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Table S1. Material collected for molecular analyses (i.e. plant tissue used for DNA extraction) and details of sampling.

Country	ID	Material	Sampling Date	Sample collector
Iran	NOO	leaf	Before 2019	Ole Kim Hansen
Georgia	LAG	leaf	Before 2019	Andreas Rudolf
Georgia	GOM	leaf	Before 2019	Andreas Rudolf
Russia	ING	leaf	Before 2019	Ladislav Paule
Russia	LAN	leaf	Before 2019	Ladislav Paule
Turkey	HAT	leaf	Before 2019	Hakan Sevik
Georgia	GOD	leaf	Before 2019	Andreas Rudolf
Turkey	ORD	leaf	Before 2019	Hakan Sevik
Turkey	KAS	leaf	Before 2019	Hakan Sevik
Turkey	ZON	leaf	Before 2019	Hakan Sevik
Turkey	BUR	leaf	Before 2019	Hakan Sevik
Bulgaria	KOS	leaf	Before 2019	Petar Zhelev
Bulgaria	NES	leaf	Before 2019	Petar Zhelev
Switzerland	LEN	leaf	Before 2019	Katalin Csillery
Switzerland	WAE	leaf/bud	2019-2021	Mirjam Kurz
France	ALL	leaf/bud/cambium	2019-2021	Mirjam Kurz
Germany	GAI	bud	2020	Adrian Kölz
Germany	GRA	cambium	2021	Adrian Kölz
Germany	LEI	leaf, cambium	2021	Jonas Gorges
Germany	KIR	leaf	2021	Adrian Kölz
Germany	RIE	bud	2020	Adrian Kölz
Germany	STU	leaf	2021	Adrian Kölz
Germany	VOR	leaf, cambium	2021	Adrian Kölz
Germany	WUP	bud	2020	Jonas Gorges

Table S2. Summary of the climatic conditions at the Oriental beech growing sites and the Western European plantations. Monthly mean values for seasons are represented by quarters of the year, i.e. the first quarter (i.e. January, February, March) as winter, the second as spring, the third as summer and the fourth as fall.

Country	ID	Temperature (°C)				Precipitation (mm)					
		Winter mean	Spring mean	Summer mean	Fall mean	Annual mean	Winter mean	Spring mean	Summer mean	Fall mean	Annual Total
Iran	NOO	7	18.9	24.8	12.9	15.9	71.4	48	54.2	105.8	838
Georgia	LAG	-5.2	9	14.9	0.2	4.7	52.4	126.9	83.9	69	997
Georgia	GOM	-2.3	11.8	17.5	3.1	7.5	33.5	88.9	68.1	39.7	691
Russia	ING	1	16.2	21.3	6.2	11.2	28.2	77.1	64.5	33	608
Russia	LAN	0.9	13.2	18.6	6	9.7	75.9	73.5	76.1	95.3	963
Turkey	HAT	2.7	14	20.7	7.6	11.2	139.5	81.7	31.3	109	1085
Georgia	GOD	-5.9	7	12.9	-0.2	3.4	92	101.9	89	105.9	1166
Turkey	ORD	1.5	12.3	18	7.1	9.7	107.3	82	72.9	137.9	1200
Turkey	KAS	0.7	11.8	17.2	5.7	8.9	90.8	58.7	64.2	124.6	1015
Turkey	ZON	4.9	15.8	21.3	10.1	13	94.7	63.2	66.5	113.5	1014
Turkey	BUR	2.9	13.5	19	7.9	10.8	113.7	82.5	42.9	113.2	1057
Bulgaria	KOS	5.3	16.5	22.4	10.6	13.7	44.1	39.7	27.2	62	519
Bulgaria	NES	1.8	13.8	19.4	7	10.5	51.3	60.3	43.3	68.3	670
Switzerland	LEN	-1	9.1	13.3	2	5.8	120.9	128.3	131.7	126.9	1523
Switzerland	WAE	1.6	12.3	16.3	4.8	8.7	69.5	109.3	114.9	78	1115
France	ALL	2.8	13.1	16.9	5.5	9.6	54.2	65.6	65.7	57.9	730
Germany	GAI	1	12.1	15.9	4	8.2	72.9	84.7	87.1	76.3	963
Germany	GRA	1.9	12.8	16.6	4.9	9	53.5	98	97.1	57.9	920
Germany	LEI	3.4	13.9	17.7	6.2	10.3	44.7	82.3	85.4	52.8	796
Germany	KIR	2.8	13.1	17	5.6	9.6	55.2	52.7	59.1	61.5	686
Germany	RIE	2.7	13.4	17.1	5.6	9.7	48.6	64.6	72.2	57.7	729
Germany	STU	3.6	14.3	18.1	6.3	10.6	49.7	68.7	65.9	56	721
Germany	VOR	3.5	14.3	18	6.2	10.5	49.7	70.3	67.6	57.2	734
Germany	WUP	2.5	12	15.8	5.5	9	76	76	90.6	89.2	995

Table S3. Summary of the genetic diversity of 16 nuclear microsatellite loci in natural European beech (35 samples) and Oriental beech (103 samples) populations. k stands for the number of alleles; r stands for the allele size range.

