SUPPLEMENTARY MATERIAL

Environmental Fire Danger Rating Systems and Indices around the globe: a review

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In the current section are included all supplementary tables mentioned in the review article that are required for forest fire index calculation and interpretation.

S1. Tables

Table S1: CFFDRS danger classes

FWI Range	Danger Class
>29	Extreme
17-29	Very High
9-16	High
5-8	Moderate
2-4	Low
0-1	Very Low

Table S2: NFDRS danger classes

SC	ERC	BI	Danger Class
>40	>60	>110	Extreme
30-40	40-60	80-110	High
15-30	20-40	40-80	Moderate
0-15	0-20	<40	Low

Table S3: Fosberg index danger classes

<table>
<tr><th>FFWI Range</th><th>FFWI$_m$ Range</th><th>Danger Class</th></tr>
<tr><td>80 – 100</td><td rowspan="3">> 50</td><td>Extreme</td></tr>
<tr><td>60 – 80</td><td>Very High</td></tr>
<tr><td>50 – 60</td><td>High</td></tr>
<tr><td rowspan="2">< 50</td><td>25 – 50</td><td>Moderate</td></tr>
<tr><td>< 25</td><td>Low</td></tr>
</table>

Table S4: Chandler's burning index danger classes

CBI Range	Danger Class
> 97.5	Extreme
90.0 – 97.5	Very High
75.0 – 90.0	High
50.0 – 75.0	Moderate
< 50.0	Low

Table S5: LASI calculation and danger classes

Elevation (m)	Pressure Level (hPa)	Stability (^{o}C) $T_{P1} - T_{P2}$	A-factor	Humidity (^{o}C) $T_{P3} - T_{dP3}$	B-factor	HI = A + B Danger Class
< 305 (low)	P1 = 950	< 4^{o}C	1	< 6^{o}C	1	2-3: very low 4: low 5: medium 6: high
	P2 = 850	4 - 8^{o}C	2	6-10^{o}C	2	
	P3 = 850	≥ 8^{o}C	3	≥10^{o}C	3	
305 – 914 (medium)	P1 = 850	< 6^{o}C	1	< 6^{o}C	1	
	P2 = 700	6 - 11^{o}C	2	6 - 13^{o}C	2	
	P3 = 850	≥ 11^{o}C	3	≥ 13^{o}C	3	
> 914 (high)	P1 = 700	< 18^{o}C	1	< 15^{o}C	1	
	P2 = 500	18 - 22^{o}C	2	15 - 21^{o}C	2	
	P3 = 700	≥ 22^{o}C	3	≥ 21^{o}C	3	

Table S6: Australian systems danger classes

FFDI	GFDI	FFBT	Danger Class
>50	50 – 100	>240	Extreme
25 - 50	20 - 50	141 - 240	Very High
12 - 25	7.5 - 20	41 - 140	High
5 - 12	2.5 – 7.5	21 - 40	Moderate
0 - 5	<2.5	<20	Low

Table S7: Sharples index danger classes

SFDI Range (for forests)	SFDI Range (for grasslands)	Danger Class
> 6.1	>7.3	Extreme
2.7 – 6.1	2.9 – 7.3	Very High
1.5 – 2.7	1.2 – 2.9	High
0.7 – 1.5	0.5 – 1.2	Moderate
0.0 – 0.7	0.0 – 0.5	Low

Table S8: Lowveld index danger classes

LFDI Range	Fire Intensity (kJ/s/m)	Danger Class
≥ 75	> 3000	Extreme
74 – 60	2001 – 3000	Very High
45 – 59	1001 – 2000	High
20 – 44	500 – 1000	Moderate
≤ 19	< 500	Low

Table S9: FMA and FMA+ alterations in calculation by rain height

Rain Height (mm)	FMA, FMA⁺ alteration in calculation
< 2.5	No alteration
2.5 – 4.9	Decrease previous day's FMA, FMA⁺ by 30% values and add current day's values
5.0 – 9.9	Decrease previous day's FMA, FMA⁺ by 60% values and add current day's values
10.0 – 12.9	Decrease previous day's FMA, FMA⁺ by 80% values and add current day's values
> 12.9	FMA = FMA⁺ = 0. Resume calculations the following day.

Table S10: FMA and FMA+ danger classes

FMA Range	FMA⁺ Range	Danger Classes
> 20.0	> 24.0	Extreme
8.1 – 20.0	14.1 – 24.0	High
3.1 – 8.0	8.1 – 14.0	Moderate
1.1 – 3.0	3.1 – 8.0	Low
0.0 – 1.0	0.0 – 3.0	Null

Table S11: Rodriguez-Moretti index components

Temperature °C	Ti	Wind Speed km/h	Wi	Relative Humidity %	RHi	Days without Rain	Ri
< 10.0	2.5	< 3.0	1.5	≥ 80	2.5	1	3.5
10.0 – 11.9	5.0	3.0 – 5.9	3.0	79 – 75	5.0	2 – 4	7.0
12.0 – 13.9	7.5	6.0 – 8.9	4.5	74 – 70	7.5	5 – 7	10.5
14.0 – 15.9	10.5	9.0 – 11.9	6.0	69 – 65	10.5	8 – 10	14.0
16.0 – 17.9	12.0	12.0 – 14.9	7.5	64 – 60	12.0	11 – 13	17.5
18.0 – 19.9	15.5	15.0 – 17.9	9.0	59 – 55	15.5	14 – 16	21.0
20.0 – 21.9	17.5	18.0 – 20.9	10.5	54 – 50	17.5	17 – 19	24.5
22.0 – 23.9	20.0	21.0 – 23.9	12.0	49 – 45	20.0	20 – 22	28.0
24.0 – 25.9	22.5	24.0 – 26.9	13.5	44 – 40	22.5	23 – 25	31.5
≥ 26	25.0	≥ 27	15.0	≤ 39	25.0	≥ 26	35.0

Table S12: Rodriguez-Moretti index danger classes

IRM Range	Danger Classes
75 – 100	Extreme
50 – 74	High
25 – 49	Moderate
0 - 24	Low

Table S13: Risco do Fogo vegetation classes and constant 'A'

Vegetation Classes	**A**
Permanent Wetlands or Broadleaf Forest	1.50
Deciduous Forest	1.72
Needleleaf or Mixed Forest	2.00
Woody Savannas or closed shrubland	2.40
Savannas or open shrubland	3.00
Croplands or Natural Vegetation	4.00
Grassland	6.00

Table S14: Risco do Fogo index danger classes

RF Range	**Danger Class**
> 0.95	Extreme
0.70 – 0.95	High
0.40 – 0.70	Moderate
0.15 – 0.40	Low
< 0.15	Null

Table S15: EPI and PEI indices restrictions for day 'i'

