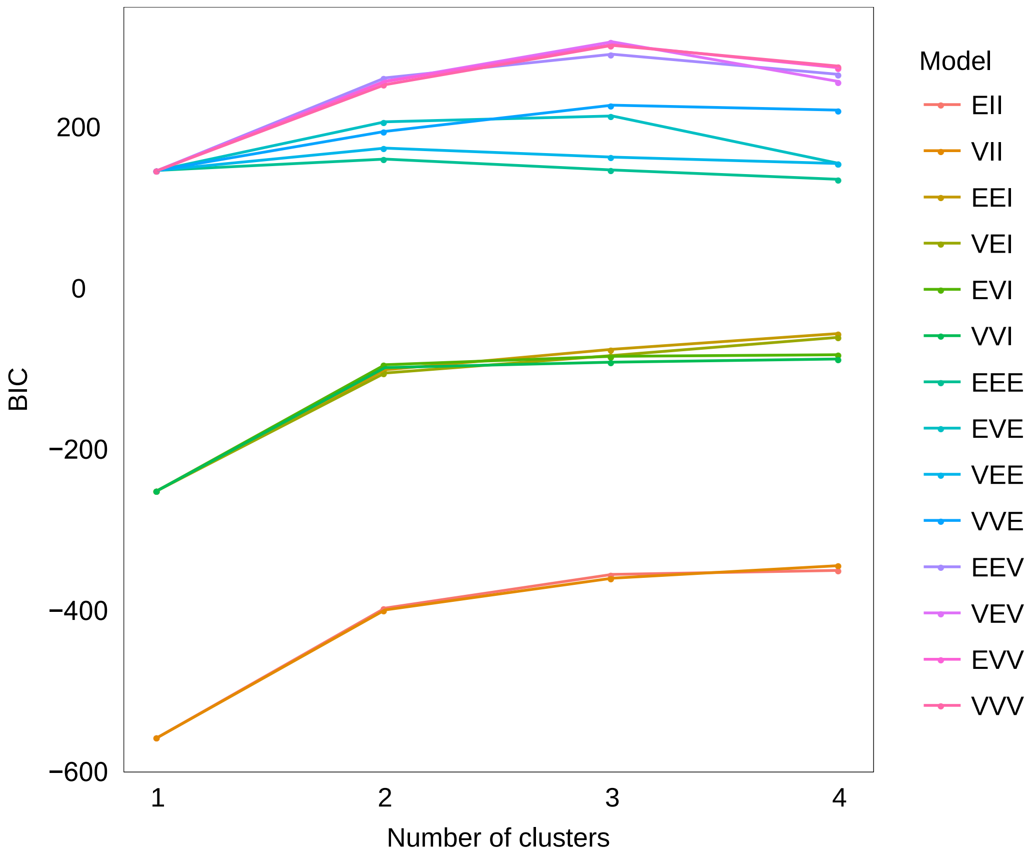
Supplementary material

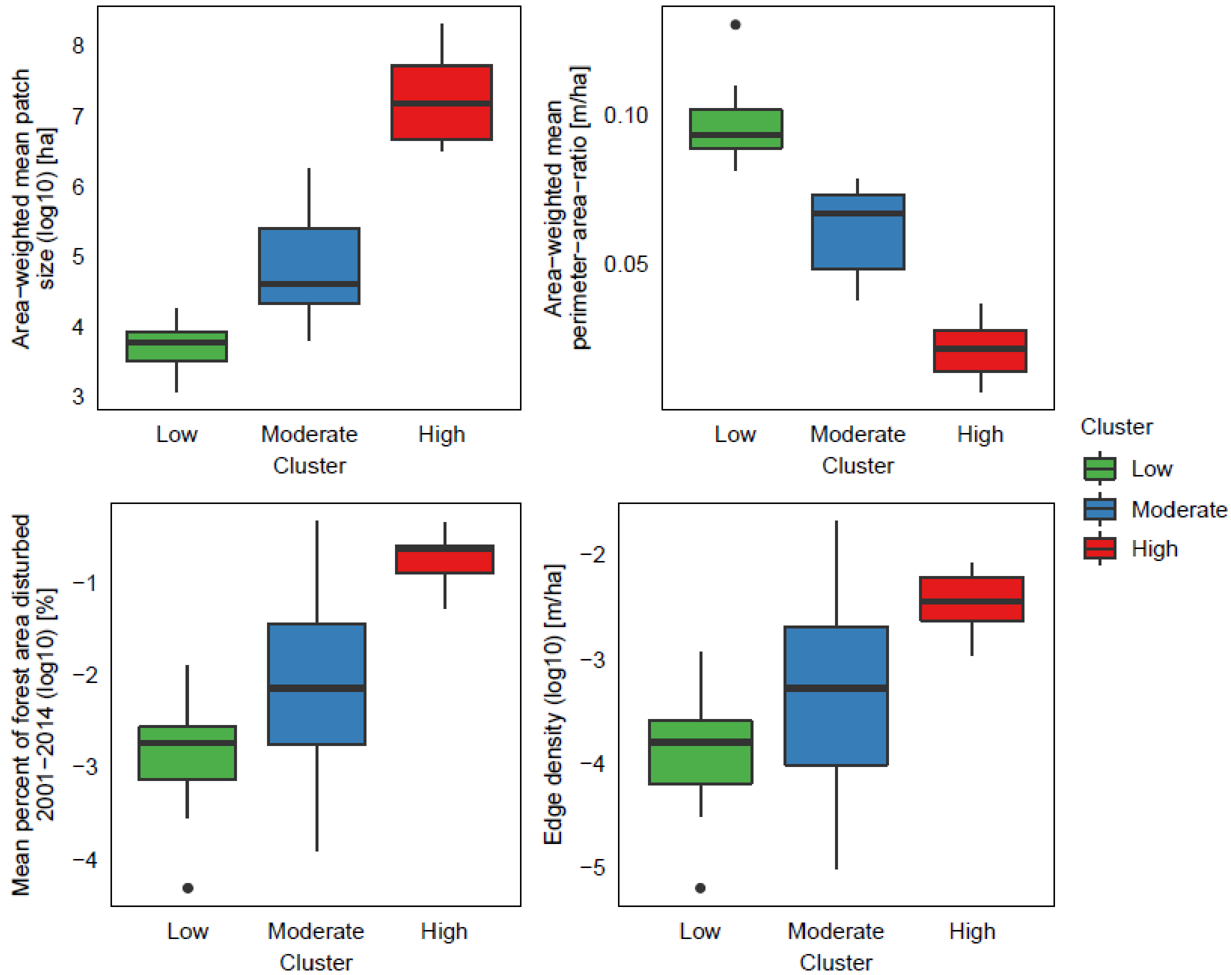
Patterns and drivers of recent disturbances across the temperate forest biome

