International Journal of Wildland Fire **2019**, *28*, 614–627
doi:10.1071/WF18210_AC

Supplementary Material

How terpene content affects fuel flammability of wildland–urban interface vegetation

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Table S1. List of the 17 species studied, their family and cladus, as well as the possible presence of terpenes.

Latin name	Plant family	Cladus	Presence of terpenes
Cotinus coggygria	Native Anacardiaceae	Angiosperm	Yes
Cotoneaster franchetii	Non- native Rosaceae	Angiosperm	No
Elaeagnus ebbingei	Non- native Elaeagnaceae	Angiosperm	No
Euonymus japonicus	Non- native Celastraceae	Angiosperm	No
Ligustrum japonicum	Non- native Oleaceae	Angiosperm	No
Nerium oleander	Non- native Apocynaceae	Angiosperm	No
Photinia fraseri	Non- native Rosaceae	Angiosperm	No
Phyllostachys sp.	Non- native Poaceae	Angiosperm	No
Pittosporum tobira	Non- native Pittosporaceae	Angiosperm	No
Prunus laurocerasus	Non- native Rosaceae	Angiosperm	No
Pyracantha coccinea	Non- native Rosaceae	Angiosperm	No
Viburnum tinus	Native Caprifoliaceae	Angiosperm	No
Cupressus sempervirens	Non- native Cupressaceae	Gymnosperm	Yes
Cupressus arizonica	Non- native Cupressaceae	Gymnosperm	Yes
Cupressocyparis leylandii	Non- native Cupressaceae	Gymnosperm	Yes
Pinus halepensis	Native Pinaceae	Gymnosperm	Yes
Thuja occidentalis	Non- native Cupressaceae	Gymnosperm	Yes

Table S2. Leaf and litter characteristics of the terpene-containing species: Means (±SD) of total terpene content, thickness and moisture content (DM: dry matter, FMC: fuel moisture content). (*) indicates the species native to the study area. The dead leaf thickness was not given as it did not differ from that of live leaves. No litter was collected for *C. coggygria*.

Latin name	Code	Leaf total terpene content (mg g^{-1}DM)	Litter total terpene content (mg g^{-1}DM)	Leaf thickness (mm)	Leaf FMC (%)	Litter FMC (%)
Cupressus sempervirens	Cs	1.339(±0.101)	1.202(±0.120)	0.087(±0.018)	104(±12)	6(±1)
Cupressus arizonica	Ca	0.966(±0.050)	0.808(±0.046)	0.113(±0.011)	128(±21)	5(±0)
Cupressocyparis leylandii (young)	Cl_y	3.407(±0.180)	2.872(±0.159)	0.089(±0.017)	112(±12)	6(±1)
Cupressocyparis leylandii (old)	Cl_o	4.468(±0.160)	3.464(±0.155)	0.089(±0.017)	103(±7)	5(±1)
Pinus halepensis (*)	Ph	2.469(±0.259)	1.542(±0.212)	0.056(±0.0005)	107(±6)	4(±1)
Thuja occidentalis	To	2.213(±0.215)	2.238(±0.239)	0.078(±0.009)	125(±7)	7(±0)
Cotinus coggygria (*)	Cc	0.329(±0.169)	-	0.022(±0.002)	95(±2)	-

Table S3. Mean content (±SD) in mg g^{-1} dry weight, retention time (RT), and retention index (RI) of the main terpenes measured in the leaves of the species studied (compounds presenting content higher than 0.1 mg g^{-1} in at least one species; in bold: highest values; *: molecule compared to authentic standards; **: molecule tentatively identified; Ca: *Cupressus arizonica*, Cl_o and Cl_y*:* mature and young *Cupressocyparis leylandii*, Cc: *Cotinus coggygria*, Cs: *Cupressus sempervirens*, Ph: *Pinus halepensis*, To: *Thuja occidentalis*).

Name	RT	RI	Ca	Cs	Ph	Cl_y	Cl_o	To	Cc
Monoterpenes									
α-pinene*	9.88	919	0.094 ±0.025	**0.289** ±0.127	**0.220** ±0.099	**0.376** ±0.132	**0.482** ±0.078	**0.186** ±0.049	-
β-pinene*	11.71	962	0.038 ±0.028	0.034 ±0.018	**0.151** ±0.113	**0.545** ±0.279	**0.602** ±0.081	0.011 ±0.002	-
Myrcene**	12.75	987	-	-	**0.459** ±0.316	**0.193** ±0.070	**0.213** ±0.006	-	-
Δ3-carene*	13.05	1004	0.012 ±0.011	**0.144** ±0.059	0.016 ±0.016	**0.392** ±0.134	**0.419** ±0.046	**0.125** ±0.097	-
Limonene*	14.54	1026	0.064 ±0.035	0.015 ±0.003	0.026 ±0.012	**0.309** ±0.435	**0.266** ±0.056	-	**0.329** ±0.169
Sabinene hydrate**	16.27	1063	0.021 ±0.015	-	-	**0.204** ±0.113	**0.159** ±0.013	-	-
Terpinene-4-ol*	21.6	1172	0.068 ±0.023	-	-	**0.120** ±0.046	**0.178** ±0.016	0.010 ±0.003	-
Total number of compounds			*6*	*4*	*5*	*7*	*7*	*4*	*1*
Total content			*0.297*	*0.482*	*0.872*	*2.139*	*2.319*	*0.332*	*0.329*
Sesquiterpenes									
Caryophyllene*	32.19	1412	-	0.013 ±0.002	**0.905** ±0.248	0.008 ±0.003	0.009 ±0.001	**0.114** ±0.33	-
β-Ylangene**	32.22	1413	-	0.016 ±0.003	-	-	-	**0.117** ±0.29	-