<table>
<tr><th>Precipitation (mm)</th><th>EPI</th><th>PEI</th></tr>
<tr><td><1.0</td><td>$E_{i-1} + E_i$</td><td rowspan="2">$\sum_{i=1}^{t}(P_i\text{-}E_i)$</td></tr>
<tr><td>1.0 -2.0</td><td rowspan="5">$E_{i-1}/P_{i-1} + E_i/P_i$,</td></tr>
<tr><td>2.1 - 5.0</td><td>$0.75 \bullet PEI_{i-1} + P_i - E_i$</td></tr>
<tr><td>5.1 – 8.0</td><td>$0.50 \bullet PEI_{i-1} + P_i - E_i$</td></tr>
<tr><td>8.1 - 10.0</td><td>$P_{i-1} - E_{i-1}$</td></tr>
<tr><td>10.0 -15.0</td><td rowspan="2">0</td></tr>
<tr><td>> 15.0</td><td>0</td></tr>
</table>

Table S16: Thornthwaite's 'K' constant calculation

Lat	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
60°N	0.54	0.67	0.97	1.19	1.33	1.56	1.55	1.33	1.07	0.84	0.58	0.48
50°N	0.71	0.84	0.98	1.14	1.28	1.36	1.33	1.21	1.06	0.90	0.76	0.68
40°N	0.80	0.89	0.99	1.10	1.20	1.25	1.23	1.15	1.04	0.93	0.83	0.78
30°N	0.87	0.93	1.00	1.07	1.14	1.17	1.16	1.11	1.03	0.96	0.89	0.85
20°N	0.92	0.96	1.00	1.05	1.09	1.11	1.10	1.07	1.02	0.98	0.93	0.91
10°N	0.97	0.98	1.00	1.03	1.05	1.06	1.05	1.04	1.02	0.99	0.97	0.96
0°	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
10°N	1.05	1.04	1.02	0.99	0.97	0.96	0.97	0.98	1.00	1.03	1.05	1.06
20°N	1.10	1.07	1.02	0.98	0.93	0.91	0.92	0.96	1.00	1.05	1.09	1.11
30°S	1.16	1.11	1.03	0.96	0.89	0.85	0.87	0.93	1.00	1.07	1.14	1.17
40°S	1.23	1.15	1.04	0.93	0.83	0.78	0.80	0.89	0.99	1.10	1.20	1.25
50°S	1.33	1.19	1.05	0.89	0.75	0.68	0.70	0.82	0.97	1.13	1.27	1.36

Table S17: Orieux index danger classes

Orieux water reserve (mm)	Wind Speed (km/h)		
	< 20	20 - 40	> 40
< 30	Moderate	High	Extreme
30 - 50	Moderate	High	Extreme
50 – 100	Moderate	Moderate	High
100 - 150	Low	Low	Low

Table S18: Numerical index danger classes

Numerical Index Range	Danger Classes
15 - 20	High
10 – 15	Moderate
< 10	Low

Table S19: Portuguese index - rain (r) and wind (w) coefficient estimation

r	Precipitation (mm)		CW	Wind Speed (Km/h)
1	$0 < P \leq 1$		1	$0 < P \leq 1$
0.8	$1 < P \leq 2$		0.8	$1 < P \leq 2$
0.6	$2 < P \leq 3$		0.6	$2 < P \leq 3$
0.4	$3 < P \leq 4$		0.4	$3 < P \leq 4$
0.2	$4 < P \leq 10$		0.2	$4 < P \leq 10$
0.1	$P > 10$		0.1	$P > 10$

Table S20: Portuguese index interpretation

Ifa Range	Danger Classes
≥ 18	Extreme
13 - 17	Severe
9 - 12	High
5 - 8	Moderate
2 - 4	Low
0 - 1	None

Table S21: Lourenco's index – 'R' coefficient values

R values	Region historical fire danger class	LFDRIs Range
1.2	Extreme	≥ 2.00
1.1	Very High	1.50 – 1.99
1.0	High	1.00 – 1.49
0.9	Moderate	0.50 – 0.99
0.8	Low	0.00 – 0.49

Table S22: ICONA index danger classes

Ignition Probability	Coastal Areas			
	Wind Speed (km/h)			
	0-9	10-19	20-39	≥ 40
10 ≤ 20	Low	Low	Low	Moderate
20 ≤ 50	Low	Moderate	Moderate	Moderate
50 < 70	High	High	High	High
≥ 70	High	High	High	Extreme
Ignition Probability	**Hinterland**			
	Wind Speed (km/h)			
	0-9	10-19	20-39	≥ 40
10 ≤ 20	Low	Moderate	Moderate	Extreme
20 ≤ 50	Moderate	High	High	Extreme
50 < 70	High	High	High	Extreme
≥ 70	High	Extreme	Extreme	Extreme

Table S23: Italian CFS index danger classes

CFS Range	Danger Class
50 - 100	Extreme
24 - 50	Very High
12 - 24	High
5 - 12	Moderate
0 - 5	Low

Table S24: IFI danger classes

IFI – normalized values	Danger Class
5	Extreme
4	High
3	Surveillance
2	Low
1	Very Low

Table S25: Tunisian index danger classes

DMRIF Range		Danger Class
N_d <= 6	N_d > 6	
< - 5500	< -100	Null
-5500 to -6		Low
-6 to 100	-100 to 25	High
> 100	> 25	Severe

Table S26: Angstrom index danger classes

Angstrom Index Range	Danger Class
< 2.0	Extreme
2.0 – 2.5	High
2.5 – 4.0	Low
> 4.0	Null

Table S27: Baumgartner index danger classes

Month	Danger Classes				
	Very Low	**Low**	**Moderate**	**High**	**Very High**
March	< 3	3 - 5	5 - 9	9 - 15	> 15
April	< 3	3 - 8	8 - 16	16 - 27	> 27
May	< 3	3 - 16	16 - 25	25 - 35	> 35
June	< 12	12 - 24	24 - 32	32 - 41	> 41
July	< 12	12 - 24	24 - 31	31 - 40	> 40
August	< 8	8 - 20	20- 28	28 - 37	> 37
September	< 6	6 - 18	18 - 26	26 - 35	> 35

Table S28: Telicyn Logarithmic index danger classes

Telicyn Logarithmic Range	**Danger Classes**
> 15.0	Extreme
5.0 – 15.0	High
3.6 – 5.0	Moderate
2.1 – 3.5	Low
< 2.0	Null

Table S29: Zhdanko index - precipitation coefficient values

P (mm)	0.0	0.1 – 0.9	1.0 – 2.9	3.0 – 5.9	6.0 – 14.9	15.0 – 19.0	> 19.0.
K_t	1.0	0.8	0.6	0.4	0.2	0.1	0.0

Table S30: Nesterov indices danger classes

Nesterov Indices Range	**Danger Class**
> 10 000	Extreme
4001 – 10000	High
1001 – 4000	Moderate
301 – 1000	Low
< 300	Null

Table S31: M68 index - coefficients

	$P_t < 1$	$1 \le P_t < 5$ S_t[1] ≥ 1	$5 \le P_t < 10$ $S_{t1} \ge 1$	$P_t \ge 10$ $S_{t2} \ge 1$	$P_t \ge 20$	$P_t < 20$ $P_{(t1\&t2\&t3)} \ge 20$	$P_{(t\&t1\&t2\&t3)} < 20$	$t < t_1$	$t_1 < t < t_2$	$t_2 < t < t_3$	$t > t_3$
k_1	1	0.5	0.25	0	-	-	-	-	-	-	-
k_2	-	-	-	-	0	0.5	1	-	-	-	-
k_3	-	-	-	-	-	-	-	3	2	1	0.5

[1] P_t corresponds to precipitation on day t in mm and S_t to snow cover in cm on day t, t_1 is the period when birch has its first leaves, t_2 is the period when the first rainfall greater than 5mm occurs after robinia's first blossom and t_3 is the period when the first rainfall greater than 5mm occurs after the 14th of August but earlier than the 1st of September.