Andreas Sommerfeld, Cornelius Senf, Brian Buma, Anthony W. D'Amato, Tiphaine Després, Ignacio Díaz-Hormazabal, Shawn Fraver, Lee E. Frelich, Álvaro G. Gutiérrez, Sarah J. Hart, Brian J. Harvey, Hong S. He, Tomáš Hlásny, Andrés Holz, Thomas Kitzberger, Dominik Kulakowski, David Lindenmayer, Akira S. Mori, Jörg Müller, Juan Paritsis, George L. W. Perry, Scott L. Stephens, Miroslav Svoboda , Monica G. Turner, Thomas T. Veblen, Rupert Seidl

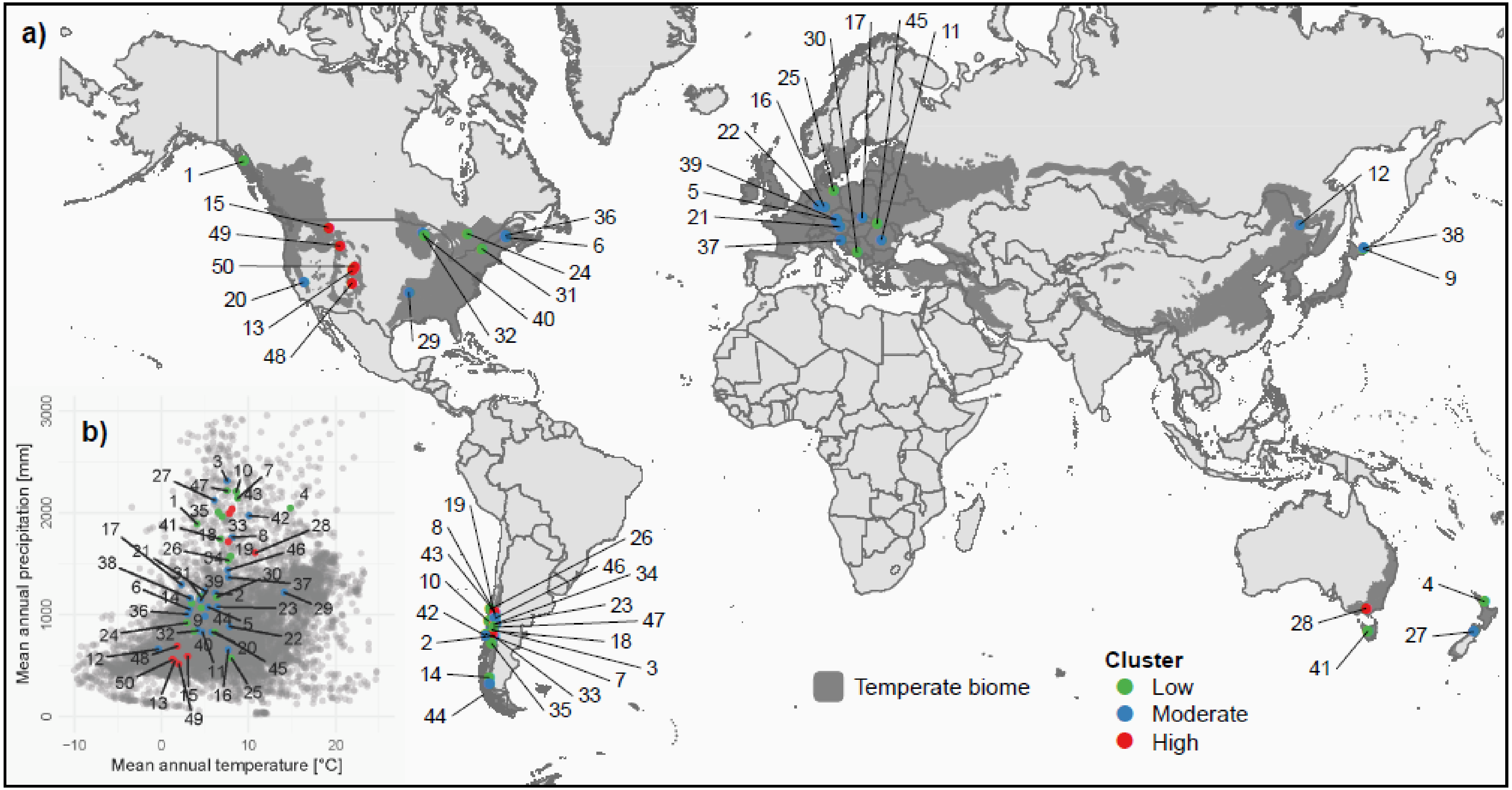
Supplementary Figures



