Open Burning Globally and in the UNECE Region

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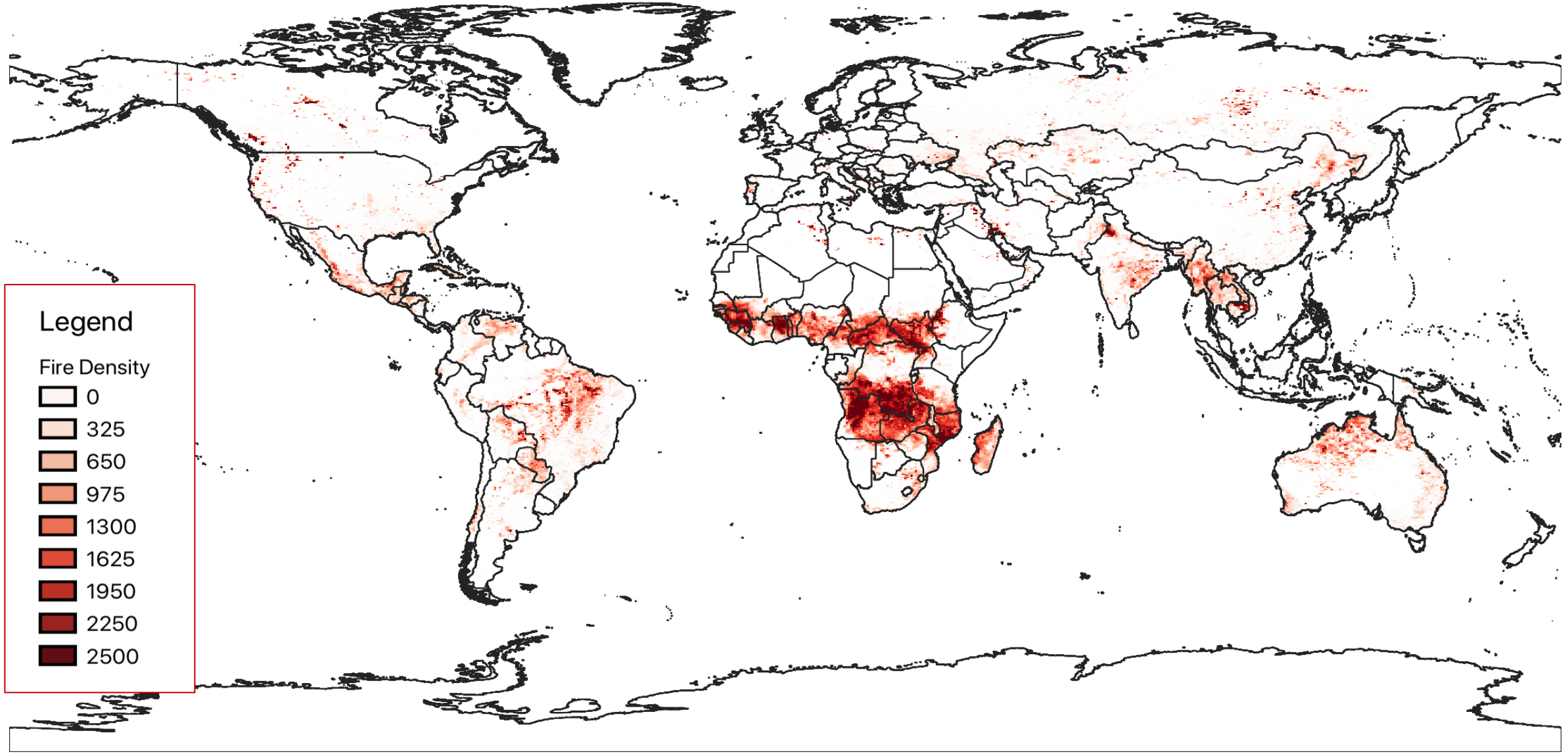
Density of 2017 Open Burning in Cropland Dominated Landscapes; 375 m VIIRS in a 0.5° grid



Health and Accidents

- North America began addressing 1950's to prevent wildfires: "managed" burns (prohibitions under dry conditions)
- Addressed in current EU members piecemeal during 1980's and 1990's, health and soil fertility
- Near-total ban in EU around 2000 under NEC directives (not directly addressed)
- In U.S., accidents in 1980-1990's (visibility) led to some state bans on burning

Impacts: Crop Yields, Higher Fertilizer Costs

- Long known impacts on humus (Soviet studies from 1930's)
- Only more recent: decreases soil fertility and crop yields by 25-30%
- Corresponding 25-35% greater need for fertilizer (UC-Davis studies during trandtion to no-burn early 2000's)
- More brittle soils and fertilizer use → More erosion, run-off and water pollution; and secondary air pollution (?ammonia?)