Table S32: M68 index danger classes

M68 Range	**Danger Class**
> 7000	Extreme (probability > 60%)
4000 - 7000	High (probability 40-60%)
2000 – 4000	Moderate (probability 20-40%)
500 – 2000	Low (probability <20%)
≤ 500	Null (probability <3%)

Table S33: Modified M68 index danger classes

<table>
<tr><th>Mm68</th><th>Wind speed ≤ 29km/h</th><th>Wind speed > 29km/h</th></tr>
<tr><td>> 700</td><td>Extreme</td><td>Extreme</td></tr>
<tr><td>501 – 700</td><td>High</td><td rowspan="2">High</td></tr>
<tr><td>301 - 500</td><td>Moderate</td></tr>
<tr><td>151 - 300</td><td rowspan="2">Low</td><td>Moderate</td></tr>
<tr><td>101 - 150</td><td rowspan="2">Low</td></tr>
<tr><td>51 - 100</td><td rowspan="2">Null</td></tr>
<tr><td>≤ 50</td><td>Null</td></tr>
</table>

Table S34: Finnish index danger classes

<table>
<tr><th>FFI</th><th>Volume Moisture</th><th>Moisture status</th><th>Danger Class</th></tr>
<tr><td>6.0</td><td>0.10</td><td>Very Dry</td><td>High</td></tr>
<tr><td>5.0 – 5.9</td><td>0.11 – 0.14</td><td>Dry</td><td rowspan="2">Moderate</td></tr>
<tr><td>4.0 – 4.9</td><td>0.15 – 0.19</td><td>Moderately Dry</td></tr>
<tr><td>3.0 – 3.9</td><td>0.20 – 0.25</td><td>Moderately Wet</td><td rowspan="3">Low</td></tr>
<tr><td>2.0 – 2.9</td><td>0.26 – 0.32</td><td>Wet</td></tr>
<tr><td>1.0 – 1.9</td><td>0.33 – 0.50</td><td>Very Wet</td></tr>
</table>

Table S35: Keetch and Byram index danger classes

KBDI	**Danger Class**
600 - 800	Extreme
400 - 600	High
200 – 400	Moderate
0 - 200	Low

Table S36: SDI - vegetation classes

Vegetation Class	**O**	**A**	**B**	**C**	**D**	**E**	**F**
R	0	0.1	0.2	0.3	0.4	0.5	0.6
C	0	0.5	1.0	2.0	2.5	3.5	4.0
W	0	0.5	0.5	0.5	0.5	0.5	1.0
FR	1/10	1/20	1/30	1/40	1/50	1/60	1/70

Table S37: Soil dryness index danger classes

SDI Range	Danger Class
>1200	Extreme
801 - 1200	Very High
601 - 800	High
401 - 600	Moderate
251 - 400	Low
0 - 250	Very Low

Table S38: Soil's water content at field capacity and at wilting point

Soil Type (USA Classification)	θ_{FC} (m^3/m^3)	θ_{WP} (m^3/m^3)	θ_{FC} - θ_{WP} (m^3/m^3)
Sand	0.07 – 0.17	0.02 – 0.07	0.05 – 0.11
Loamy Sand	0.11 – 0.19	0.03 – 0.10	0.06 – 0.12
Sandy Loam	0.18 – 0.28	0.06 – 0.16	0.11 – 0.15
Loam	0.20 – 0.30	0.07 – 0.17	0.13 – 0.18
Silt Loam	0.22 – 0.36	0.09 -0.21	0.13 – 0.19
Silt	0.28 – 0.36	0.12 – 0.22	0.16 – 0.20
Silt Clay Loam	0.30 – 0.37	0.17 – 0.24	0.13 – 0.18
Silt Clay	0.30 – 0.42	0.17 – 0.29	0.13 – 0.19
Clay	0.32 – 0.40	0.20 – 0.24	0.12 – 0.20

Table S39: Palmer's index interpretation

PDSI Range	Drought Danger Class
≥ 4.00	Extremely Wet
3.00 to 3.99	Very Wet
2.00 to 2.99	Moderately Wet
1.00 to 1.99	Slightly Wet
0.50 to 0.99	Incipient Wet Spell
0.49 to -0.49	Near Normal
-0.50 to -1.00	Incipient Drought
-1.00 to -1.99	Mild Drought
-2.00 to -2.99	Moderate Drought
-3.00 to -3.99	Severe Drought
≤ -4.00	Extreme Drought

Table S40: Reconnaissance drought index

RDI_S Range	Drought Danger Class
< -2.0	Extreme
-1.5 to -2.0	Severe
-1.0 to -1.5	Moderate
-0.5 to -1.0	Mild

Table S41: NFDRS fuel models for FPI

NFDRS Fuel Type	Live Fuel Load	Dead Fuel Load	Extinction Moisture %	Vegetation Description
A	0.67	0.45	15	Western annual grasses
B	25.73	17.93	15	California mixed chaparral
C	2.91	3.14	20	Pine grass savannah
D	8.41	6.73	30	Southern rough
F	20.18	13.45	15	Intermediate brush
G	29.14	21.30	25	Short needle conifers (heavy)
H	6.73	10.09	20	Short needle conifers (normal)
L	1.12	0.56	15	Western perennial grasses
N	4.48	6.73	25	Sawgrass or thick grass
O	20.18	17.93	30	High pocosin
P	3.36	4.48	30	Southern pine plantation
Q	12.33	14.57	25	Alaskan black spruce
R	2.24	3.36	25	Hardwoods
S	3.36	3.36	25	Alpine tundra
T	6.73	3.36	15	Sagebrush grass mixture
U	2.24	7.85	20	Western long needle conifer

Table S42: FPI - equilibrium moisture content input corrections

Variable	Cloudiness in %			
	0.0 – 0.1	0.1-0.5	0.6-0.9	0.9-1.0
T (°F)	+ 25	+ 19	+ 12	+ 5
RH (%)	- 0.75	- 0.83	-0.91	-1.00

S2. Analytical Computations

S2.1 Fosberg computations

Fosberg original equations are given below [1,2]:

$$FFWI = \frac{\eta(1+w^2)^{0.5}}{0.3002} \quad (S1)$$

where FFWI is Fosberg's fire weather index, η represents a coefficient calculated by Eq. (S3) and W is wind speed (mi/h)

$$m = 0.03229 + 0.281073\ RH - 0.000578\ RH\ T, \text{ if } RH < 10\% \quad (S2a)$$

$$m = 2.22749 + 0.160107\ RH - 0.01478\ T, \text{ if } 10\% \leq RH \leq 50\% \quad (S2b)$$

$$m = 21.0606 + 0.005565\ RH^2 - 0.00035\ RH\ T - 0.483199\ RH, \text{ if } RH > 50\% \quad (S2c)$$

where RH is the relative humidity (%) and T is dry bulb air temperature (^oF).