Locus	k		r	
	Oriental beech	European beech	Oriental beech	European beech
csolfagus_29	9	3	16	8
csolfagus_05	12	7	22	12
csolfagus_06	16	7	34	16
csolfagus_19	14	11	26	22
csolfagus_31	13	10	32	22
FS1_15	28	12	56	28
sfc_0036	14	6	28	12
sfc_1143	19	8	38	18
DE576	9	5	24	18
DUKCT	9	6	16	20
DZ447	24	5	56	6
EEU75	14	7	32	18
EJV8T	10	7	18	12
EMILY	17	7	32	34
ERHBI	13	4	24	8
concat14	9	4	18	22
MEAN	14.37	6.81	29.5	17.25

Table S4. Number of private alleles per genetic cluster and per locus, along with the frequency.

Cluster	Locus	Allele	Frequency
Elbuz Mountains	csolfagus29	130	0.11
Elbuz Mountains	csolfagus_06	229	0.07
Elbuz Mountains	DE576	209	0.04
Elbuz Mountains	DUKCT	83	0.04
Elbuz Mountains	EJV8T	163	0.04
Elbuz Mountains	EMILY	166	0.04
Elbuz Mountains	EMILY	168	0.04
Elbuz Mountains	ERHBI	181	0.07
Elbuz Mountains	sfc_0036	92	0.14
Greater Caucasus	csolf_05	178	0.03
Greater Caucasus	csolf_05	180	0.03
Greater Caucasus	csolf_06	237	0.01
Greater Caucasus	DE576	233	0.01
Greater Caucasus	FS1_15	137	0.01
Greater Caucasus	sfc_0036	90	0.01
Greater Caucasus	sfc_0036	116	0.03
Greater Caucasus	sfc_1143	137	0.01
Taurus Mountains	concat14	193	0.04
Taurus Mountains	DZ447	231	0.04
Taurus Mountains	DZ447	241	0.04
Taurus Mountains	DZ447	243	0.04
Pontic Mountains	DZ447	211	0.02
Pontic Mountains	ERHBI	183	0.02
Pontic Mountains	FS1_15	83	0.04
Pontic Mountains	FS1_15	139	0.02
Pontic Mountains	sfc_1143	147	0.02
SW Black Sea coast	csolfagus29	150	0.02
SW Black Sea coast	concat14	209	0.02
SW Black Sea coast	concat14	211	0.02
SW Black Sea coast	csolfagus_19	161	0.05
SW Black Sea coast	csolfagus_19	187	0.02
SW Black Sea coast	csolfagus_31	107	0.02

SW Black Sea coast	csolfagus_31	111	0.04
SW Black Sea coast	DZ447	187	0.02
SW Black Sea coast	DZ447	225	0.09
SW Black Sea coast	DZ447	233	0.02
SW Black Sea coast	EEU75	101	0.18
SW Black Sea coast	EMILY	162	0.02
SW Black Sea coast	ERHBI	153	0.02
SW Black Sea coast	FS1_15	127	0.02
SW Black Sea coast	sfc_0036	118	0.04
European beech	concat14	177	0.08
European beech	csolfagus_31	121	0.27
European beech	csolfagus_31	131	0.02
European beech	DUKCT	77	0.04
European beech	DZ447	190	0.06
European beech	DZ448	204	0.02

Table S5. Analyses of molecular variance.

Source of variation	d.f.	Sum of squares	Variance components	Percentage of variation	
Among populations	5	229.42	0.88	Va	13.78
Among individuals within populations	133	777.00	0.33	Vb	5.09
Within individuals	139	721.50	5.19	Vc	81.13
Total	277	1727.92	6.40		

Fixation Indices

F_{IS} : 0.0591

F_{ST} : 0.1378

F_{IT} : 0.1887

Fig. S1. Sampling scheme. We sampled seedlings around the largest adult trees (focal mother trees) and along four transects facing four different directions around it. We sampled seedlings within circular plots, each with a radius of 2 m, whose centers were located 2, 6 and 14 m away from the focal tree. The circular plots were labelled A–L. We started with the A-B-C transect and then continued in a clockwise direction. The starting orientation of the first transects was randomly chosen.