Aromadendrene*	33.38	1441	0.092 ±0.029	0.019 ±0.011	-	-	-	-	-
α-humelene*	33.59	1447	-	0.01 ±0.001	**0.145** ±0.044	-	-	-	-
Cadina-1(6) 4 diene <cis>**	34.11	1459	**0.192** ±0.071	-	-	-	**0.356** ±0.048	0.009 ±0.001	-
γ-muurolene**	34.76	1475	-	**0.136** ±0.055	-	-	-	0.041 ±0.015	-
Cedrol**	39.34	1594	0.015 ±0.010	0.050 ±0.012	-	0.010 ±0.004	0.012 ±0.002	**0.308** ±0.121	-
Total number of compounds			*3*	*6*	*2*	*2*	*3*	*5*	*0*
Total content			*0.299*	*0.244*	*1.05*	*0.018*	*0.377*	*0.589*	*0*
Diterpenes									
Cembrene**	50.75	1924	-	-	**0.184** ±0.140	0.081 ±0.043	**0.140** ±0.012	-	-
Isophyllocladene**	51.64	1954	-	-	-	**0.352** ±0.091	0.061 ±0.004	-	-
Cembrene-α**	51.69	1981	-	-	0.025 ±0.013	0.047 ±0.028	**0.141** ±0.011	-	-
Manool oxide <13-epi>**	53.2	2045	-	0.049 ±0.019	**0.164** ±0.136	-	0.046 ±0.004	-	-
Nezukol**	56.57	2126	0.014 ±0.009	-	-	**0.182** ±0.072	**0.187** ±0.020	**0.870** ±0.262	-
Abietal <4-epi->**	61.67	2299	0.011 ±0.003	-	-	-	**0.345** ±0.041	**0.153** ±0.046	-
Totarol (trans)**	61.81	2321	0.012 ±0.003	**0.343** ±0.105	-	0.091 ±0.052	**0.219** ±0.015	-	-
Total number of compounds			*3*	*2*	*3*	*5*	*7*	*2*	*0*
Total content			*0.037*	*0.392*	*0.373*	*0.753*	*0.794*	*1.023*	*0*

Table S4. Mean content (±SD) in mg g^{-1} dry weight, retention time (RT), and retention index (RI) of the main terpenes measured in the litter of the species studied (compounds presenting content higher than 0.1 mg g^{-1} in at least one species; in bold: highest values; *: molecule compared to authentic standards; **: molecule tentatively identified; Ca: *Cupressus arizonica*, Cl_o and Cl_y*:* mature and young *Cupressocyparis leylandii*, Cs: *Cupressus sempervirens*, Ph: *Pinus halepensis*, To: *Thuja occidentalis*).

Name	RT	RI	Ca	Cs	Ph	Cl_y	Cl_o	To
Monoterpenes								
α-pinene*	9.88	919	0.088 ±0.042	**0.134** ±0.052	0.086 ±0.039	**0.186** ±0.048	**0.412** ±0.211	**0.211** ±0.082
β-pinene*	11.71	962	0.026 ±0.010	0.008 ±0.002	0.045 ±0.016	**0.108** ±0.087	**0.205** ±0.141	0.007 ±0.001
Myrcene**	12.75	987	-	-	0.034 ±0.026	**0.123** ±0.011	**0.124** ±0.072	-
Δ3-carene*	13.05	1004	0.010 ±0.013	0.030 ±0.010	0.012 ±0.004	**0.198** ±0.032	**0.346** ±0.184	0.092 ±0.071
Limonene*	14.54	1026	0.061 ±0.018	0.004 ±0.001	0.013 ±0.003	**0.600** ±0.311	**0.496** ±0.431	-
Sabinene hydrate**	16.27	1063	0.009 ±0.003	-	-	0.044 ±0.019	0.049 ±0.037	-
Terpinene-4-ol*	21.6	1172	0.029 ±0.015	-	-	0.036 ±0.021	**0.134** ±0.078	0.006 ±0.001
Total number of compounds			*6*	*4*	*5*	*7*	*7*	*4*
Total content			*0.223*	*0.176*	*0.19*	*1.295*	*1.766*	*0.316*
Sesquiterpenes								
Caryophyllene*	32.19	1412	-	0.021 ±0.016	**0.866** ±0.334	0.005 ±0.001	0.004 ±0.001	**0.120** ±0.045
β-Ylangene**	32.22	1413	-	0.022 ±0.009	-	-	-	**0.118** ±0.049

