

Supporting Information

Three centuries of insect outbreaks across the European Alps

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Table S1 Characteristics of the 70 larch sites sorted by elevation, and statistics referring to 300-yr spline chronologies. Green shadings refer to sites from which a distinct ~8-yr cycle was detected along the reconstructed LBM outbreak time-series.

Site	m asl	Par	Lat	Lon	S-reg	Series	Start	>5	End	>5	MSL	AGR	Rbar	EPS	L-1	P-L	Res	Tar
1	500	TRW	47°24'	15°15'	East	20	1905	1911	1995	1995	78	0.47	0.33	0.91	0.72	2	-0.20	M-A
2	500	TRW	47°49'	16°05'	East	18	1865	1867	1997	1997	117	1.01	0.49	0.93	0.55	2	0.12	A-A
3	900	TRW	47°46'	14°27'	East	20	1778	1798	1996	1996	154	0.50	0.24	0.78	0.55	2	0.02	M-S
4	930	TRW	47°49'	14°29'	East	14	1794	1854	1996	1996	141	1.50	0.40	0.84	0.78	2	0.12	J-S
5	950	TRW	47°45'	14°29'	East	20	1891	1896	1996	1996	95	1.90	0.70	0.98	0.90	2	-0.12	M-A
6	980	TRW	47°49'	14°24'	East	22	1794	1805	1996	1996	178	1.44	0.47	0.95	0.76	2	0.28	M-S
7	1000	TRW	47°46'	14°27'	East	6	1805	1859	1996	1996	159	1.34	0.56	0.86	0.75	2	-0.20	J-J
8	1000	TRW	47°45'	14°29'	East	32	1817	1821	1996	1996	147	1.67	0.48	0.96	0.78	2	0.05	J-S
9	1050	TRW	47°47'	14°26'	East	7	1813	1850	1996	1996	161	1.42	0.54	0.88	0.72	2	0.14	J-S
10	1055	TRW	47°49'	14°23'	East	8	1801	1818	1996	1996	177	1.66	0.48	0.87	0.62	2	0.14	J-S
11	1150	TRW	47°46'	14°24'	East	14	1801	1844	1996	1996	152	1.40	0.40	0.87	0.77	2	0.34	J-S
12	1220	TRW	47°46'	14°24'	East	10	1832	1844	1996	1996	149	1.13	0.57	0.92	0.73	2	0.19	M-S
13	1250	TRW	47°21'	15°15'	East	19	1885	1891	1995	1995	99	1.54	0.43	0.93	0.86	5	0.16	M-A
14	1250	TRW	47°42'	14°30'	East	38	1813	1834	1996	1996	113	1.82	0.37	0.90	0.71	2	0.15	J-S
15	1300	TRW	47°47'	14°19'	East	20	1674	1824	1996	1996	176	1.56	0.45	0.86	0.60	2	0.26	J-J
16	1350	TRW	46°33'	12°07'	Cent	32	1845	1854	2002	2001	129	1.84	0.43	0.96	0.41	2	0.14	J-A
17	1400	TRW	47°04'	11°35'	Cent	58	1783	1806	2002	2002	121	1.43	0.30	0.90	0.55	1	0.50	M-A
18	1500	TRW	49°09'	20°04'	Tatra	64	1612	1676	2004	2004	166	0.97	0.59	0.96	0.46	5	0.26	J-J
19	1500	TRW	49°09'	20°10'	Tatra	18	1831	1842	2003	2003	149	0.89	0.63	0.97	0.42	5	0.29	J-J
20	1550	TRW	46°37'	12°45'	Cent	36	1796	1842	1999	1999	127	1.74	0.41	0.92	0.52	1	0.29	M-A
21	1550	TRW	46°24'	14°27'	East	10	1736	1832	2002	2001	174	1.25	0.43	0.82	0.49	1	0.44	M-A
22	1600	TRW	46°27'	13°27'	East	37	1645	1726	1999	1999	203	0.77	0.39	0.89	0.37	1	0.43	J-J
23	1650	TRW	46°12'	8°04'	West	31	1405	1438	2003	2003	378	0.61	0.45	0.92	0.58	4	0.16	A-S