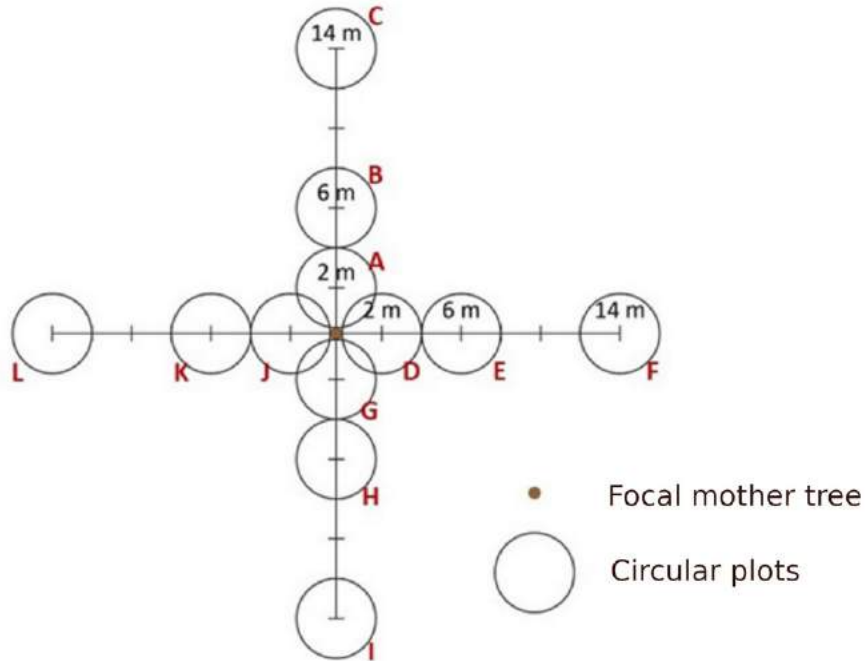


Fig. S2. Definitions of *Fagus* phenological stages following Vitasse et al. (2013). Stage 1: bud swelling, Stage 2: bud burst, Stage 3: leaf-out, Stage 4: leaf unfolded. In seedlings, we pressed on the bud, if it was soft we noted stage 1, if it was hard we noted stage 0.