Fosberg in S.I. units is given below:

$$\eta = 1 - 2(m/30) + 1.5(m/30)2 - 0.5(m/30)3 \quad (S3)$$

$$m = 0.03229 + 0.281073RH - 0.000578RH(1.8T + 32), \text{ if } RH < 10\% \quad (S4a)$$

$$m = 2.22749 + 0.160107RH - 0.01478(1.8T + 32), \text{ if } 10\% \leq RH \leq 50\% \quad (S4b)$$

$$m = 21.0606 + 0.005565RH2 - 0.00035RH(1.8T+32) - 0.483199RH, \text{ if } RH > 50\% \quad (S4c)$$

S2.2 Australian indices computations

The computational procedure of the FFDI components is presented below [3]:

$$DF = 0.191(I + 104)\frac{(N+1)^{1.5}}{(3.52(N+1)^{1.5}+P-1)} \quad (S5a)$$

where I is a drought index – either SDI or KBDI (with the latter being the most used and N the number of days since the last rainfall event.

An improved method for DF calculation has been provided in the literature [4]:

$$DF = \max[10.5(1 - e^{\left(\frac{30-I}{40}\right)})(\frac{y+42}{y^2+3y+42}, 10] \quad (S5b)$$

where y can be calculated as follows:

$$y = \frac{P-2}{N^{1.3}}, \text{ if } N \geq 1 \ \&\ P > 2,$$

$$y = \frac{P-2}{0.8^{1.3}}, \text{ if } N = 0 \ \&\ P > 2, \quad (S6)$$

$$y = 0, \text{ if } P \leq 2.$$

The other two grassland indices ('Mark 3' and 'Mark 4') can be calculated as follows:

$$GFDI_3 = 2e^{(-23.6 + 5.01\ln(C) + 0.0281T - 0.226\sqrt{RH} + 0.633\sqrt{W})} \quad (S7a)$$

$$GFDI_4 = \exp(-1.523 + 1.027\ln Q - 0.009432(100 - C)^{1.536} + 0.02764T + 0.6422\sqrt{W} - 0.2205\sqrt{RH}) \quad (S7b)$$

$$GFDI_5 = 3.3F_we^{(-0.0897M + 0.0403W)}, \text{ if } M<18.8\% \quad (S7c)$$

$$GFDI_5 = 0.299F_w(30-M)e^{(-1.686 + 0.0403W)}, \text{ if } 18.8 \leq M < 30 \quad (S7d)$$

where C is the degree of curing (%) of grass where 100% corresponds to fully dry grassland, and Q describes fuel quantity (t/ha) in the range of 1 to 6 which correspond to "Very Sparse" and "Heavy", respectively. $GFDI_4$ is an improvement of $GFDI_3$, as fuel quantity is considered stable and equal to 4.5 t/ha in the latter; however, in the current study both indices are included. F_w represents fuel weight with an average value of 5 t/ha, and M is given by the following equation in which C is the degree of curing:

$M = \frac{(97.7+4.06RH)}{T+6} - 0.00854RH + \frac{3000}{C} - 30$ (S8)

The main equation of FFBT is given below [5,6]:

$FFBT = Y + Ze^{W_2 N}$ (S9)

Where, for jarrah tree types:

$Y = 21.37 - 3.42M + 0.085M^2$ (S10a)

$Z = 48.09Me^{-0.6M} + 11.9$ (S11a)

$W_2 = rW$ (S12a)

$N = -0.096M^{1.05} + 0.44$ (S13a)

where r is the wind ratio factor assigned based on wind ratio, and M is the moisture content as defined and computed in [5].

Or, for karri tree types:

$Y = 4.88 - 263.78M^{1.8}$ (S10b)

$Z = 163.4M^{-1.18}$ (S11b)

$W_2 = rW$ (S12b)

$N = -0.059M + 0.54$ (S13b)

S2.3 Lowveld index computations

The three factors presented in the respective review article can be computed as follows [7,8]:

$BI = T - 35 - [\frac{35-T}{30}] + 0.37(100 - RH) + 30$ (S14a)

$WF = -0.0000227W^4 + 0.0026348W^3 - 0.09087W^2 + 1.65W + 0.2$ (S14b)

$RCF = 0.62 - 0.0342P + 0.000609P^2 - 0.000004P^3 + 0.1761D - 0.01141D^2 + 0.000279D^3$ (S15)

where T is the dry bulb air temperature (°C), RH is the relative humidity (%), W is wind speed (km/h), P is the last precipitation depth (mm), and D is the number of days since the last rainfall event.

S2.4. Risco do Fogo computations

$f_{P1} = \exp(-0.14 \bullet \sum_{i=1}^{1} Pi)$

$f_{P2} = \exp(-0.07 \bullet [\sum_{i=1}^{2} Pi - \sum_{i=1}^{1} Pi])$

$f_{P3} = \exp(-0.04 \bullet [\sum_{i=1}^{3} Pi - \sum_{i=1}^{2} Pi])$

$f_{P4} = \exp(-0.03 \bullet [\sum_{i=1}^{4} Pi - \sum_{i=1}^{3} Pi])$

$f_{P5} = \exp(-0.02 \bullet [\sum_{i=1}^{5} Pi - \sum_{i=1}^{4} Pi])$ (S16)

$f_{P6\_10} = \exp(-0.01 \bullet [\sum_{i=1}^{10} Pi - \sum_{i=1}^{5} Pi])$

$f_{P11\_15} = \exp(-0.008 \bullet [\sum_{i=1}^{15} Pi - \sum_{i=1}^{10} Pi])$

$f_{P16\_30} = \exp(-0.004 \bullet [\sum_{i=1}^{30} Pi - \sum_{i=1}^{15} Pi])$

$f_{P31\_60} = \exp(-0.002 \bullet [\sum_{i=1}^{60} Pi - \sum_{i=1}^{30} Pi])$

$f_{P61\_90} = \exp(-0.001 \bullet [\sum_{i=1}^{90} Pi - \sum_{i=1}^{60} Pi])$

$f_{P91\_120} = \exp(-0.0007 \bullet [\sum_{i=1}^{120} Pi - \sum_{i=1}^{90} Pi])$

where f_P is the precipitation factor defined for the following set of days: {1, 2, 3, 4, 5, 6-10, 11-15, 16-30, 31-60, 60-90, 90-120}, and P_i is the amount of precipitation on day i.

The period of drought – an important vegetation indicator - is estimated by the following equation [9-12]:

$$PD = 105\prod fi \quad (S17)$$

where PD is the period of drought and fi is the precipitation factor for the corresponding period 'i'.