Aromadendrene*	33.38	1441	0.065 ±0.024	0.026 ±0.011	-	-	-	-
α-humelene*	33.59	1447	-	0.015 ±0.011	**0.134** ±0.056	-	-	0.092 ±0.036
Cadina-1(6) 4 diene <cis>**	34.11	1459	**0.209** ±0.060	-	-	-	**0.156** ±0.080	0.004 ±0.001
γ-muurolene**	34.76	1475	-	**0.121** ±0.053	-	-	-	0.023 ±0.009
Cedrol**	39.34	1594	0.012 ±0.004	0.039 ±0.022	-	0.011 ±0.016	0.004 ±0.002	**0.367** ±0.146
Total number of compounds			*3*	*6*	*2*	*2*	*3*	*6*
Total content			*0.286*	*0.244*	*1*	*0.016*	*0.164*	*0.724*
Diterpenes								
Cembrene**	50.75	1924	-	-	**0.686** ±0.353	0.060 ±0.021	0.090 ±0.051	-
Isophyllocladene**	51.64	1954	-	-	-	**0.455** ±0.061	0.039 ±0.008	-
Cembrene-α**	51.69	1981	-	-	0.016 ±0.008	0.035 ±0.017	**0.102** ±0.026	-
Manool oxide <13-epi>**	53.2	2045	-	0.065 ±0.023	**0.112** ±0.055	-	0.033 ±0.010	-
Nezukol**	56.57	2126	0.016 ±0.010	-	-	**0.321** ±0.098	**0.182** ±0.093	**0.940** ±0.324
Abietal <4-epi->**	61.67	2299	0.012 ±0.008	-	-	-	**0.335** ±0.115	0.092 ±0.026
Totarol (trans)**	61.81	2321	0.012 ±0.005	**0.536** ±0.102	-	**0.299** ±0.174	**0.270** ±0.049	-
Total number of compounds			*3*	*2*	*3*	*5*	*7*	*2*
Total content			*0.04*	*0.601*	*0.814*	*1.17*	*1.051*	*1.032*

Table S5. Correlations between leaf characteristics and flammability variables (a) as well as their loadings on the main components (b) resulting from co-inertia analysis ($T_{MAX:}$ maximum temperature, TTI: time-to-ignition, FD: flaming duration, IF: ignition frequency, $T_{TTI:}$ ignition temperature).

(a)

LEAVES	T_{MAX}	TTI	FD	IF	T_{TTI}
Thickness	0.1925351	0.6220879	-0.869374	0.1100499	0.3410142
Monoterpene content	-0.019532	0.0751155	-0.319406	-0.10132	0.0588336
Sesquiterpene content	0.7544071	-0.047019	-0.387583	0.0270488	0.0413439
Diterpene content	0.0819041	0.1735354	-0.463381	-0.242139	0.3096822
Fuel moisture content	-0.280557	0.5476734	0.1661942	-0.401865	0.2456081

(b)

Leaf characteristics	Axis1	Axis2	Axis3
Thickness	1.1128371	-0.128065	-0.199093
Monoterpenes	0.2973084	-0.052117	-0.050409
Sesquiterpenes	0.5348864	0.5943449	0.2836703

Diterpenes	0.570357	-0.132473	0.0990228
Fuel Moisture Content	0.1140874	-0.739263	0.248361
Flammability variables			
T_{MAX}	0.4486353	0.6420395	0.2611978
TTI	0.6091687	-0.557401	0.0277507
FD	-1.084629	-0.169323	0.1693833
IF	-0.055225	0.3476569	-0.301661
T_{TTI}	0.446536	-0.252932	0.0738387

Table S6. Correlations between litter characteristics and flammability variables (a) as well as their loadings on the main components (b) resulting from co-inertia analysis ($T_{MAX:}$ maximum temperature, TTI: time-to-ignition, FD: flaming duration, $T_{TTI:}$ ignition temperature).

LITTER	T_{MAX}	TTI	FD	T_{TTI}
Thickness	-0.045388	0.4500374	-0.430318	0.4437508
Monoterpenes	0.4323021	0.2841625	-0.091659	0.2463913
Sesquiterpenes	-0.003002	-0.412587	-0.181415	-0.020247
Diterpenes	0.4623183	0.0624668	0.3939316	-0.008498
Fuel Moisture Content	0.2844349	-0.071616	0.3304803	-0.015408

Litter characteristics	Axis1	Axis2	Axis3
Thickness	0.7497853	0.146373	0.0161753
Monoterpenes	0.2459649	0.4989952	0.1555325
Sesquiterpenes	-0.112217	-0.265203	0.3469227
Diterpenes	-0.323479	0.5178099	0.0069818
Fuel Moisture Content	-0.321799	0.294418	0.0285722

Flammability variables			
T_{MAX}	-0.18341	0.6390913	0.2012631
TTI	0.4970196	0.3937022	-0.244372
FD	-0.608241	0.2885702	-0.188541
T_{TTI}	0.4391329	0.2210229	0.0994996