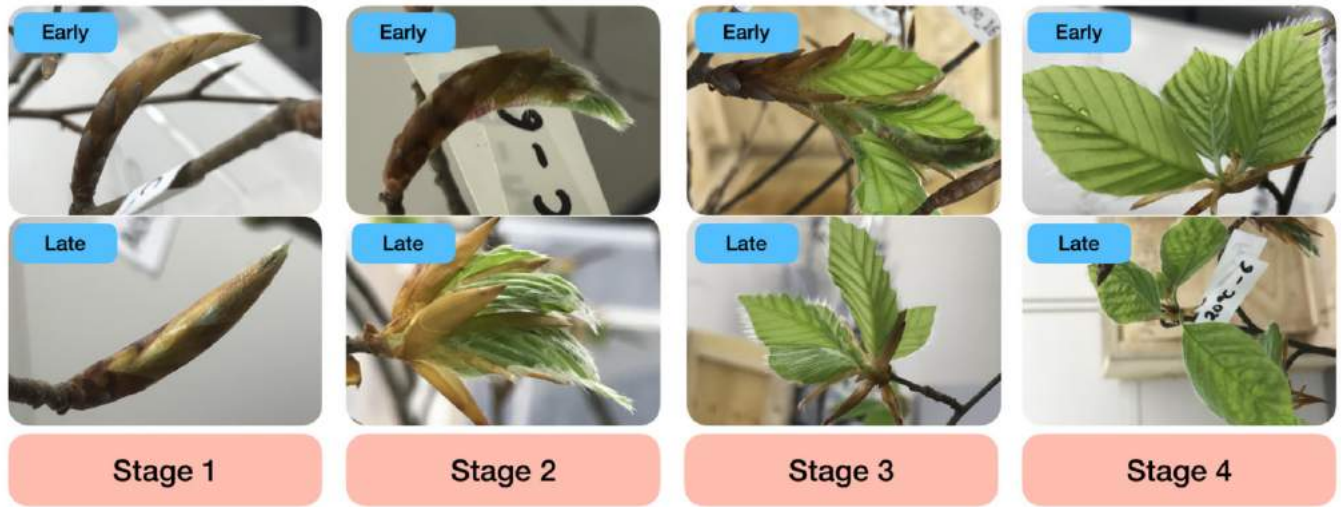
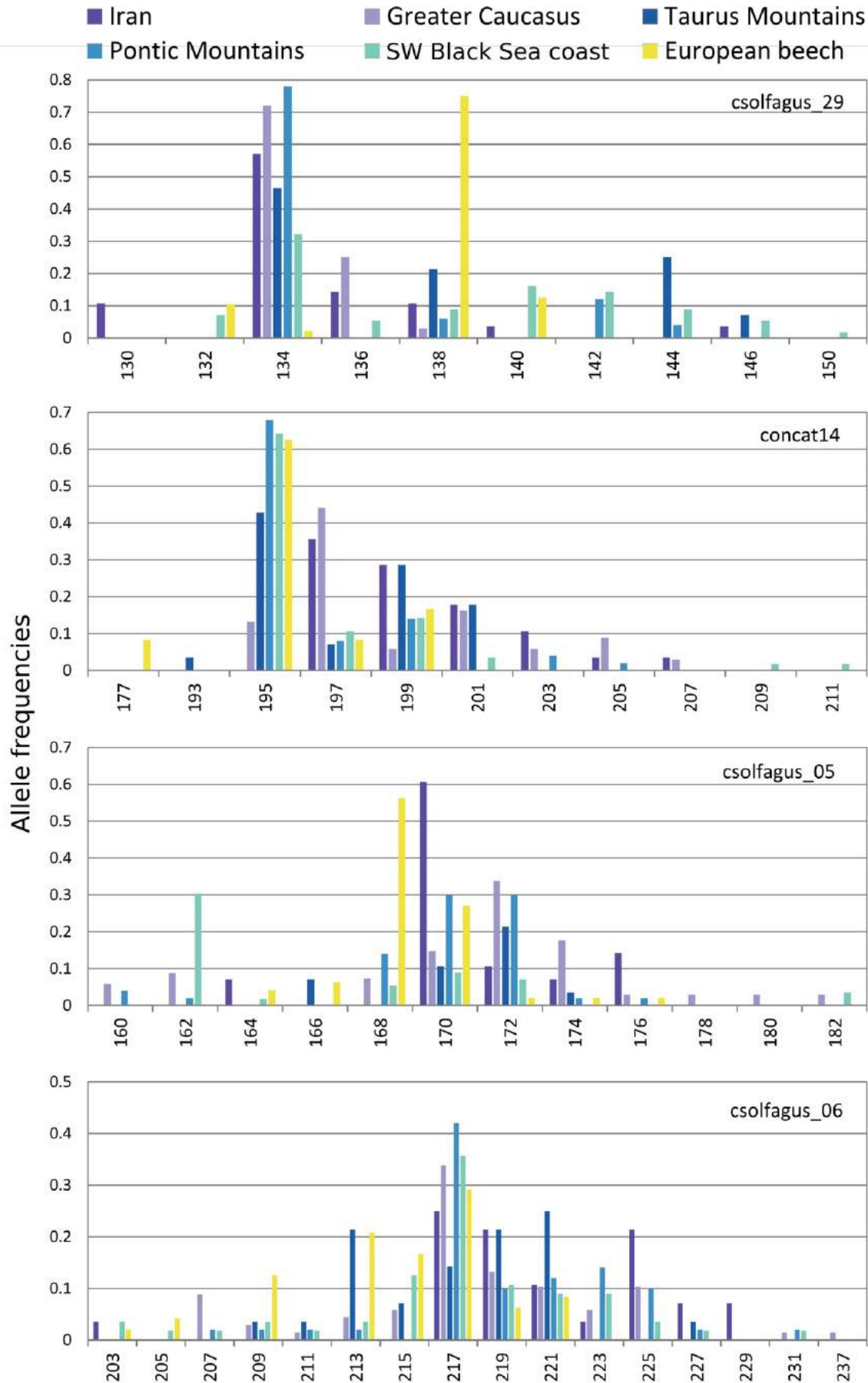