Afterwards, the basic fire risk can be computed in accordance with Eq. (S18) [11]:

$$Rbn = 0.4\{1 + \sin[(A \bullet PD - 90)(3.14/180)]\} \quad (S18)$$

where Rbn is the basic risk fire, PD is the drought period mentioned above and A is a constant based on vegetation type defined in Table S13. Eqs. (25) to (27) are used in order to estimate the observed fire risk [9-12]:

$$FRH = -0.006RH + 1.3 \quad (S19)$$

$$FT = 0.02Tmax + 0.4 \quad (S20)$$

$$RFo = Rbn \bullet FRH \bullet FT \quad (S21)$$

where FRH and FT correspond to relative humidity and maximum dry bulb air temperature factors, respectively, and RFo is the observed fire risk.

Ultimately, the observed fire risk must be corrected due to latitude and topography characteristics, based on Eqs. (28) to (30) [9-12]:

$$FLAT = (1 + 0.003abs(lat)) \quad (S22)$$

$$FELV = 1 + 0.00003elv \quad (S23)$$

S2.5 Thornthwaite's equation

The Potential evapotranspiration (PET) can be estimated by the following equations [13-15]:

$$ETP = K[1.6(10\frac{T_i}{I})^{\alpha}] \quad (S24)$$

where K is a constant defined in Table S16, Ti is the average monthly temperature for month i and I, α can be calculated as follows:

$$I = \sum_{i=1}^{12}(\frac{T_i}{5})^{1.514} \quad (S25)$$

$$\alpha = 0.000000675I^3 – 0.0000771I^2 + 0.01792I + 0.49239 \quad (S26)$$

Finally, the superficial water reserve is computed according to the next equation:

$$rs = 10\text{^}(((15-\Sigma ETP)/15)) \quad (S27)$$

where ΣETP is the potential evapotranspiration sum of previous and current day.

S2.6 Numerical index calculations

Firstly, the false humidity factor (FHR) must be calculated [16-18]:

$$FHR = \frac{100E_{sat}(T_{dew})}{E_{sat}(T_{soil})} \quad (S28)$$

where E_{sat} is the saturated vapor pressure, T_{dew} is dew point temperature and T_{soil} is soil's temperature. Then the coefficient for soil water reserve (Cres) as well as the coefficient of wind (Cvent) and the correction coefficient (A) must be calculated:

$$Cres = 3 + 2\tanh(\frac{r-50}{25}) \quad (S29)$$

where tanh is the hyperbolic tangent and r is Orieux's water reserve index.

$$Cvent = 3 + 3\tanh(\frac{45-w}{50}) \quad (S30)$$

where W is wind speed.

A = -3 if ROS (rate of spread) ≤ 600, A = 2 if ROS ≥ 1000 and A = 0 in all other cases. Rate of spread can be calculated by the formula below:

$$ROS = 180e^{1714T}\tanh(\frac{100-r}{150})\{1 + 2[0.8483 + \tanh(\frac{w}{30} - 1.25)]\} \quad (S31)$$

The authors in the original publications do not clarify the method of estimating the parameters in equation 45. However, the following equations can be used [19,20]:

$$E_{sat} = 0.6108e^{[\frac{17.27T}{T+237.3}]} \quad (S32)$$

where T is mean temperature – produced by the half sum of maximum and minimum temperatures.

$$T_{dew} = \frac{116.91+237.3\,ln(E_a)}{16.78-ln(E_a)} \quad (S33)$$

where E_{act} is actual vapor pressure and can be calculated as follows:

$$E_{act} = E_{sat} \cdot \frac{RH}{100} \quad (S34)$$

with RH being the Relative Humidity (0-100%).

Eventually, T_{soil} can be found based on the following formula:

$$T_{soil} = 0.874T - 0.189W + 21.38, \text{ if } Cc \leq 2 \quad (S35)$$

$$T_{soil} = 1.36T - 1.422Cc - 0.22\,T_{dew} + 13.42, \text{ if } Cc \geq 3 \quad (S36)$$

where W is wind speed, T is dry bulb air temperature Cc is cloud coverage in octas and T_{dew} is dew point temperature.

S2.7 Portuguese indices computations

The Portuguese index is based on the next equations [21-23]:

$$I_i = T_i(T_i - T_{dew,i}) \quad (S37)$$

where T_i is dry bulb air temperature on day i and $T_{dew,i}$ = dew point temperature on day i.

$$Ia_{(i-1)} = r\sum_{i=1}^{n-1} Ii \quad (S38)$$

where r is a rain coefficient of previous day precipitation, as described in Table S19 - alongside with the CW factor.

In addition, Lourenço's fire danger risk indices variations can be computed as follows:

$$LFDRI_{max} = \frac{T_{max}}{RH_{max}} \quad (S39)$$

A modification of the original index can be achieved by introducing wind speed in the equation:

$$LFDRI_m = \frac{T}{RH} + W_c \quad (S40)$$

where W_c is a wind speed coefficient. The coefficient value for wind led to a second version of the modified equation, in which W_c was replaced by the division of wind speed by 100, including only the values of wind that form clockwise angles with the North direction from 0° to 180° and 350° to 360°:

$$LFDRI_{m100} = \frac{T}{RH} + \frac{W}{100} \quad (S41)$$

S2.8 ICONA calculations

In the first step, the estimation of Fine Dead Fuel Moisture Content (FDFMC) is required, according to "TABLA II.1" of the original publication, combining relative humidity and dry bulb air temperature [24].

Then, Summing Corrector (SC) is defined by "TABLA II.2", "TABLA II.3", "TABLA II.4" and "TABLA II.5", depending on current month, time, slope, aspect and cloudiness percentage, and is added to FDFMC. Next, the Adjusting Factor of Wind (AFW) can be concluded based on fuel model type, according to "CUADRO I", as well as the Multiplication Factor of Wind (MFW), in section 8 of the original publication, which is related to current and approximating slope - where fire is heading.

Afterwards, Ignition Probability (IP) - one of the basic outputs of the system – is estimated according to "TABLA III" combining FDFMC plus SC value, cloud percentage and dry bulb air temperature.

Index categorization is, finally, based on "TABLA IV", combining IP and Corrected Wind (CW) and differs for coastal and hinterland areas. CW is defined by the following equation:

$$CW = W \bullet AFW \bullet MFW \tag{S42}$$

S2.9 Italian indices calculations

For the estimation of CFS, the soil water deficit must be estimated firstly, according to Eq. (S43):

$$IS_i = IR_i + AS \tag{S43}$$

where IS_i is water deficit on day i, IR_i is reduced water deficit on the same day and AS is increase in water deficit.

$$IR_i = IS_{i-1} - P_{net} \tag{S44}$$

where IS_{i-1} is previous day's water deficit and P_{net} is net rainfall, calculated as follows:

$$P_{net} = P - 5 \tag{S45}$$

where P is the total amount of rain and 5mm are considered to be the amount of rain intercepted by trees' canopy.

The estimation of AS is based on "Table 6" in the original publication and is a function of maximum dry bulb air temperature and IR_i. The last parameter needed for the ultimate index is drought code (Ar), which can be produced by tables from the original publication as a relation of IS_i, the number of days since last rainfall event and the amount of precipitation.