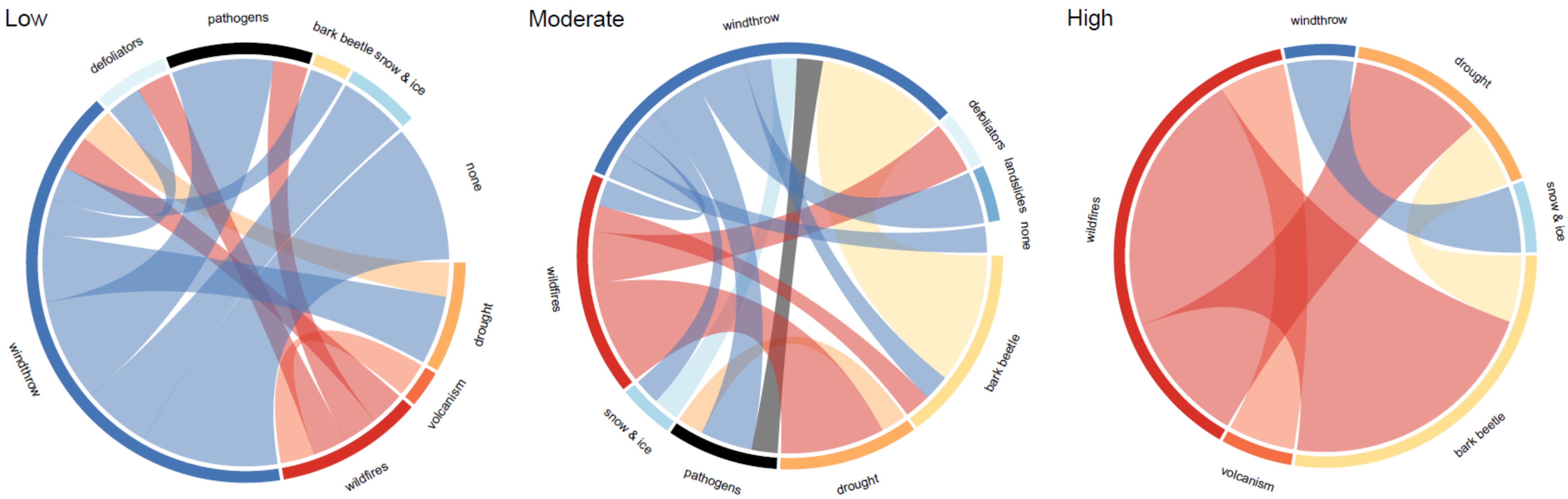
Supplementary Figure 1: Comparison of different clustering models (colors) and number of clusters using the Bayes Information Criterion (BIC). Models are identified using three letter codes describing the geometric characteristics of the approach, namely volume, shape, and orientation. E means equal and V means varying across components or clusters, while I refers to the identity matrix in specifying shape or orientation and is a special case of E. For details we refer to Fraley et al. [1].