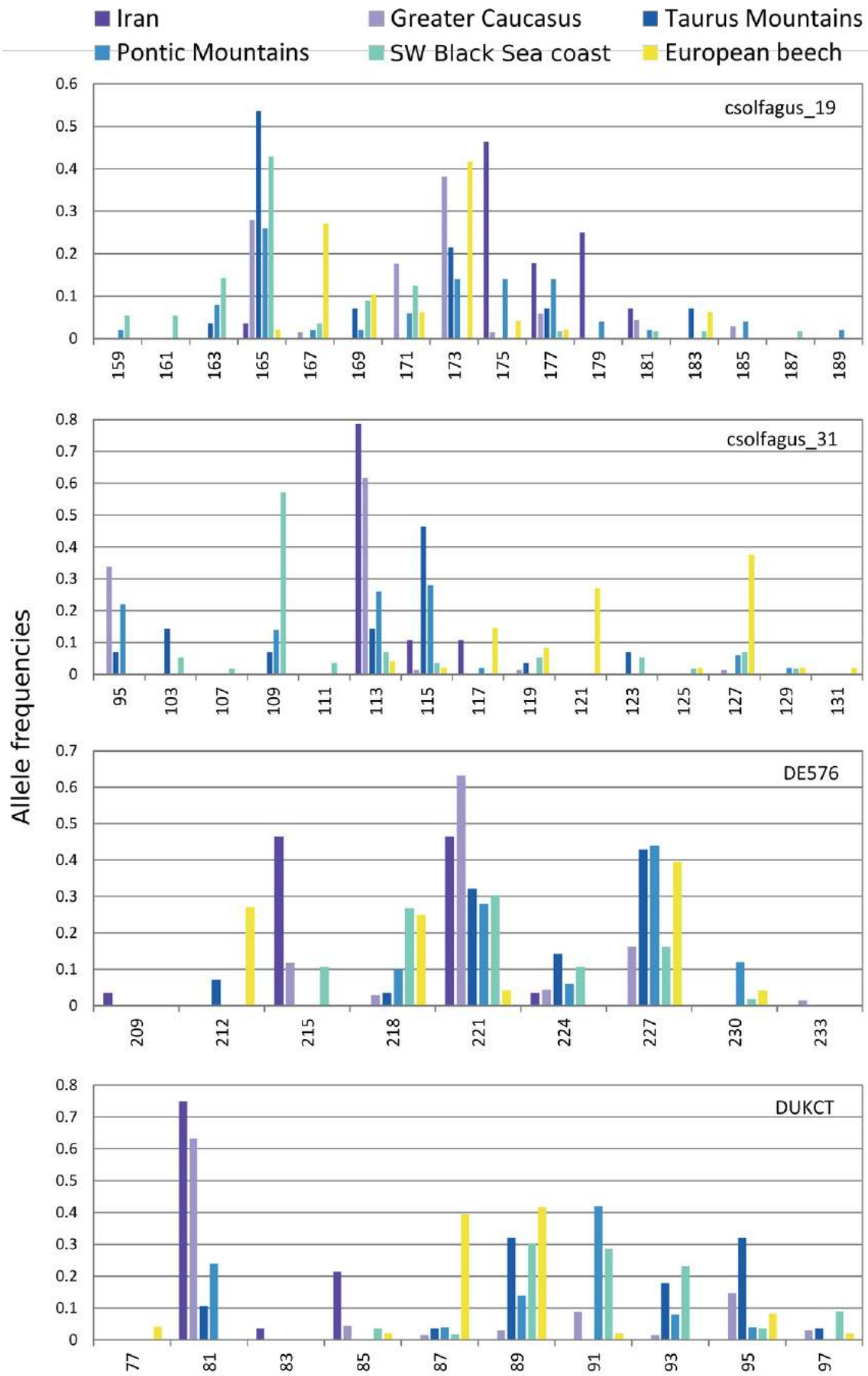
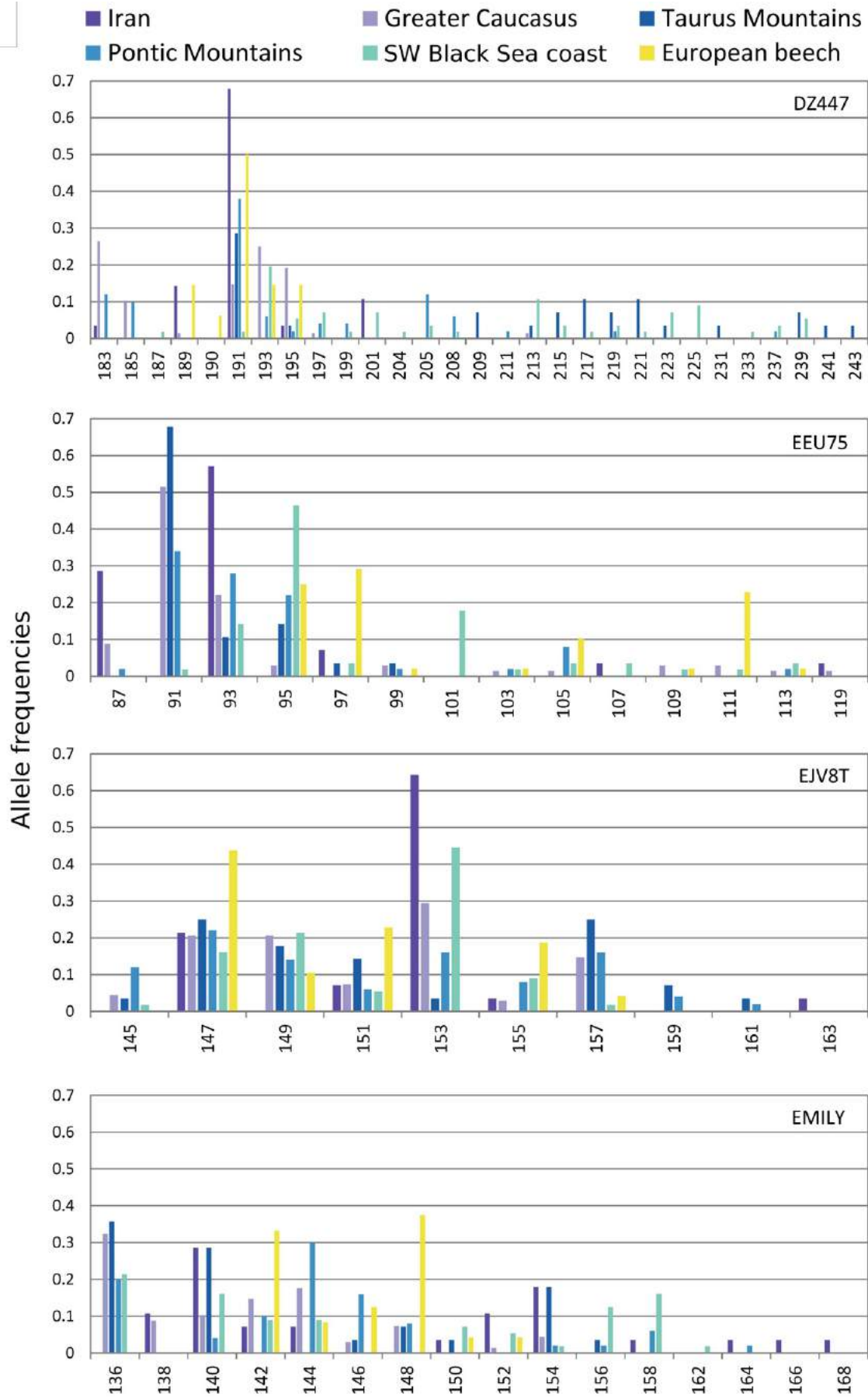