The computational procedure of IFI starts with dorught code (DC):

$$DC = \frac{e^{\frac{0.261 Rg \cdot T}{\lambda}}}{1+\left(P_a+(P_{c100})^{\frac{1}{3}}\right)^{0.5}} \tag{S46}$$

where Rg represents global daily solar radiation (W/m^2), T represents mean daily dry bulb air temperature (^{o}C), λ is the latent heat of evaporation (J/g), P_a is daily rain height (mm) and P_{c100} is total rainfall height of the last 4 days – or 100 hours (mm). DC values range from 0.1 to 5 with the highest values indicating higher fire danger risk (Sirca et al., 2018).

The MC parameter calculation differs in the relative literature. According to Spano et al. (2001) [25]:

$$MC = 0.14\ e^{(0.05T + 0.1W - 0.0.62(RH - 50))} \tag{S47a}$$

where T represents dry bulb air temperature, W the wind speed and RH the relative humidity.

According to Sirca et al. (2007) and Sirca et al. (2018) [26,27]:

$$MC = 0.14[e^{(0.0625T_{max})} + e^{(0.1W_{max})} + e^{(RH_{min})}] \tag{S48b}$$

where T_{max} is the maximum dry bulb air temperature, W_{max} is maximum wind speed and RH_{min} is minimum relative humidity.

$$FC = LAI \bullet LAD \bullet DW \tag{S49}$$

where LAI is Leaf Area Index (tree canopy area/ground area), LAD is Leaf Area Density (in m^2 / m^3) and DW is fuel moisture content ranging from 0 (maximum water concentration) and 1 (minimum water concentration). The estimation of FC prerequisites the classification of fuel types. However, the computational procedure is not clear in the respective literature, thence it is concluded that any scientific method for calculating these three parameters is accepted for FC estimation [27].

$$TC = S \bullet Vp \bullet Rg \bullet VE \quad (S50)$$

where S is terrain slope, Vp is the angle between wind direction and maximum terrain slope projection, Rg is global solar radiation and VE is East-West orientation [26].

Finally, the R coefficient varies according to maximum daily solar radiation values (Rgmax):

$R = 0.24$ if $Rg_{max} < 400\ W/m^2$

$R = 0.32$ if $400\ W/m^2 \leq Rg_{max} \leq 800\ W/m^2$

$R = 1$ if $Rg_{max} > 800\ W/m^2$

S2.10 Nesterov modifications

The first modification of Nesterov index is presented below [28]:

$$NI_{t,m} = k_1 \bullet NI_{t-1} + k_2 \bullet (T_t - T_{dew,t})T_t \quad (S51)$$

where NI_{t-1} is previous day's index and k_1, k_2 are two coefficients estimated as follows:

$k_1 = 1$ if $P_t = 0mm$, $k_1 = 0.5$ if $0 < P_t < 1$ or $k_1 = 0$ if $P_t = 0mm$, where P_t is the precipitation height on current day (day t).

$k_2 = 0.25$ if there was a rainfall event with height greater than 5mm in the past 5 days, or $k_2 = 1$ if there was no day in the past 5 days with a rain height greater than 5mm.

The second modification of the Nesterov Index, applied in Russia, is the Zhdanko Index, computed according to Eq. (S52) [29,30]:

$$Zh_t = Zh_{t-1} + (T_t - T_{dew,i}) \bullet K_t \quad (S52)$$

where Zh_t is the Zhdanko index on day t, Zh_{t-1} is previous day's index, T_t is dry bulb air temperature at 15:00 local time, $T_{dew,i}$ is dew point temperature at 15:00 local time and K_t is a coefficient in case any precipitation occurs on current day t, estimated as in Table S29.

S2.11 M68 Modifications

The modifications of M68 index are presented below:

$$M68_t = k_3 \bullet \{k_1 \bullet M68_{t-1} + \max(0, k_2 \bullet (T_t + 10) \bullet \Delta e_t)\} \quad (S53)$$

where $M68_t$ is M68 index on day t, $M68_{t-1}$ is previous day's M68 index, T_t is dry bulb air temperature on day t, Δe_t is vapor pressure deficit and k_1,k_2,k_3 are the coefficients mentioned above. Vapor pressure deficit is calculated as the difference between saturation and actual vapor pressure [19]:

$$\Delta e_t = e_s - e_a \quad (S54)$$

where e_s and e_a are saturated and actual vapor pressure, computed as shown in paragraph S2.4. The estimation of the three coefficients is analyzed in Table S31. The categorization of the index is shown in Table S32 [28,31,32]. The modified version of M68 – used by German Weather Service (DWD) is given by the following equation [33]:

$$Mm68_t = k_3\{k_1 \bullet Mm68_{t-1} + \max(0, \frac{k_2[T_t + k_4]}{10})\Delta e_t\} \quad (S55)$$

where $Mm68_t$ is current day Modified M68 index, $Mm68_{t-1}$ is previous day's Modified M68 index, k_1,k_2,k_3 Δe_t and T_t as in Eq. (S53) and k_4 is a coefficient depending on vapor pressure deficit range and in more detail, $k_4 = 10$ if $RH > 66$, $k_4 = 20$ if $26 < RH \leq 66$ or $k_4 = 30$ if $RH < 26$.

S2.12 Finnish index calculations

The first component needed to be estimated is the potential evaporation [34]:

$$E_{pot}=\frac{\Delta\cdot R_n+\Delta e\left(\rho\cdot\frac{c_p}{r_a}+b\right)}{\Delta+\gamma\cdot\lambda\left(1+\frac{b\cdot r_a}{\rho\cdot c_p}\right)} \quad \text{(S56a)}$$

where E_{pot} is potential evaporation in kg/(m^{2}s), Δ represents the gradient of the saturation water vapor pressure versus temperate curve in hPa/K, R_n is net radiation in W/m^2, ϱ stands for air density (equals to 1.2923kg/m^3, c_p is the specific air heat (equals to 1004J/[kg•K]), b is a correction multiplier for measuring height – not well documented in the original publication – in W/(m^{2}K), r_a is the aerodynamic resistance, Δe is vapor pressure deficit in hPa, γ is a psychrometer constant (equals to 0.66 hPa/K) and λ is the latent heat of vaporization (equals to 2.5•10^{6}J/kg). However, the E_{pot} has been documented in a more uniform version as in equation S23b [19,35]:

$$E_{pot}=\frac{\Delta(R_n-G)+\frac{\rho\cdot c_p\Delta e}{r_a}}{\lambda\left[\Delta+\gamma\left(1+\frac{r_s}{r_a}\right)\right]} \quad \text{(S56b)}$$

where G is the soil heat flux density in MJ/(m^2•day), r_s is bulk surface resistance and all other parameters as in equation (S23a), with the exception of c_p which equals to 1.013•10^{-3} MJ/(kg^{o}C).

$$\Delta=\frac{4098\cdot 0.6108e^{\frac{17.27T}{T+237.3}}}{(T+237.3)^2} \quad \text{(S57)}$$

where T is dry bulb air temperature in ^{o}C.