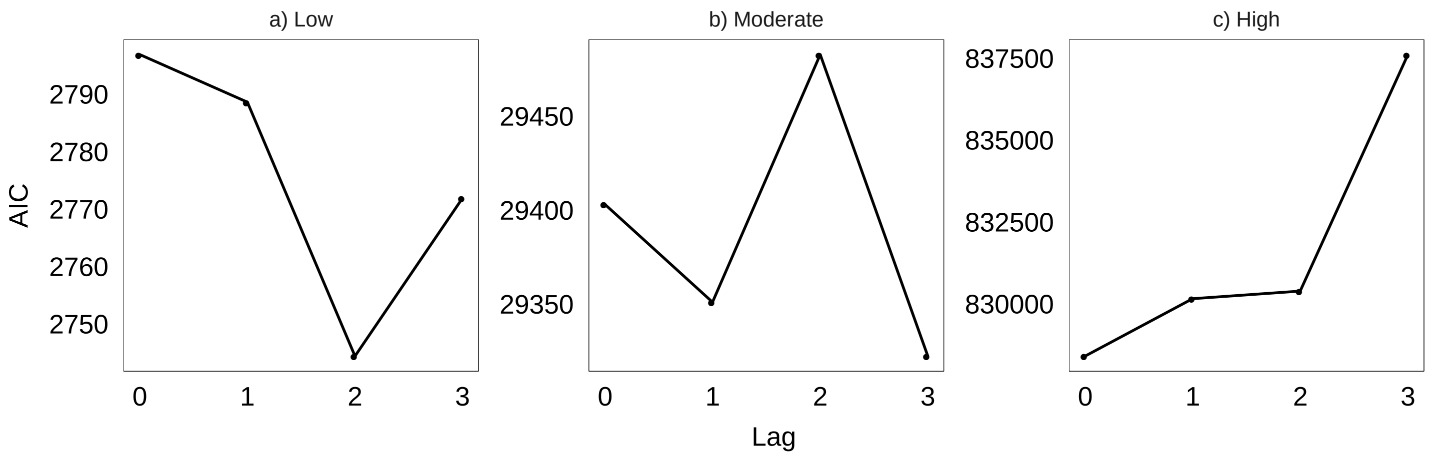
Supplementary Figure 2: Boxplots showing the distribution of the four disturbance metrics in the three clusters of disturbance activity. See also Table 1. Boxplots denote the median (center line) and interquartile range (box), with whiskers extending to three times the interquartile range and points indicating values outside this range. The number of experimental replicates equals the number of study sites per cluster (*Low:* 18, *Moderate:* 23, *High:* 9)



Supplementary Figure 3: A network of 50 protected landscapes across the temperate biome (biome area indicated in dark grey[2]). The panels show a) the geographic location, and b) the location of the landscapes in climate space. Study sites are colored according to their respective cluster, with green, blue and red representing clusters of *low*, *moderate* and *high* disturbance activity. Note that the climatic envelope of the biome (dark grey dots in panel b) is based on a sample of 10,000 4500 m × 4500 m grid cells throughout the biome.



Supplementary Figure 4: Co-occurrences of the two most important disturbance agents per landscape in clusters with *low*, *moderate*, and *high* disturbance activity. The sector size in the outer circle indicates the relative prevalence of a disturbance agent in a respective cluster, while the links denote co-occurrence.



Supplementary Figure 5: Variable lag times (years) between climate anomaly and disturbance response, compared using the Akaike Information Criterion (AIC) of the respective GLMM. The lag with the lowest AIC was chosen in the final model.

Supplementary Tables

Supplementary Table 1: Summary of the 50 study sites. Disturbance characteristics (area-weighted mean patch size, area-weighted perimeter-area ratio, percent of area disturbed, and edge density) pertain to the years 2001 to 2014.

#	Landscape name	Country	Local experts	Total area disturbed [ha]	Forest-cover [ha]	Main disturbance agents	Dominant tree species	Percent of area disturbed [%]	Edge density [m/ha]	Area-weighted mean patch size [ha]	Area-weighted perimeter-area ratio [m/ha]	Cluster
1	Admirality Island	USA	B. Buma	192	367853	windthrow, pathogens, snow & ice, landslides, lack of snow	*Tsuga heterophylla, Picea sitchensis, Tsuga mertensiana, Callitropsis nootkatensis, Pinus contorta*	0.05	0.53	0.85	1011	*Low*
2	Alerces	Argentina	A. Holz & J. Paritsis	1338	154313	wildfires, defoliators, snow & ice, drought	*Nothofagus pumilio, Nothofagus antarctica, Nothofagus dombeyi, Austrocedrus chilensis, Fitzroya cupressoides*	0.87	6.53	4.39	754	*Moderate*
3	Alerce Andino	Chile	Á. G. Gutiérrez & I. Díaz-Hormazábal	38	36009	windthrow, landslides	*Fitzroya cupressoides, Nothofagus betuloides, Nothofagus nitida, Nothofagus pumilio, Nothofagus dombeyi*	0.11	0.71	2.07	670	*Moderate*
4	Te Paparahi Conservation Area	New Zealand	G. L. W. Perry	23	12378	windthrow, herbivory, drought, landslides	*Kunzea robusta, Agathis australis, Beilschmiedia tarairi, Vitex lucens, Dysoxylum spectabile*	0.19	1.55	1.15	821	*Low*
5	Bavarian Forest	Germany	J. Müller	1694	7271	bark beetles, windthrow, pathogens	*Picea abies, Fagus sylvatica, Abies alba, Sorbus aucuparia, Acer pseudoplatanus*	23.3	103.65	56.89	445	*Moderate*
6	Baxter State Park	USA	S. Fraver	169	69939	windthrow, pathogens	*Picea rubens, Abies balsamea, Acer saccharum, Betula alleghaniensis, Fagus grandifolia*	0.24	1.03	48.87	427	*Moderate*