Fig. S3. Allele frequency distributions per cluster. See Fig. 1 for the geographic range of the clusters.







■ Iran
 ■ Greater Caucasus
 ■ Taurus Mountains
■ Pontic Mountains
 ■ SW Black Sea coast
 ■ European beech

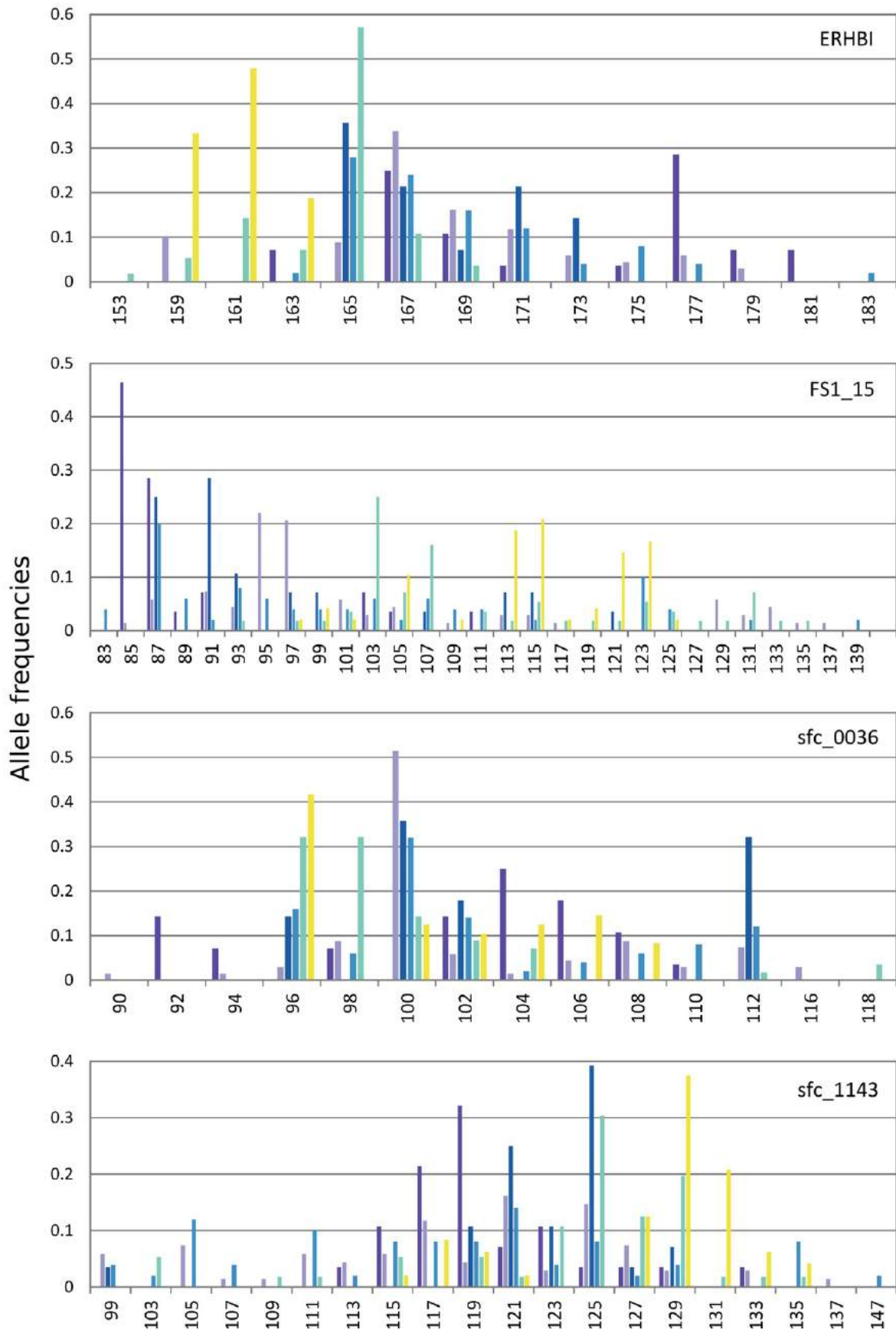


Fig. S4. Genetic clustering using the software Structure and settings identical to the analysis shown on Fig. 1B, but using K from 2 to 6.