Impacts: Better Data on Health

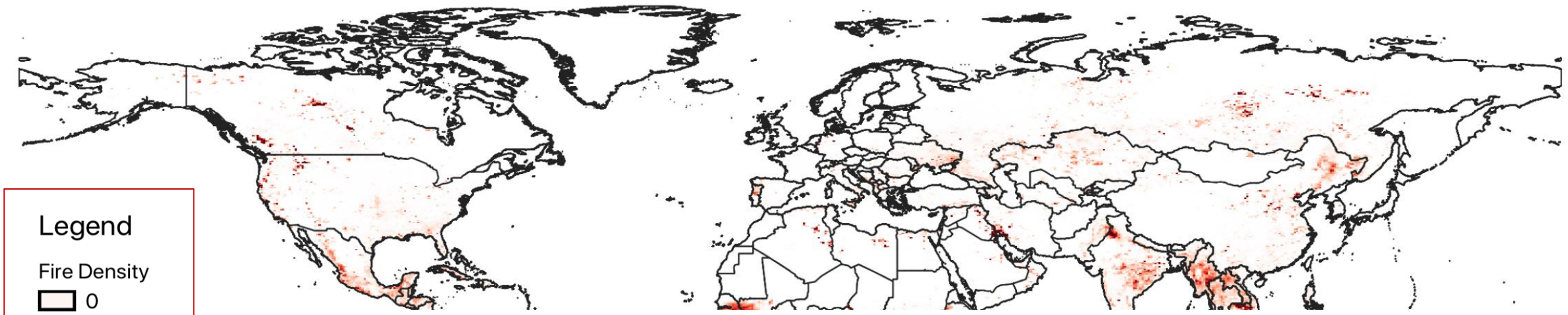
- **Burning a PRIMARY source of air pollution as other sources (energy, diesel transport) come under greater control**
- **Despite its EPISODIC or SEASONAL NATURE**
- **In a rapidly changing, more extreme climate**

  - ✓ **Higher mortality from respiratory or cardiac illness, especially among young and elderly**
  - ✓ **Higher morbidity INCLUDING LONG AFTER FIRE EVENT from respiratory illness (asthma, pneumonia)**
  - ✓ **Increased mortality/morbidity due to accidents**
  - ✓ **Also in cities!**

Impacts: Climate

- Emissions and impacts travel (regional/hemisphere)
- Largest single BC source globally (36%),close to cryosphere = more intense regional warming/glacier and snow melt
- Wildfires spread from set agricultural fires lead to additional pollution and climate impacts.
- Set fires, AND the fires that spread from them, release methane, CO, CO2, black carbon
- Not (really) carbon neutral due to wildfire spread
- Not carbon-neutral due to humus C loss
- Enhanced impact in Arctic and mountains due to BC deposition

Density of 2017 Open Burning in Cropland-Dominated Landscapes; 375 m VIIRS in a 0.5° grid: Focus on Northern Hemisphere



Legend

Fire Density

- 0
- 325
- 650
- 975
- 1300
- 1625
- 1950
- 2250
- 2500

2017 Open Burning Emissions in Cropland-Dominated Landscapes; 375 m VIIRS Active Fire Detections

Rank	Country	BC	CO2	CH4
1	China	23,435	49,525,771	181,855
2	Russian Federation	15,503	32,763,177	120,304
3	Ukraine*	7,588	16,035,270	58,880
4	United States	5,298	11,195,690	41,110
5	Kazakhstan	1,758	3,714,738	13,640
6	Canada	1,429	3,020,158	11,090
7	*Italy*	1,395	2,947,870	10,824
8	Turkey	1,226	2,590,035	9,510
9	*Romania*	930	1,964,414	7,213
10	*Germany*	696	1,471,160	5,402
11	*Bulgaria*	509	1,074,753	3,946
12	*Spain*	412	869,959	3,194
13	*France*	328	693,470	2,546
14	*Poland*	314	663,222	2,435
15	*Belgium*	258	545,979	2,005
16	*Croatia*	232	489,924	1,799
17	*Greece*	207	437,199	1,605
18	*Austria*	171	361,720	1,328
19	*United Kingdom*	170	358,528	1,316
20	*Slovakia*	162	341,879	1,255

Rank	Country	BC	CO2	CH4
21	*Hungary*	103	217,282	798
22	*Czechia*	52	108,918	400
23	*Denmark*	47	98,790	363
24	*Netherlands*	42	87,967	323
25	*Portugal*	22	45,649	168
26	*Luxembourg*	7	14,985	55
27	*Lithuania*	5	9,712	36
28	*Latvia*	2	3,469	13
29	Mongolia	1	2,497	9
30	*Sweden*	1	1,526	6
31	*Estonia*	0.4	832	3
32	*Slovenia*	0.3	555	2
33	*Finland*	0	0	0
33	*Ireland*	0	0	0
33	*Malta*	0	0	0
33	Norway	0	0	0
33	Iceland	0	0	0

EU 27 countries
* Seeking to join EU
(Metric tonnes)

Better Monitoring Technology:

Better Tracking of Sources and Emissions

- **New VIIRS satellite mapping captures 4-6x more fires than older MODIS satellites**
- **VIIRS can differentiate crops and burning conditions (plant mass, dry/wet), with more reliable emissions estimates**
- **Burning is NOT carbon neutral: add to suite of negative-carbon tools**

Peru, 2015-17 from VIIRS

(compare with total 159,000,000 Mt CO2 in 2012):

YEAR	Black Carbon Mt	CO2 Mt	CH4 Mt	PM2.5 Mt
2015	54,605	170,856,059	537,797	940,285
2016	64,944	203,061,615	640,856	1,121,869
2017	45,189	141,136,684	446,023	772,418

Open burning currently spreads from Croplands to other human-dominated landscapes.