#	Landscape name	Country	Local experts	Total area disturbed [ha]	Forest-cover [ha]	Main disturbance agents	Dominant tree species	Percent of area disturbed [%]	Edge density [m/ha]	Area-weighted mean patch size [ha]	Area-weighted perimeter-area ratio [m/ha]	Cluster
7	Chiloé	Chile	Á. G. Gutiérrez & I. Díaz-Hormazábal	2	34827	windthrow	*Nothofagus nitida, Tepualia stipularis, Aextoxicon punctatum, Fitzroya cupressoides, Eucryphia cordifolia*	0	0.06	0.12	1298	*Low*
8	Conguillío	Chile	Á. G. Gutiérrez & I. Díaz-Hormazábal	104	20885	wildfires, drought, windthrow, snow & ice, landslides	*Nothofagus dombeyi, Nothofagus antarctica, Nothofagus pumilio, Araucaria araucana, Nothofagus alpina*	0.5	2.93	4.07	587	*Moderate*
9	Shiretoko Cool temperate	Japan	A. S. Mori	9	7029	windthrow, browsing, defoliators, snow & ice, landslides	*Picea jezoensis, Abies sachalinensis, Quercus crispula, Betula ermanii, Kalopanax septemlobus*	0.13	1.06	0.62	810	*Low*
10	Alerce Costero	Chile	Á. G. Gutiérrez & I. Díaz-Hormazábal	15	22858	windthrow	*Laureliopsis philippiana, Nothofagus nitida, Nothofagus dombeyi, Drimys winteri, Fitzroya cupressoides*	0.06	0.55	0.57	860	*Low*
11	Fagaras	Romania	M. Svoboda	241	7736	bark beetles, windthrow	*Fagus sylvatica, Abies alba, Picea abies*	3.11	13.15	19.16	423	*Moderate*
12	Feng Lin	China (PRC)	H. S. He	243	17571	wildfires, bark beetles, windthrow, defoliators, drought	*Pinus koraiensis, Abies nephrolepis, Betula costata, Picea koraiensis, Tilia amurensis*	1.38	10.78	2.13	781	*Moderate*
13	Flattops	USA	D. Kulakowski, T. T. Veblen & S. J. Hart	5516	44540	wildfires, bark beetles, drought	*Picea engelmannii, Abies lasiocarpa, Populus tremuloides, Pinus contorta, Pseudotsuga menziesii*	12.38	17.16	1511.41	139	*High*

#	Landscape name	Country	Local experts	Total area disturbed [ha]	Forest-cover [ha]	Main disturbance agents	Dominant tree species	Percent of area disturbed [%]	Edge density [m/ha]	Area-weighted mean patch size [ha]	Area-weighted perimeter-area ratio [m/ha]	Cluster
14	Glaciares	Argentina	A. Holz & J. Paritsis	733	61828	wildfires, defoliators, snow & ice (avalanches, ice storms, etc.)	*Nothofagus pumilio, Nothofagus antarctica, Nothofagus betuloides*	1.19	11.66	0.65	984	*Low*
15	Glacier	USA	B. J. Harvey & M. G. Turner	153393	642334	wildfires, bark beetles	*Pinus contorta, Pseudotsuga menziesii, Picea engelmannii, Abies lasiocarpa, Larix occidentalis*	23.88	35.37	5882.1	148	*High*
16	Hainich	Germany	J. Müller	40	4458	pathogens, windthrow, snow & ice	*Fagus sylvatica, Acer pseudoplatanus, Fraxinus excelsior, Quercus robur, Carpinus betulus*	0.91	6.47	2.6	714	*Moderate*
17	High Tatra	Slovakia	T. Hlasny	388	4695	bark beetles, windthrow, pathogens	*Pinus mugo, Picea abies, Sorbus aucuparia, Larix decidua, Betula sp*	8.26	31.53	80.48	382	*Moderate*
18	Hornopirén	Chile	Á. G. Gutiérrez & I. Díaz-Hormazábal	23	19961	windthrow, snow & ice	*Nothofagus betuloides, Nothofagus pumilio, Nothofagus nitida, Fitzroya cupressoides, Nothofagus dombeyi*	0.12	1.17	0.41	1016	*Low*
19	Huerquehue	Chile	Á. G. Gutiérrez & I. Díaz-Hormazábal	12	9527	drought, windthrow, snow & ice, landslides	*Nothofagus dombeyi, Nothofagus pumilio, Nothofagus obliqua, Nothofagus antarctica, Araucaria araucana*	0.13	1.18	0.76	930	*Low*
20	Illilouette Creek/ Yosemite	USA	S. L. Stephens	1903	23221	wildfires, drought, bark beetles, pathogens	*Abies concolor, Abies magnifica, Pinus contorta, Pinus jeffreyi*	8.19	33.19	175.8	405	*Moderate*