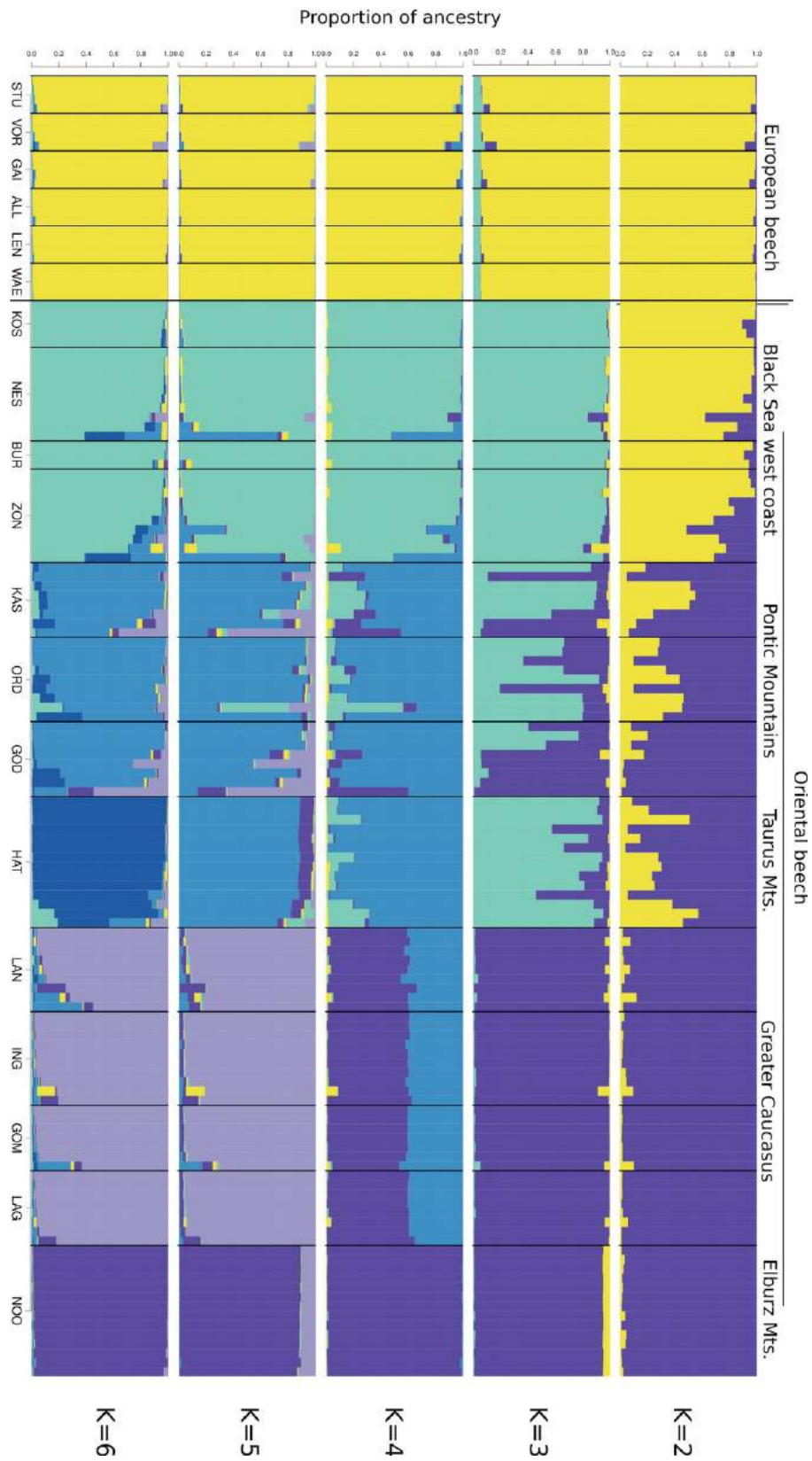
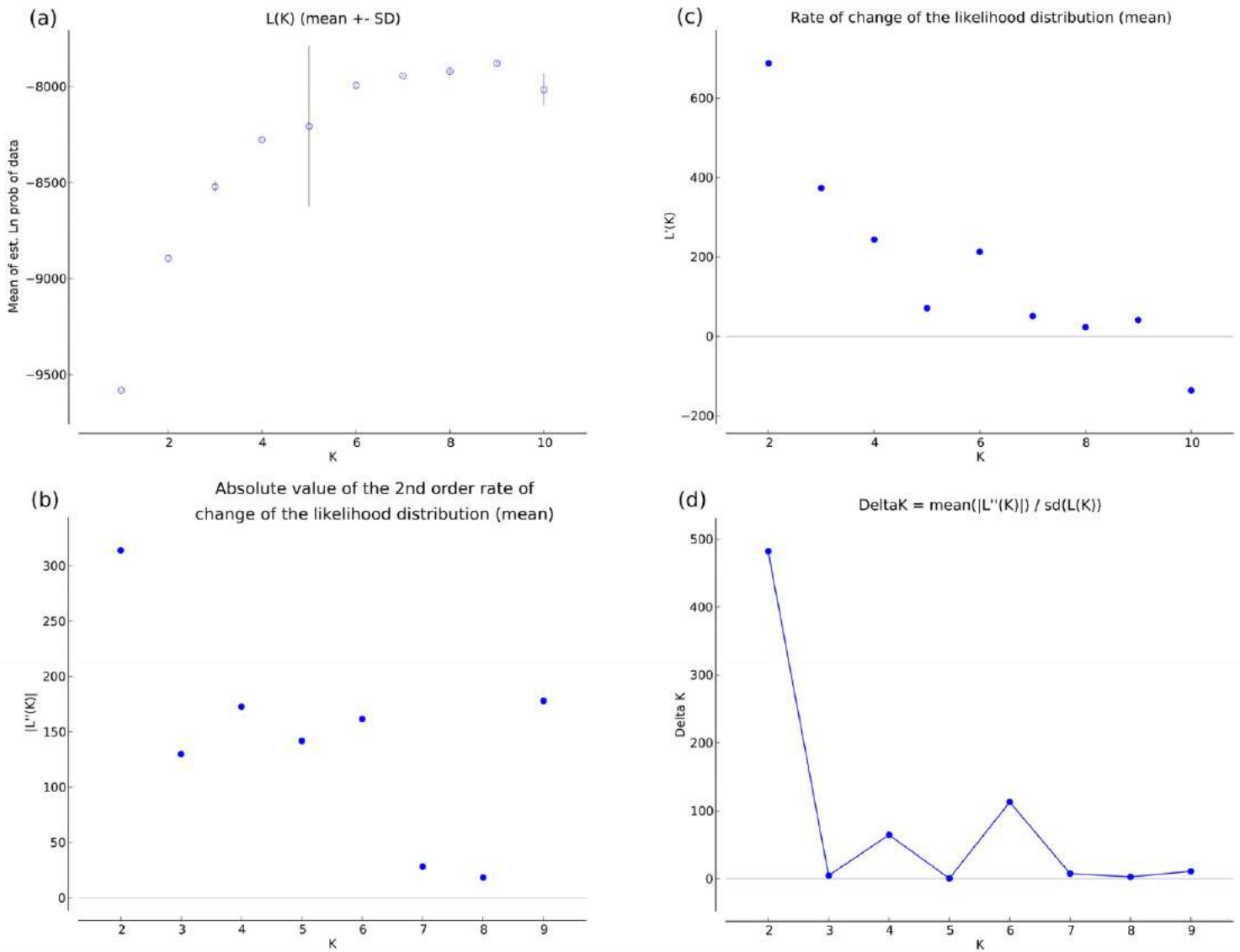


Fig. S5. Summary statistics for the performance of the genetic clustering using the software Structure for the analyses shown on Fig. 1b.