What about the future?

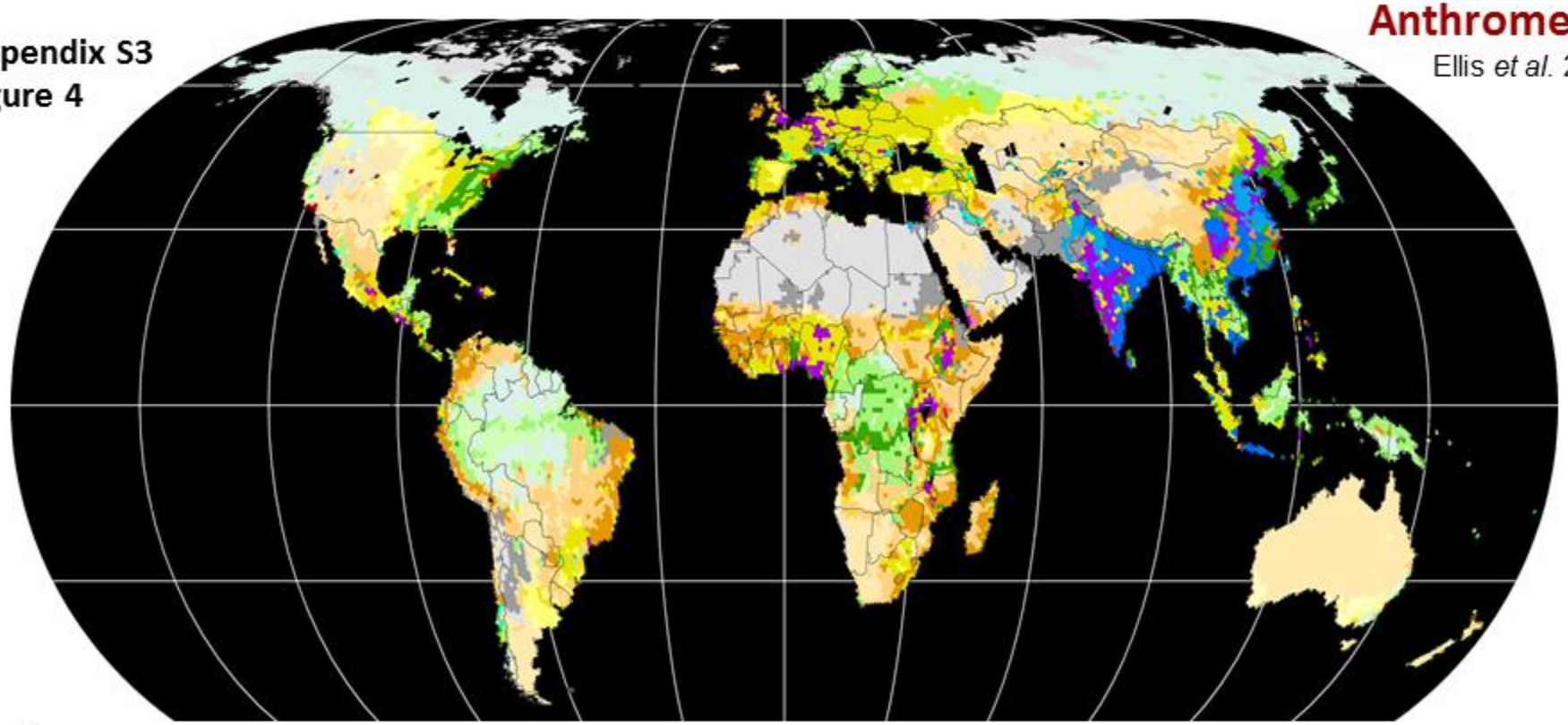
Ellis EC, Klein Goldewijk K, Siebert S, Lightman D, Ramankutty N. 2010.
Anthropogenic transformation of the biomes, 1700 to 2000
Global Ecology and Biogeography **19**:589-606.

Laboratory for Anthropogenic Landscape Ecology

Anthropogenic Biomes (v2)