#	Landscape name	Country	Local experts	Total area disturbed [ha]	Forest-cover [ha]	Main disturbance agents	Dominant tree species	Percent of area disturbed [%]	Edge density [m/ha]	Area-weighted mean patch size [ha]	Area-weighted perimeter-area ratio [m/ha]	Cluster
21	Kalkalpen	Austria	R. Seidl	492	13465	windthrow, bark beetles, snow & ice, wildfires	*Picea abies*, *Fagus sylvatica*, *Larix decidua*, *Abies alba*, *Acer pseudoplatanus*	3.65	19.32	4.6	529	*Moderate*
22	Kellerwald	Germany	J. Müller	241	5048	bark beetles, windthrow, snow & ice, drought, pathogens	*Fagus sylvatica*, *Picea abies*, *Quercus robur*, *Larix europaea*, *Pinus sylvestris*	4.78	24.32	5.53	509	*Moderate*
23	Nahuel Lanin	Argentina	T. Kitzberger	4506	628938	wildfires, drought, volcanism, defoliators, snow & ice	*Nothofagus pumilio*, *Nothofagus antarctica*, *Nothofagus dombeyi*, *Austrocedrus chilensis*, *others*	0.72	5.24	33.15	731	*Moderate*
24	Malakisis	Canada	T.Després	8	2861	windthrow, bark beetles	*Acer saccharum*, *Betula alleghaniensis*, *Tsuga canadensis*, *Abies balsamea*, *Betula papyrifera*	0.28	2.5	0.39	902	*Low*
25	Müritz	Germany	J. Müller	51	4077	wildfires, windthrow	*Pinus sylvestris*, *Fagus sylvatica*, *Betula pendula*, *Alnus glutinosa*, *Quercus robur*	1.26	11.43	0.87	906	*Low*
26	Nahuelbuta	Chile	Á. G. Gutiérrez & I. Díaz-Hormazábal	26	6065	windthrow, drought, pathogens	*Araucaria araucana*, *Nothofagus dombeyi*, *Nothofagus obliqua*, *Nothofagus antarctica*	0.43	3.81	1.36	882	*Low*

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27	Nelson Lakes National Park	New Zealand	G. L. W. Perry	204	52503	windthrow, landslides, herbivory	*Lophonzonia menziesii, Fuscaspora fuscaspora, Fuscaspora cliffortioides, others*	0.39	2.33	3.93	598	*Moderate*
28	O'Shannassy	Australia	D. Lindenmayer	5845	13241	wildfires, drought	*Eucalyptus regnans, Eucalyptus delegatensis, Eucalyptus nitens, Eucalyptus obliqua, others*	44.14	60.32	5304.76	137	*High*
29	Ozarks	USA	H. S. He	9	7264	drought, pathogens, bark beetles, defoliators, snow & ice	*Quercus alba, Pinus echinata, Quercus rubra, Quercus veltutina, Carya tomentosa*	0.12	0.86	2.2	722	*Moderate*
30	Perućica	Bosnia and Herzegowina	M. Svoboda	3	1408	windthrow, pathogens, landslides, snow & ice, bark beetles	*Fagus sylvatica, Abies alba, Picea abies*	0.23	2.26	0.28	981	*Low*
31	Five Ponds	USA	A. D'Amato	6	12574	windthrow, pathogens, defoliators, snow & ice, drought	*Acer saccharum, Fagus grandifolia, Picea rubens, Tsuga canadensis, Betula alleghaniensis*	0.05	0.51	0.27	1071	*Low*
32	Porcupine	USA	L. E. Frelich	30	24006	windthrow, wildfires, defoliators, drought	*Acer saccharum, Tsuga canadensis, Betula alleghaniensis, Tilia americana, Acer rubrum*	0.12	0.9	3.14	732	*Moderate*
33	Pumalín	Chile	Á. G. Gutiérrez & I. Díaz-Hormazábal	8728	169220	windthrow, snow & ice	*Nothofagus nitida, Nothofagus dombeyi, Nothofagus pumilio, Nothofagus betuloides, Laureliopsis philippiana*	5.16	11.07	4659.35	215	*High*

#	Landscape name	Country	Local experts	Total area disturbed [ha]	Forest-cover [ha]	Main disturbance agents	Dominant tree species	Percent of area disturbed [%]	Edge density [m/ha]	Area-weighted mean patch size [ha]	Area-weighted perimeter-area ratio [m/ha]	Cluster
34	Puyehue	Chile	Á. G. Gutiérrez & I. Díaz-Hormazábal	21531	67012	volcanism, wildfires, windthrow, snow & ice	*Nothofagus pumilio, Nothofagus dombeyi, Laureliopsis philippiana, Nothofagus betuloides, Nothofagus antarctica*	32.13	23.35	20045.21	73	*High*
35	Queulat	Chile	Á. G. Gutiérrez & I. Díaz-Hormazábal	82	11082	windthrow, snow & ice	*Nothofagus betuloides, Nothofagus pumilio, Nothofagus dombeyi, Nothofagus nitida, Laureliopsis philippiana*	0.74	6.93	0.68	932	*Low*
36	Big Reed	USA	S. Fraver	6	1929	windthrow, pathogens	*Picea rubens, Abies balsamea, Thuja occidentalis, Acer saccharum, Fagus gradifolia*	0.32	2.43	0.69	754	*Moderate*
37	Risnjak	Croatia	M. Svoboda	4	3224	snow & ice, windthrow, bark beetles	*Fagus sylvatica, Abies alba, Picea abies*	0.12	0.89	0.65	744	*Moderate*
38	Shiretoko subalpine	Japan	A. S. Mori	6	44069	windthrow, snow & ice, defoliators, browsing, landslides	*Betula ermanii, Sorbus commixta, Sorbus matsumurana, Alnus maximowiczii, Acer tschonoskii*	0.01	0.1	1.67	774	*Moderate*
39	Sumava	Czech	M. Svoboda	1095	2422	bark beetles, windthrow	*Picea abies, Sorbus aucuparia*	45.22	207.68	89.04	459	*Moderate*
40	Sylvania	USA	L. E. Frelich	11	6006	windthrow, drought, defoliators	*Tsuga canadensis, Acer saccharum, Betula alleghaniensis, Tilia americana, Acer rubrum*	0.18	1.63	0.51	929	*Low*

