5/2/93	15/2/83	1577	16/2/81	5/2/93
Optimum		0.5 (0.0;25.6)	0.6 (0.0;21.7)		69.1 (0.0;4932.8)	88.8 (0.0;3975.8)		29.7 (0.0;3303.5)	158.6 (0.0;3303.5)
		0.67 (0.65)***	0.89 (0.90)***		0.69 (0.68)***	0.40 (0.58)***		0.15 (0.12)***	0.32 (0.61)***
Minimum		0.3 (0.0;24.3)	0.4 (0.0;11.4)		59.2 (0.0;4370.5)	64.1 (0.0;2974.5)		33.0 (0.0;3207.7)	33.0 (0.0;1688.1)
		0.79 (0.76)***	0.97 (0.98)***		0.81 (0.82)***	0.57 (0.78)***		0.39 (0.38)***	0.41 (0.69)***

Maximum		0.3 (0.0;22.5)	0.4 (0.0;21.3)		54.3 (0.0;3892.0)	64.1 (0.0;2737.7)		42.9 (0.0;3234.2)	175.1 (0.0;2309.2)
		0.83 (0.79)***	0.93 (0.94)***		0.79 (0.78)***	0.57 (0.65)***		0.30 (0.27)***	0.45 (0.67)***
Swiss Alps									
II	10	80/0/20	10/0/90	5	60/0/40	0/0/100	10	80/0/20	10/20/70
III	36	3/0/97	33/11/56	40	8/3/90	35/3/63	36	6/8/86	36/14/50
IV	160	3/1/97	50/9/41	125	3/2/95	35/2/63	156	1/1/98	56/4/40
V	78	1/3/96	37/0/63	114	2/0/98	18/4/78	82	1/1/98	20/5/76
Total	284	5/1/94	43/6/51	284	4/1/95	28/2/70	284	5/2/94	42/6/52
Optimum		0.1 (0.0;5.1)	0.1 (0.0;5.4)		33.0 (0.0;1104.7)	48.9 (0.0;1155.8)		18.7 (0.0;871.9)	20.8 (0.0;992.6)
		0.91 (0.93)***	0.49 (0.70)***		0.98 (0.94)***	0.65 (0.81)***		0.98 (0.97)***	0.56 (0.72)***
Minimum		0.2 (0.0;7.1)	0.2 (0.0;4.0)		25.5 (0.0;1671.4)	29.8 (0.0;823.0)		22.9 (0.0;805.3)	33.3 (0.0;634.7)
		0.95 (0.94)***	0.62 (0.80)***		1.03 (0.98)***	0.77 (0.88)***		0.94 (0.95)***	0.73 (0.88)***
Maximum		0.1 (0.0;5.9)	0.2 (0.0;3.6)		31.9 (0.0;1297.2)	44.7 (0.0;512.5)		29.1 (0.0;1375.5)	33.3 (0.0;1329.8)
		0.89 (0.90)***	0.68 (0.85)***		0.92 (0.92)***	0.85 (0.95)***		1.00 (0.95)***	0.67 (0.82)***

Figure S2.1: Relationship between species optimum (maximum probability of occurrence) along three European climatic gradients (minimum temperature, TMIN; growing-degree-days, GDD; water balance, WBAL) obtained with the HOF models and GLMs or GAMs.