Appendix S3
Figure 4

Anthromes 2
Ellis *et al.* 2010



Dense Settlements
Urban | Mixed settlements

Villages
Rice | Irrigated | Rainfed | Pastoral

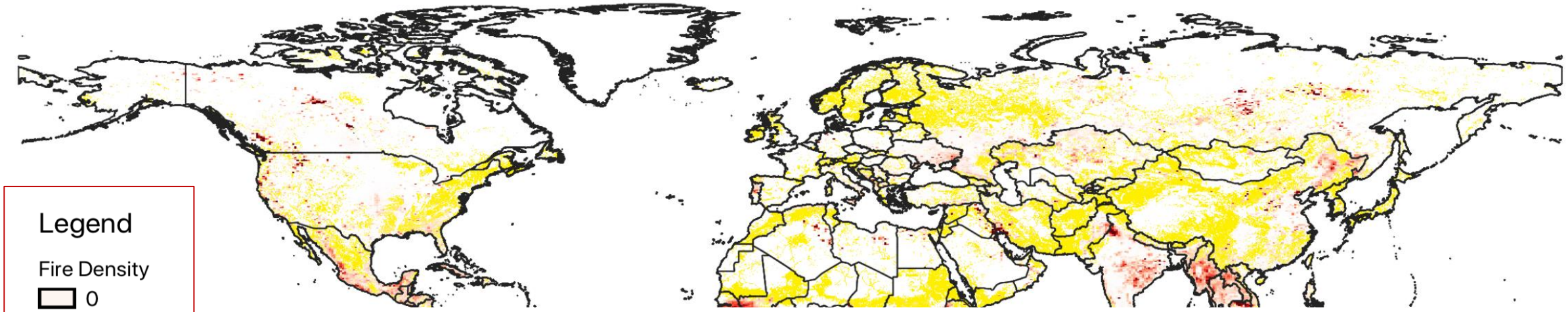
Croplands
Residential | Populated | Remote
Irrigated | Rainfed

Rangelands
Residential | Remote
Populated

Seminatural
Woodlands | Treeless & Barren
Residential | Remote
Populated

Wildlands