R_n and G can be either measured or estimated as in Allen et al. (1998) [19] – Chapter 3. Eventually, r_a and r_s can be computed as follows [19]:

$$r_a=\frac{ln\left(\frac{z_m-d}{z_{om}}\right)ln\left(\frac{z_h-d}{z_{oh}}\right)}{k^2W_z} \quad \text{(S58)}$$

where z_m, z_h are the height of wind and humidity respectively measurements, (usually equal to 2m), d = 2h/3 – where h is crop height (usually equal to 0.12m), z_{om} = 0.123h and z_{oh} = 0.1z_{om}, k is equal to 0.41 and W_z is the wind speed at height z in m/s.

$$r_s=\frac{r_1}{LAI_{active}} \quad \text{(S59)}$$

where r_s is bulk surface resistance, r_1 is bulk stomatal resistance of the well-illuminated leaf (usually equal to 100s/m) and LAI_{active} = 0.5 LAI (leaf area index) and for a typical grassland is equal to 24 times the grass height (LAI = 24•h).

The second component is given by the following equation [36]:

$$DE=\frac{0.757}{1+e^{2.74-16.67(W_{vol}-0.1)}} \quad \text{(S60)}$$

where W_{vol} is volumetric moisture of the surface layer, ranging from 0.10 to 0.50, with the latter being the starting value when the index is computed for the first time after the snowmelt.

The third and final component is computed as follows [36]:

$$P_i=5.612[1-e^{\frac{-P}{5.612}}] \quad \text{(S61)}$$

where P_i is the remaining water amount in the surface layer and P is the precipitation depth in mm.

S2.13 KBDI original equation

KBDI components can be computed as follows [37-40]:

$$Q=KBDI_{t-1}-\frac{10}{25.4}P_{net} \quad \text{(S62)}$$

where KBDI is the Keetch and Byram drought index on day t, dt is the time increment in days, set to 1, P_a is the mean annual precipitation in mm, Q is the previous day's index and P_{net} is net precipitation depth computed as shown in Eq. (S63):

$$P_{net} = P - Int - Run \quad (S63)$$

where P is the precipitation in mm, Int is interception and Run is the runoff in mm.

The original equation is presented below:

$$KBDI_t = Q + \frac{(800-Q)(0.968e^{0.0486T}-8.3)\,dt}{10^3(1+10.88e^{-0.0441Pa})} \quad (S64)$$

$$Q = KBDI_{t-1} - 100P_{net} \quad (S65)$$

The Modified version is included below, although the following equation produces different index ranges:

$$KBDI_{mt} = Q + \frac{(203.2-Q)(0.968e^{0.0875T+1.5552}-8.3)\,dt}{10^3(1+10.88e^{-0.001736Pa})} \quad (S66)$$

S2.14 SDI calculation

Hydrological parameters included in SDI can be estimated as follows [41-43]:

$$Pnet = P - Int - Run \quad (S67)$$

$$Int = R \bullet P, \text{ if } R \bullet P - CW_{t-1} \leq C \quad (S68)$$

$$Int = C - CW_{t-1}, \text{ if } R \bullet P + CW_{t-1} > C \quad (S69)$$

$$CW_t = CW_{t-1} + Int - W, \text{ if } P > 0 \quad (S70)$$

$$CW_t = 0, \text{ if } P = 0 \quad (S71)$$

$$Run = FR \bullet P \quad (S72)$$

where Int is the interception, R is the canopy rainfall interception fraction, P is the precipitation height, C is Canopy storage capacity, CW is the canopy water storage on day t, W is Canopy loss per wet day, FR is flash runoff fraction and Run is the runoff. Finally, the evapotranspiration is considered as a linear equation related to maximum temperature, pan-evaporation and mean monthly daily maximum temperature:

$$ET = a_i T_{max} + b_i \quad (S73)$$

where a and b can be estimated through regression. However, ET can be approximated through the Penman equation [19].

S2.15 Palmer index calculations

The computational procedures starts with the estimation of current moisture anomaly on month 'i' (Z_i):

$$Z_i = K_i (P - P_m) \quad (S74)$$

where K is the climatic weighting factor on month i, P is the monthly precipitation and P_m is the Climatic Appropriate For Existing Conditions (CAFEC) precipitation. The calculating procedure for P_m is shown below:

$$P_m = \alpha_i ETP + \beta_i PR + \gamma_i PRO - \delta_i PL \quad (S75)$$

where ETP is potential evapotranspiration, PR is potential recharge, PRO is potential runoff, PL is potential loss and $\alpha,\beta,\gamma,\delta$ are empirical coefficients described further below. All the components of equation 99 are average values for the month of the calculations. ETP can be estimated in many ways – as already described in the current study – however Palmer uses Thornthwaite's equation [44].

$$PR = AWC - S \quad (S76)$$

where S is the sum of the amounts of water in the surface and the underneath layers measured at field and AWC is the available water capacity of the soil system that plants have access to and can either be measured or calculated by the following formula [19]:

$$AWC = 1000(\theta_{FC} - \theta_{WP})Z_e \quad (S77)$$

where θ_{FC}, θ_{WP} are soil water content at field capacity and at wilting point respectively and Z_e is the depth of the surface soil layer – typically between 0.10 and 0.15 meters. The θ_{FC} - θ_{WP} can be estimated as in line with Table S38 [19].

$$PRO = AWC - PR = S = S_s + S_u \quad (S78)$$

$$PL = \min(ETP, S_s) + [ETP - \min(ETP, S_s)]\frac{S_u}{AWC} \quad (S79)$$

where S_s, S_u are the amount of water in the surface and in the underneath layers respectively.

$$\alpha_i = \frac{ETR_i}{ETP_i} \quad (S80)$$

$$\beta_i = \frac{R_i}{PR_i} \quad (S81)$$

$$\gamma_i = \frac{RO_i}{PRO_i} \quad (S82)$$

$$\delta_i = \frac{L_i}{PL_i} \quad (S83)$$

where ETR is real evapotranspiration, R is the recharge, RO is the runoff and L is the total moisture loss. Actual evapotranspiration can be estimated from potential evapotranspiration with the following formulas [45]:

$$ETR = ETP, \text{ if } S \geq \theta_{FC} \quad (S84)$$

$$ETR = [\frac{S - \theta_{FC}}{\theta_{FC} - \theta_W}]ETP, \text{ if } \theta_{WP} < S < \theta_{FC} \quad (S85)$$

$$ETR = 0, \text{ if } S \leq \theta_{WP} \quad (S86)$$

A plethora of different approaches is documented in the literature for estimating recharge (R), most of them including field measurements [46]. A simple method is described by the following equation [47]:

$$R = S_y\frac{dh}{dt} = S_y\frac{\Delta h}{dt} \quad (S87)$$

where S_y is specific yield that can be estimated from Table 2 in Healy and Cook (2002) [47], h is water table's height and has to be measured on field t represents time while d and Δ stand for changing rates. Finally, runoff can be either measured or estimated through the water balance equation [48]:

$$RO = R - ET_g - \Delta S_g \quad (S88)$$

where ET_g is the evapotranspiration of groundwater and has to be measured and ΔS_g represents the changes in water storage and must be estimated. Accordingly, total loss can be computed as the sum of surface and underground loss [44,,49]:

$$L = [(ETP - P) - \min(S_s, (ETP - P))]\frac{S_u}{AWC} \quad (S89)$$

The factor K form equation 98 can be calculated as follows [44,49]:

$$K_j = \frac{17.67K'}{\sum_{i=1}^{12} D_i K_i'} \quad (S90)$$

where K is the factor as in equation S74 for month j, D is the average monthly value of the P-P_m (as in equation 98) for month i - including historical values of P - P_m from previous years for month i – while K' values can be estimated as follows:

$$K' = 1.5log_{10}\left(\frac{\frac{ETP+R+R0}{P+L}+2.8}{D}\right) + 0.5 \quad (S91)$$