(e) Evanno's Table

K	Reps	Mean LnP(K)	Stdev LnP(K)	Ln'(K)	Ln''(K)	Delta K
1	20	-9582.455	1.0298			
2	20	-8894.875	0.6512	687.58	313.95	482.099999
3	20	-8521.245	28.0399	373.63	129.91	4.633037
4	20	-8277.525	2.6819	243.72	172.83	64.443511
5	20	-8206.635	417.1175	70.89	141.775	0.339892
6	20	-7993.97	1.4313	212.665	161.49	112.830071
7	20	-7942.795	3.7286	51.175	28.13	7.544347
8	20	-7919.75	6.6464	23.045	18.225	2.742066
9	20	-7878.48	16.3444	41.27	177.965	10.888414
10	20	-8015.175	79.221	-136.695		

Fig. S6. Origin of Oriental beech in 11 Western European plantations. Genetic clustering was performed using the software Structure, as shown on Fig. 2, but with USEPOPINFO.

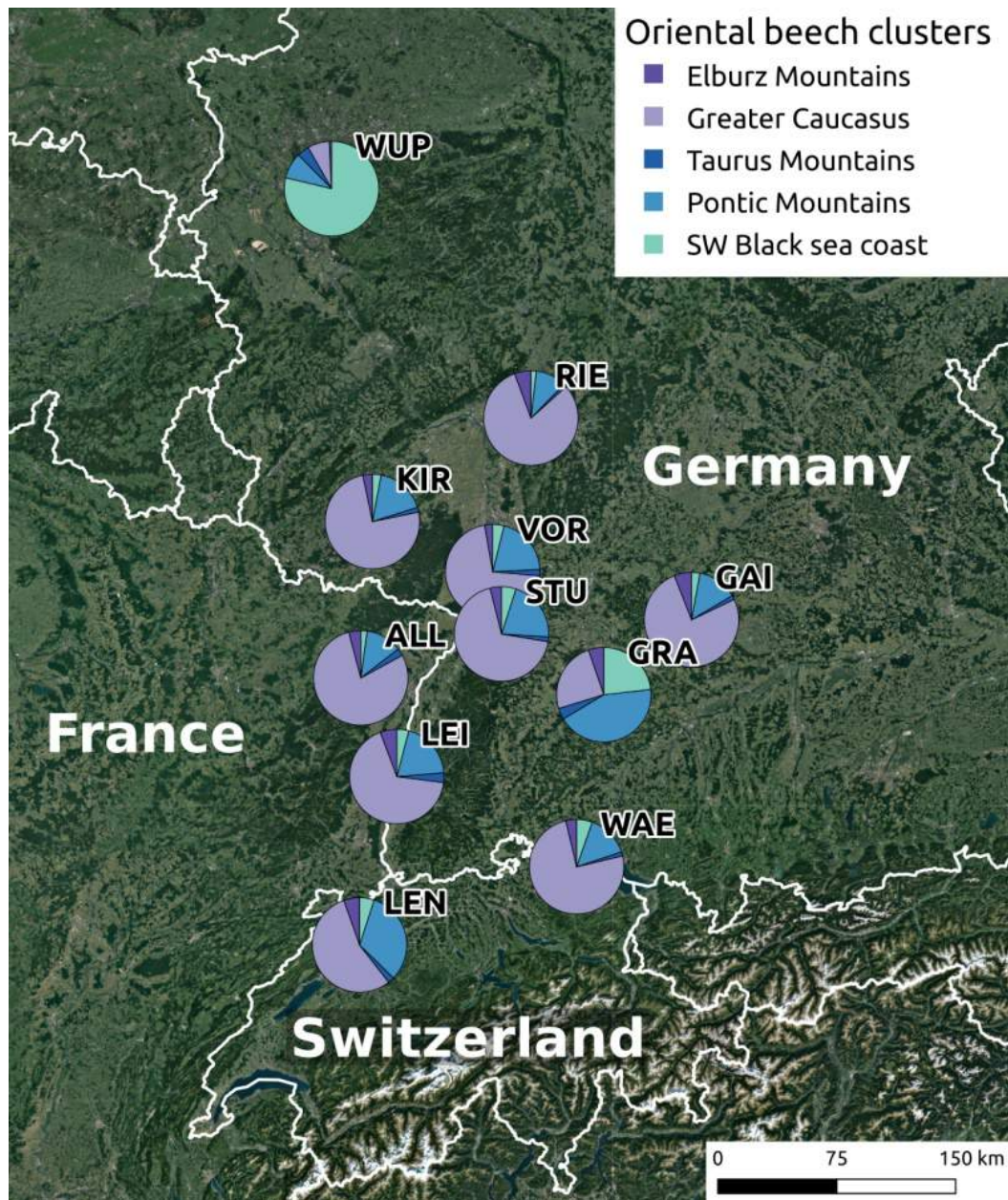


Fig. S7. Ancestry coefficients from the software Structure for offspring sampled around the focal mother trees in WAE and ALL. See Fig. 3 for an overview of the results.