Woodlands | Treeless & Barren

Anthromes near Current Open Burning in Cropland-Dominated Landscapes;



Legend

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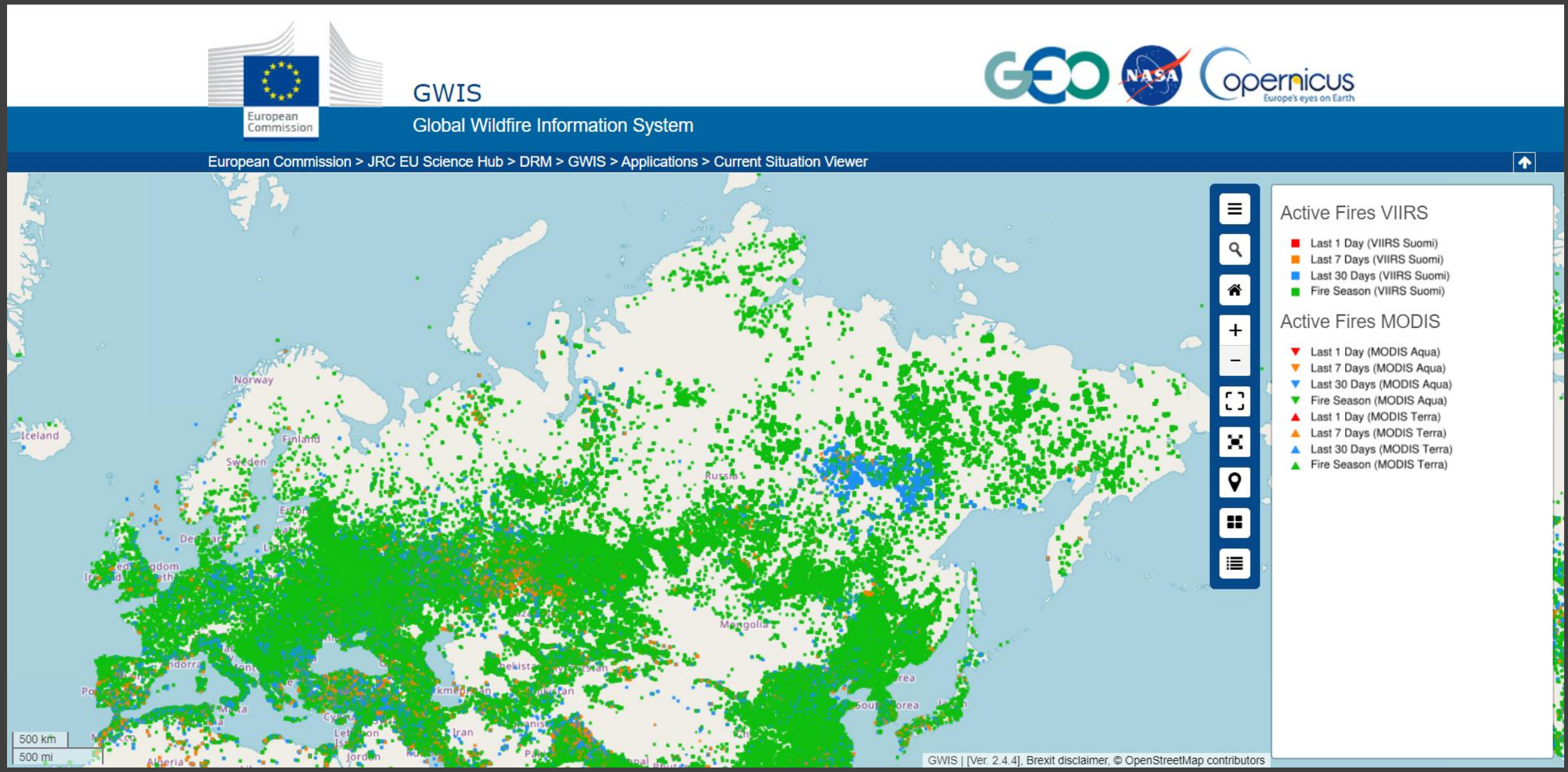
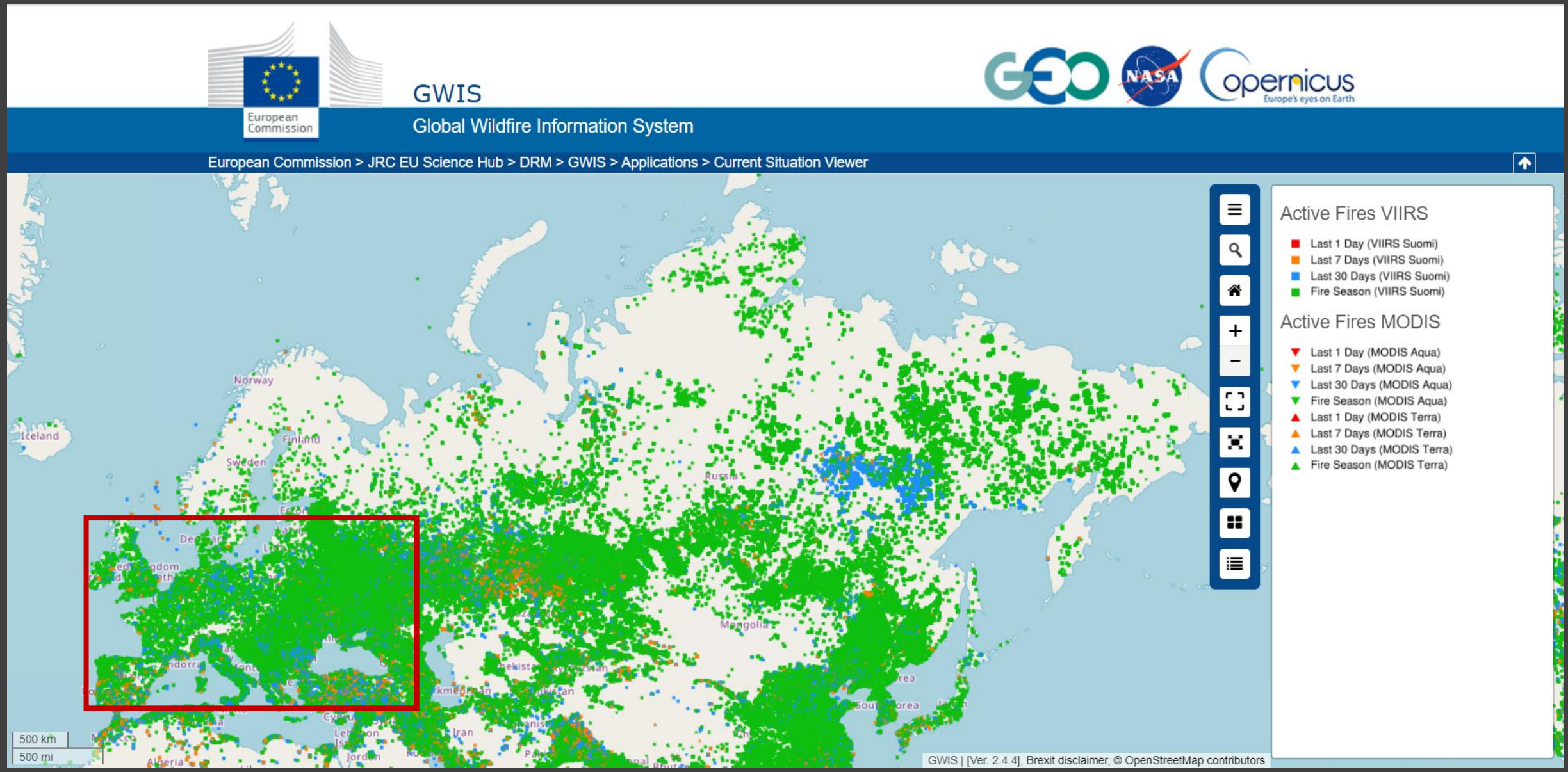
- Pastoral villages
- Residential rangelands
- Populated rangelands
- Residential woodlands
- Populated woodlands
- Inhabited treeless and barren lands