24	1700	TRW	46°28'	13°41'	East	36	1594	1691	1999	1999	239	1.18	0.48	0.93	0.40	1	0.38	M-A
25	1700	TRW	47°32'	14°41'	East	41	1658	1724	1997	1997	197	1.02	0.53	0.95	0.46	1	0.45	J-J
26	1750	TRW	46°54'	12°56'	East	29	1568	1632	2003	2003	294	0.90	0.45	0.91	0.58	1	0.61	M-A
27	1750	TRW	46°15'	12°33'	Cent	35	1698	1729	1999	1999	161	1.13	0.30	0.82	0.49	1	0.36	M-A
28	1750	TRW	47°10'	13°35'	East	24	1679	1735	2003	2003	228	0.98	0.48	0.90	0.58	1	0.62	J-A
29	1750	TRW	47°04'	11°35'	Cent	68	1741	1781	2002	2002	146	1.27	0.32	0.88	0.60	1	0.51	M-A
30	1750	TRW	47°34'	14°40'	East	53	1669	1721	1997	1997	194	0.81	0.51	0.94	0.45	1	0.38	J-A
31	1760	TRW	46°28'	9°47'	Cent	372	800	951	1993	1915	144	1.11	0.28	0.84	0.57	1	0.28	J-A
32	1770	TRW	46°26'	8°11'	West	325	505	951	2003	2002	129	1.04	0.25	0.87	0.64	1	0.32	M-A
33	1780	TRW	46°26'	7°49'	West	330	1085	1168	2002	2001	201	0.86	0.40	0.94	0.66	1	0.38	M-A
34	1790	TRW	46°12'	8°04'	West	78	685	1213	2003	1994	259	0.87	0.38	0.87	0.58	4	0.20	M-S
35	1800	TRW	46°22'	8°02'	West	13	1877	1899	1973	1973	65	1.90	0.43	0.88	0.47	4	0.16	M-A
36	1800	TRW	47°29'	13°46'	East	74	1357	1439	1998	1998	246	0.70	0.50	0.91	0.34	1	0.59	J-J
37	1835	TRW	46°26'	13°44'	East	11	1677	1764	2001	2001	175	0.93	0.47	0.81	0.30	1	0.55	J-J
38	1850	TRW	46°26'	12°40'	Cent	42	1685	1698	1999	1999	190	0.91	0.39	0.87	0.55	1	0.41	M-A
39	1870	TRW	47°01'	14°03'	East	39	1616	1621	2003	2002	253	0.78	0.44	0.93	0.50	1	0.55	J-J
40	1870	TRW	47°19'	13°46'	East	30	1784	1809	2003	2003	158	1.43	0.41	0.93	0.45	1	0.30	J-J
41	1900	TRW	46°24'	7°30'	West	10	1681	1771	1986	1982	211	0.98	0.69	0.89	0.49	1	0.36	M-A
42	1900	TRW	45°13'	6°41'	South	58	1516	1539	1973	1973	208	1.08	0.47	0.95	0.44	1	0.46	M-A
43	1900	TRW	46°50'	10°36'	Cent	28	1497	1577	1999	1999	332	0.85	0.56	0.93	0.52	1	0.08	M-A
44	1900	TRW	47°10'	13°38'	East	33	1566	1679	2003	2003	204	0.91	0.46	0.87	0.58	1	0.58	J-J
45	1970	TRW	46°38'	12°06'	Cent	69	1520	1559	1990	1988	136	1.10	0.41	0.92	0.42	1	0.61	M-A
46	2000	TRW	46°24'	8°01'	West	8	1792	1849	1974	1974	137	1.17	0.43	0.76	0.44	1	0.45	M-A
47	2000	TRW	46°35'	12°16'	Cent	42	1463	1573	1998	1998	288	0.68	0.53	0.89	0.44	1	0.6	J-J
48	2000	TRW	46°14'	11°40'	Cent	29	1681	1749	1998	1998	206	0.91	0.55	0.94	0.55	1	0.35	M-A
49	2050	TRW	46°35'	10°57'	Cent	15	1517	1563	2004	2004	411	0.56	0.63	0.86	0.45	1	0.52	J-J
50	2050	TRW	46°35'	12°16'	Cent	41	1695	1740	1998	1998	225	0.94	0.53	0.95	0.45	1	0.62	M-A
51	2050	TRW	46°10'	10°34'	Cent	34	1468	1694	1999	1998	220	0.92	0.53	0.88	0.31	1	0.45	J-J