#	Landscape name	Country	Local experts	Total area disturbed [ha]	Forest-cover [ha]	Main disturbance agents	Dominant tree species	Percent of area disturbed [%]	Edge density [m/ha]	Area-weighted mean patch size [ha]	Area-weighted perimeter-area ratio [m/ha]	Cluster
41	Tasmania	Australia	A. Holz	13	45078	wildfires, pathogens, drought	*Athrotaxis cupressoides, Eucalyptus coccifera*	0.03	0.31	0.24	1096	*Low*
42	Tepuhueico	Chile	Á. G. Gutiérrez & I. Díaz-Hormazábal	72	19779	windthrow	*Tepualia stipularis, Nothofagus nitida, Drymis winteri, Amomyrtus luma, Aextoxicon punctatum*	0.37	2.63	2.11	719	*Moderate*
43	Tolhuaca	Chile	Á. G. Gutiérrez & I. Díaz-Hormazábal	668	4169	wildfires, drought, windthrow, snow & ice, landslides	*Nothofagus obliqua, Nothofagus dombeyi, Nothofagus alpina, Nothofagus pumilio, Araucaria araucana*	16.02	44.2	407.81	276	*High*
44	Torres del Paine	Chile	A. Holz & J. Paritsis	1456	43475	wildfires, defoliators, snow & ice (avalanches, ice storms, etc.)	*Nothofagus pumilio, Nothofagus antarctica, Nothofagus betuloides*	3.35	21.6	12.1	645	*Moderate*
45	Uholka	Ukraine	M. Svoboda	14	5489	windthrow	*Fagus sylvatica, others*	0.25	2.6	0.3	1024	*Low*
46	Villarrica	Chile	Á. G. Gutiérrez & I. Díaz-Hormazábal	19	24145	wildfires, drought, windthrow, snow & ice, landslides	*Nothofagus pumilio, Nothofagus dombeyi, Nothofagus antarctica, Nothofagus obliqua, Araucaria araucana*	0.08	0.54	1.71	695	*Moderate*
47	Vicente Pérez Rosales	Chile	Á. G. Gutiérrez & I. Díaz-Hormazábal	365	158085	volcanism, wildfires, windthrow, snow & ice	*Nothofagus dombeyi, Nothofagus pumilio, Nothofagus betuloides, Nothofagus nitida, Eucryphia cordifolia*	0.23	1.92	1.75	831	*Low*

#	Landscape name	Country	Local experts	Total area disturbed [ha]	Forest-cover [ha]	Main disturbance agents	Dominant tree species	Percent of area disturbed [%]	Edge density [m/ha]	Area-weighted mean patch size [ha]	Area-weighted perimeter-area ratio [m/ha]	Cluster
48	Weminuche	USA	T. T. Veblen & S. J. Hart	17666	77444	bark beetles, drought, wildfires, defoliators	*Picea engelmannii, Abies lasiocarpa, Pinus contorta, Pinus flexilis, Populus tremuloides*	22.81	82.84	316.74	363	*High*
49	Yellowstone	USA	B. J. Harvey & M. G. Turner	113924	915221	wildfires, bark beetles, defoliators, pathogens	*Pinus contorta, Pseudotsuga menziesii, Picea engelmannii, Abies lasiocarpa, Pinus albicaulis*	12.45	30.55	1469.1	245	*High*
50	Mount Zirkel	USA	D. Kulakowski & B. Buma	7953	32392	wildfires, bark beetles	*Picea engelmanii, Abies latifolia, Populus tremuloides, Pinus contorta, Pseudotsuga menziesii*	24.55	84.12	462.86	343	*High*

Supplementary Table 2: Multiple comparisons of species composition and weighted mean trait values among clusters of disturbance activity. Test statistics and p-values are based on approximate Kruskal-Wallis tests with 9,999 permutations. P-values were adjusted for multiple comparisons using false discovery rate (FDR) correction.

Trait	Comparison of clusters	Statistic (H)	p-value	p-value (FDR-corrected)
Dominance	Low – Moderate	0.0699	0.7936	0.7936
	Low – High	2.9120	0.0880	0.1320
	Moderate – High	5.9930	0.0133	0.0399
Conifers	Low – Moderate	1.1780	0.2809	0.5320
	Low – High	0.9316	0.3547	0.5320
	Moderate – High	0.3500	0.5722	0.5722
Height	Low – Moderate	1.7950	0.1879	0.1879
	Low – High	5.8440	0.0147	0.0441
	Moderate – High	2.2140	0.1476	0.1879
Wood density	Low – Moderate	0.0994	0.7645	0.7645
	Low – High	5.5980	0.0154	0.0231
	Moderate - High	6.6440	0.0079	0.0231

Supplementary Table 3: Comparison of area-weighted mean patch size and area-weighted mean perimeter-area-ratio inside and outside of protected areas. Test statistics and p-values are based on approximate Kruskal-Wallis tests with 9,999 permutations.