European Commission
GWIS
Global Wildfire Information System
European Commission > JRC EU Science Hub > DRM > GWIS > Applications > Current Situation Viewer
Active Fires VIIRS
Last 1 Day (VIIRS Suomi)
Last 7 Days (VIIRS Suomi)
Last 30 Days (VIIRS Suomi)
Fire Season (VIIRS Suomi)
Active Fires MODIS
Last 1 Day (MODIS Aqua)
Last 7 Days (MODIS Aqua)
Last 30 Days (MODIS Aqua)
Fire Season (MODIS Aqua)
Last 1 Day (MODIS Terra)
Last 7 Days (MODIS Terra)
Last 30 Days (MODIS Terra)
Fire Season (MODIS Terra)
Norway
Iceland
Finland
Sweden
Russia
Mongolia
500 km
500 mi
GWIS | [Ver. 2.4.4], Brexit disclaimer, © OpenStreetMap contributors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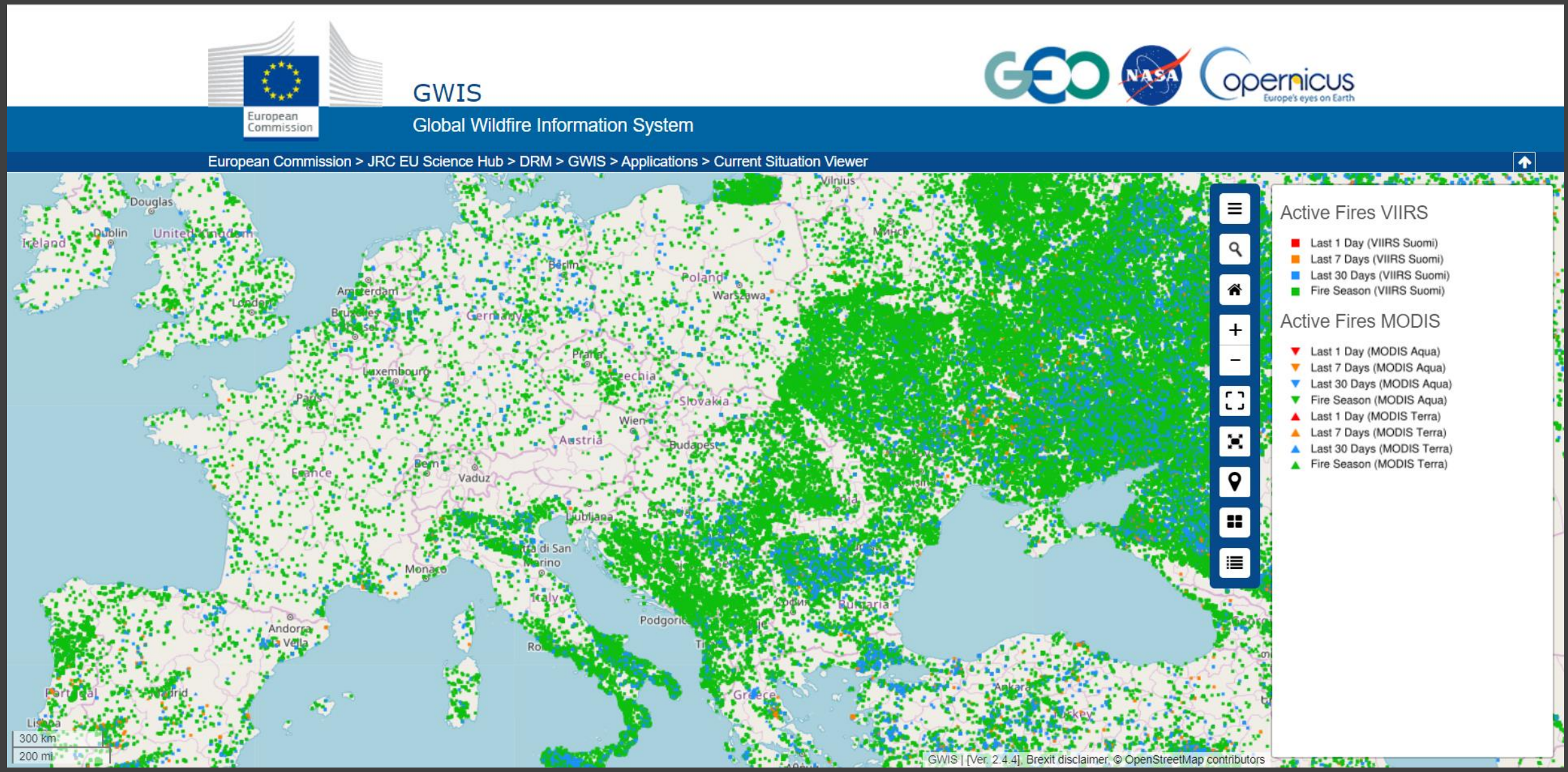
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Last 1 Day (MODIS Aqua)
Last 7 Days (MODIS Aqua)
Last 30 Days (MODIS Aqua)
Fire Season (MODIS Aqua)
Last 1 Day (MODIS Terra)
Last 7 Days (MODIS Terra)
Last 30 Days (MODIS Terra)
Fire Season (MODIS Terra)
300 km
200 mi
GWIS | [Ver. 2.4.4], Brexit disclaimer, © OpenStreetMap contributors