52	2100	TRW	46°49'	12°10'	Cent	32	1414	1546	1999	1999	309	0.74	0.42	0.87	0.46	1	0.58	M-A
53	2100	TRW	46°29'	12°06'	Cent	114	1515	1551	1994	1994	274	0.64	0.56	0.96	0.35	1	0.51	J-J
54	2100	TRW	46°45'	10°58'	Cent	34	1528	1536	1999	1999	310	0.91	0.57	0.96	0.46	1	0.30	M-A
55	2100	TRW	45°13'	6°41'	South	16	1353	1382	1958	1958	424	0.85	0.52	0.91	0.50	1	0.41	J-A
56	2100	TRW	46°45'	10°46'	Cent	7	1571	1683	1999	1999	331	0.54	0.73	0.94	0.54	1	0.48	J-A
57	2100	TRW	46°13'	10°55'	Cent	104	1209	1234	2002	2002	258	0.63	0.49	0.95	0.34	1	0.45	J-J
58	2130	TRW	46°06'	7°42'	West	29	1508	1536	2004	2004	323	0.67	0.57	0.96	0.43	1	0.43	J-A
59	2150	TRW	46°28'	12°07'	Cent	88	1575	1623	1997	1997	239	0.88	0.54	0.95	0.32	1	0.61	J-J
60	2150	TRW	46°29'	12°05'	Cent	25	1717	1737	1995	1995	203	0.96	0.52	0.94	0.31	1	0.57	J-J
61	2165	TRW	44°03'	7°27'	South	112	988	1150	1974	1974	275	0.36	0.55	0.95	0.27	1	0.26	J-J
62	2200	TRW	46°20'	10°40'	Cent	35	1438	1458	1999	1999	447	0.73	0.55	0.96	0.49	1	0.50	J-J
63	2200	TRW	46°33'	10°45'	Cent	29	1525	1561	1999	1999	359	0.54	0.63	0.97	0.35	1	0.54	J-J
64	2300	TRW	44°38'	6°48'	South	5	1754	1841	2000	2000	197	1.12	0.43	0.75	0.66	4	0.14	A-S
65	1500	MXD	49°09'	20°04'	Tatra	64	1612	1676	2004	2004	166	0.89	0.46	0.92	0.20	5	0.55	M-A
66	1780	MXD	46°26'	7°49'	West	26	1682	1702	1998	1998	265	0.85	0.63	0.97	0.40	3	0.56	J-S
67	1800	MXD	46°22'	8°02'	West	13	1877	1899	1973	1973	65	1.05	0.59	0.91	0.18	3	0.74	A-S
68	1900	MXD	46°24'	7°30'	West	10	1681	1771	1986	1982	211	0.87	0.53	0.87	0.25	3	0.65	J-S
69	2000	MXD	46°24'	8°01'	West	8	1792	1849	1974	1974	137	0.94	0.62	0.90	0.16	3	0.79	J-S
70	2130	MXD	46°06'	7°42'	West	29	1508	1536	2004	2004	320	0.84	0.50	0.94	0.28	3	0.69	J-A

Par= parameter, S-reg= sub-region, MSL= mean segment length , AGR= average growth rate , Rbar, EPS= calculated over 30 years lagged by 50, L-1= first year autocorrelation, P-L= PC with max. loading using 5 varimax rotations over 1905-1958, Res= highest monthly correlation with temperature over the full period of overlap, TAR= inst. target season

Fig. S1(a–i) Annually resolved maps of Alpine-wide LBM outbreaks of the period 1700–2000. Thin black triangles show the existing site chronologies per year, and colors refer to the reconstructed outbreak intensity ranging from heavy (purple) to low (grey). The six different colors are based on the six detection methods (*i–vi*) as described in the main text and detailed in Fig. 4. Corresponding numbers in the lower right summarize each year’s data availability and outbreak intensity.

