S2.16 RDI modifications

The two modifications of the index are presented as follows [50]:

$$RDI_{n,k} = \frac{RDI_k}{RDI_{k,m}} - 1 \quad (S92a)$$

where $RDI_{n,k}$ is the normalized reconnaissance drought index for month k, RDI is as in the original equation and $RDI_{k,m}$ is the average value of RDI_k for the k-th month of all years with available historical data. Finally, the third version of the index is relied on the satisfactory hypothesis that RDI follows a lognormal distribution, as presented below [50,51]:

$$RDI_{S,k} = \frac{ln\left(\frac{RDI_k}{\mu}\right)}{\sigma} \quad \text{(S92b)}$$

where $\mu = \sum_{i=1}^{n} \frac{\ln(RDI_k)}{n}$ and $\sigma = \sum_{i=1}^{n} \frac{[\ln(RDI_{k,i}) - \mu]^2}{n}$ are mean value and standard deviation for the lognormal distribution.

S2.17 Darcy's law calculations

The following procedure leads to the estimation of Darcy's law components [52]:

$$\psi_L = d(\omega_L - 1) \quad \text{(S93a)}$$

where d is a capacitance of water volume in turgid leaf that can be approximated on average by 7.5 and ω_L is relative water content estimated as follows [53]:

$$\omega_L = \frac{FW - DW}{TW - DW} \quad \text{(S93b)}$$

where FW, DW and TW are fresh, dry and turgid respectively weights that have to be measured experimentally, with $0 < \omega_L < 1$.

$$\psi_s = \varrho \bullet g \bullet z \quad \text{(S93c)}$$

where z is the height of measurement from ground level – which can be replaced by tree height – ϱ is water density equal to 1000kg/m^3 and g is the acceleration due to gravity equal to 9.819 m/s^2.

S2.18 FPI index and modified versions calculations

The computations start with the estimation of live fuel moisture for pixel 'p' (LL_p)

$$LL_p = RG\frac{LL_{fm}}{100} \quad \text{(S94)}$$

where LL_p stands for live fuel moisture for pixel p, RG is relative greenness and LL_{fm} can be estimated through Table S12.

$$DL_p = (1 - \frac{RG}{100})LL_{fm} + DL_{fm} \quad \text{(S95)}$$

where DL_p is dead fuel load for pixel p, DL_{fm} is dead fuel load for the fuel model from Table S12.

$$L_f = \frac{LL_p}{LL_{fm} + DL_{fm}} \quad \text{(S96)}$$

$$D_f = \frac{DL_p}{LL_{fm} + DL_{fm}} \quad \text{(S97)}$$

where L_f and D_f are the fractions of total fuel model load that is live and dead respectively. Afterwards, the fractional 10-hour fuel moisture must be calculated:

$$TN_f = \frac{FM_{10}}{MX_d} \quad \text{(S98)}$$

where MX_d is extinction moisture from Table S41 and FM_{10} is the NFDRS 10-hour fuel moisture content calculates as follows [54,55]:

$$FM_{10} = 1.28m_{f-a} \quad \text{(S99)}$$

where m_{f-a} is equilibrium moisture content with T and RH being inserted after the corrections in Table S42.

$$FPI_u = 100 - (RG \bullet L_f + TN_f \bullet D_f \bullet 100) \quad \text{(S100)}$$

$$FPI_{max} = 100 - 2\frac{100}{MX_d} \quad (S101)$$

$$FPI = FPI_u + \frac{200FPI_u}{Mx_d FPI_m} \quad (S102)$$

where FPI_u is the uncorrected FPI, FPI_{max} is the uncorrected maximum value of FPI and all others as in previous equations. The index ranges from 1 to 100, with high fire risk been observed at values greater than 80, however, clouds and/or snow can cause FPI drop to 0 [56]. Another version of the index is found in the respective literature, while the computational process is presented below [57]:

$$LR = \frac{RG \cdot MLR}{100} \quad (S103)$$

where LR is live ratio and MLR is the maximum live ratio, calculated as follows:

$$MLR = 35 + \frac{45}{36.8}(NDVI_{max}100 - 62.4) \quad (S104)$$

$$FMR_{10} = FM_{10} + (MX_D - FM_{10})R_f \quad (S105)$$

where FMR_{10} is the 10-hour fuel moisture ratio, FM_{10} and MX_d as above respectively. R_f is a rain factor from 0 to 1 depending on the amount of rain needed to wet small dead fuels to extinction moisture.

$$TN_f = \frac{FMR_{10}-2}{MX_d-2} \quad (S106)$$

$$FPI_{m1} = 100(1 - TN_f)(1 - LR) \quad (S107)$$

where TN_f is fractional 10-hour fuel moisture and FPI_{m1} is the modified version of FPI.

Another modification of the FPI was proposed, in order to simplify the calculation procedure as follows [58]:

$$FPI_{m2} = 100(1 - FMR_{10})(1 - VC) \quad (S108)$$

where FPI_{m2} is the second modification of the FPI, FMR_{10} represents the 10-hour fuel moisture ratio and VC is the percentage of vegetation cover (0-1).

$$FMR_{10} = \frac{FM_{10}}{MX_D} \quad (S109)$$

$$VC = [0.25 + 0.5\frac{NDVI_{max}}{NDVI_{abs,max}}]RG \quad (S110)$$

where $NDVI_{max}$ is the maximum NDVI for the location in which FPI is estimated, $NDVI_{abs\_max}$ is the maximum NDVI of all the locations bordering the selected area. Instead of NDVI, other relevant indices can be used, such as NDWI (Huesca et al. 2009).

S3. Nomenclature

Symbol	Description	Unit
T	Dry bulb air temperature	°C
RH	Relative humidity	%
W	Wind speed	km/h
P	Precipitation height	mm
Δe	Vapor pressure deficit	hPa
N	Number of days since rain	-
C	Degree of curing	%
Q	Fuel quantity	t/ha

lat	Latitude	degrees
E	Evaporation	mm
ETP	Potential	mm
ETR	Real evapotranspiration	mm
r	Water reserve	mm
Tdew	Dew point temperature	^oC
Pnet	Net precipitation	mm
LAI	Leaf area index	m^2/m^2
LAD	Leaf area density	m^2/m^3
Rg	Global daily solar	W/m^2
Epot	Potential evapotration	mm
Rn	Net radiation	W/m^2
Int	Interception	mm
Run	Runoff	mm
R	Recharge	mm

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