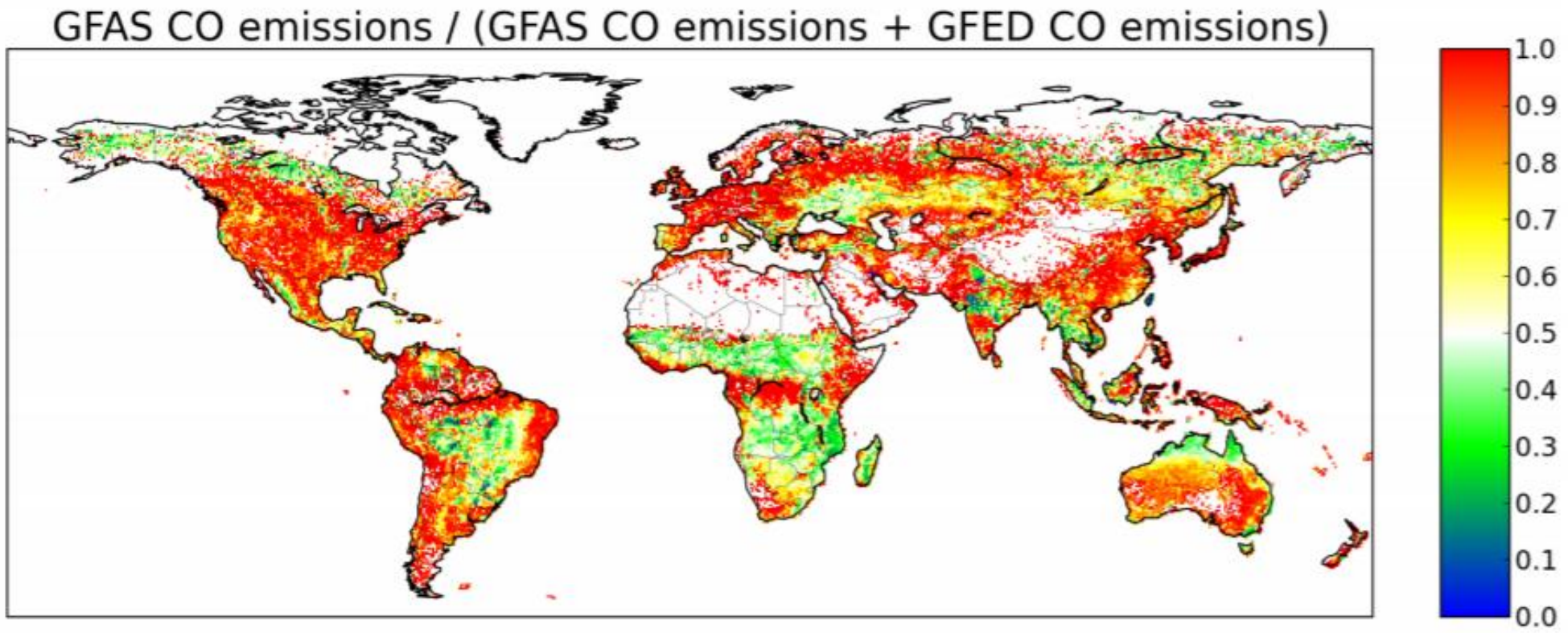


Figure 2.4: Ratio of GFAS / (GFED + GFAS) CO emissions. A value of 0.5 (white) indicates that both products predict equal emissions.

https://www.ecmwf.int/sites/default/files/elibrary/2013/7707-assessment-global-fire-assimilation-system-gfasv1.pdf

Majority of summer 2018 wildfires in Siberia are caused by human-caused fires in agroforestry or agricultural fields:
Combination of VIIRS, Sentinel-2, and very high resolution data in ESRI ArcGIS to determine fire starting points and relate to observed burned area. (https://unearthed.greenpeace.org/2019/05/28/russia-wildfires-siberia-map/).