Metric	Cluster	Statistic (H)	p-value
Area-weighted mean patch size	Low	26.2703	< 0.0001
	Moderate	12.5885	0.0002
	High	0.0020	1.0000
Area-weighted mean perimeter-area-ratio	Low	24.9922	< 0.0001
	Moderate	12.7448	0.0005
	High	0.5634	0.4777

Supplementary Table 4: Summary of the GLMMs testing the effect of temperature and precipitation anomalies as well as relative topographic ruggedness on disturbance probability. Values in parentheses are standard errors estimated from the GLMMs. Asterisks indicate the level of significance (*** P < 0.001, ** P < 0.01, * P < 0.05). Results of likelihood-ratio-tests comparing the full model to a spatial-only and a Null-model are also indicated.

Cluster	Model	Intercept	Topographic Ruggedness Index	Precipitation anomaly	Temperature anomaly	Precipitation × temperature anomaly	AIC	Log-likelihood	χ^2 (DF)	*P*
Low	Full	0.02 (±0.36)	0.30 (±0.04)***	0.33 (±0.07)***	-0.20 (±0.07)**	-0.04 (±0.06)	2744.36	-1365.18	63.07 (3)	< 0.001
	Spatial-only	0.08 (±0.35)	0.29 (±0.04)***	-	-	-	2801.42	-1396.71	47.67 (1)	< 0.001
	Null	0.08 (±0.35)	-	-	-	-	2847.09	-1420.55	-	-
Moderate	Full	-0.50 (±0.50)	-0.05 (±0.01)***	-0.11 (±0.02)***	-0.17 (±0.03)***	-0.03 (±0.02)***	29322.28	-14654.14	255.94 (3)	< 0.001
	Spatial-only	-0.41 (±0.50)	-0.05 (±0.01)***	-	-	-	29572.22	-14782.11	12.36 (1)	< 0.001
	Null	-0.41 (±0.50)	-	-	-	-	29582.58	-14788.29	-	-
High	Full	-0.65 (±0.24)**	-0.10 (±0.00)***	-0.09 (±0.01)***	0.59 (±0.01)***	-0.43 (±0.00)***	828401.56	-414193.78	18073.93 (3)	< 0.001
	Spatial-only	0.07 (0.28)	-0.11 (±0.00)***	-	-	-	846469.48	-423230.74	1670.36 (1)	< 0.001
	Null	0.07 (0.28)	-	-	-	-	848137.85	-424065.92	-	

Supplementary Table 5: Questionnaire to compile expert-based information on tree species, disturbance agents, and potential human interventions for the 50 protected landscapes. See Table S1 for the names of the local experts contacted.

#	Question
1	What are the five most important tree species (in terms of basal area share) occurring on the landscape? Please give scientific names and approximate percentages.
2	List the major disturbance agents that were active on the landscape during 2001-2014 (in decreasing order of importance).
3	Which tree species where affected by these disturbance agents?
4	Were any human interventions undertaken during or after disturbance (e.g., fire suppression, salvage logging)? If so, please list them in decreasing order of their intensity.

Supplementary Table 6: Known direct human interventions within the studied protected landscapes (see Supplementary Table 1 for more details on landscapes).

#	Landscape name	Country	Main disturbance agents	Direct human interventions
2	Alerces	Argentina	wildfires, defoliators, snow & ice, drought	fire suppression
8	Conguillio	Chile	wildfires, drought, windthrow, snow & ice, landslides	fire suppression, irrigation
11	Fargaras	Romania	bark beetles, windthrow	sanitary cuts, salvage logging
12	Feng Lin	China (PRC)	wildfires, bark beetles, windthrow, defoliators, drought	fire & defoliator suppression, salvage logging
13	Flattops	USA	wildfires, bark beetles, drought	fire suppression
14	Glaciares	Argentina	wildfires, defoliators, snow & ice	fire suppression
23	Nahuel Lanin	Argentina	wildfires, drought, volcanism, defoliators, snow & ice	fire suppression
28	O'Shannassy	Australia	wildfires, drought	fire suppression
29	Ozarks	USA	drought, pathogens, bark beetles, defoliators, snow & ice	pathogen & defoliator suppression
32	Porcupine	USA	windthrow, wildfires, defoliators, drought	fire suppression
34	Puyehue	Chile	volcanism, wildfires, windthrow, snow & ice	fire suppression
37	Risnjak	Croatia	snow & ice, windthrow, bark beetles	sanitary cuts, salvage logging
39	Sumava	Czech	bark beetles, windthrow	sanitary cuts, salvage logging
43	Tolhuaca	Chile	wildfires, drought, windthrow, snow & ice, landslides	fire suppression, irrigation
44	Torres del Paine	Chile	wildfires, defoliators, snow & ice	fire suppression
46	Villarrica	Chile	wildfires, drought, windthrow, snow & ice, landslides	fire suppression, irrigation
48	Weminuche	USA	bark beetles, drought, wildfires, defoliators	fire suppression, salvage logging

Supplementary References

1. Fraley, C., Raftery & Adrian, E. Model-based Methods of Classification : Using the mclust Software in Chemometrics. *J. Stat. Softw.* **18,** 1–13 (2007).
2. Olson, D. M. *et al.* Terrestrial ecoregions of the world: A new map of life on earth A new global map of terrestrial ecoregions provides an innovative tool for conserving biodiversity. *Bioscience* **51,** 933–938 (2001).