ABOUT

UNEARTHED

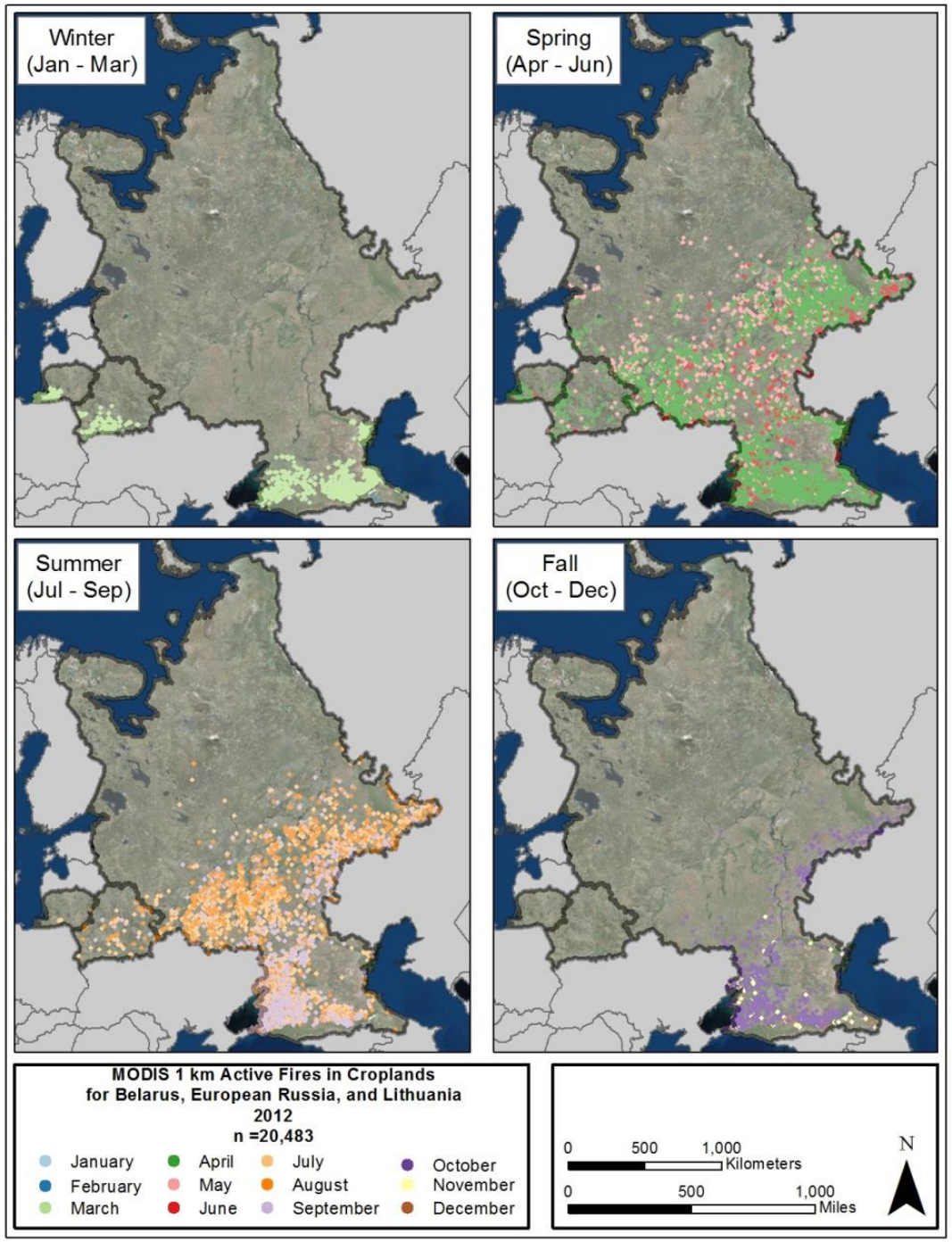
27.05.2019 by **Unearthed staff**

Wildfires that ravaged millions of hectares of land and forests in Russia last year may have been caused by so-called "prescribed burning" – a controversial practice intended to prevent the spread of forest fire.

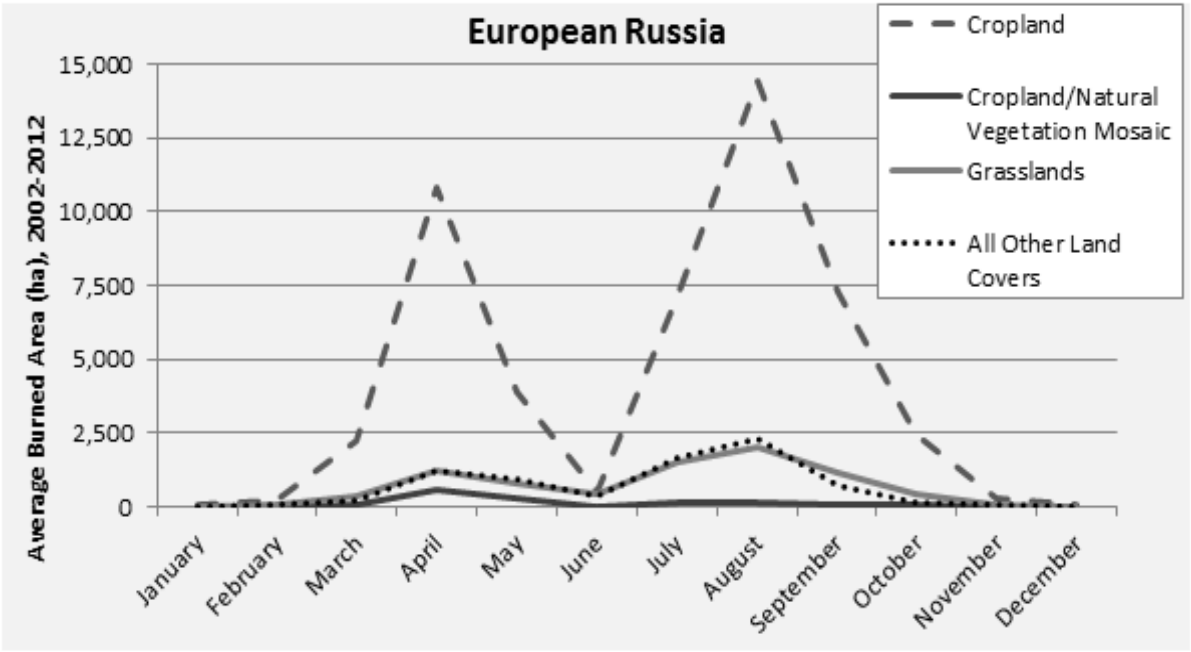
That's according to a new analysis of 2018's Siberian wildfires carried out by GIS specialists at Greenpeace's Global Mapping Hub, who found that the overwhelming majority of those fires started close to places where people travel, work or live, or to sites of deliberate 'prescribed burnings'.

Across the four regions studied the proportion of fires fitting into this category ranged from 65% in Krasnoyarsk Krai to 99% in Amur Oblast.

Zoom-in to fires starting in agricultural fields in Amur Oblast.



Seasonal and monthly cropland fires for the study region, 2012; fire observations from the 1 km MODIS Active Fire Product and croplands extent from the MOD12Q1 MODIS Land Cover Product (land cover class = 12).



McCarty, Jessica L., et al. "Agricultural fires in European Russia, Belarus, and Lithuania and their impact on air quality, 2002–2012." *Land-Cover and Land-Use Changes in Eastern Europe after the Collapse of the Soviet Union in 1991*. Springer, Cham, 2017. 193-221.