International Workshop on "Inventory, Modeling and Climate Impacts of Greenhouse Gas emissions (GHG's) and Aerosols in the Asian Region"

FIRE OCCURRENCES and BURNING EMISSIONS IN CENTRAL ASIA

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- Fire Emissions in Central Asian countries
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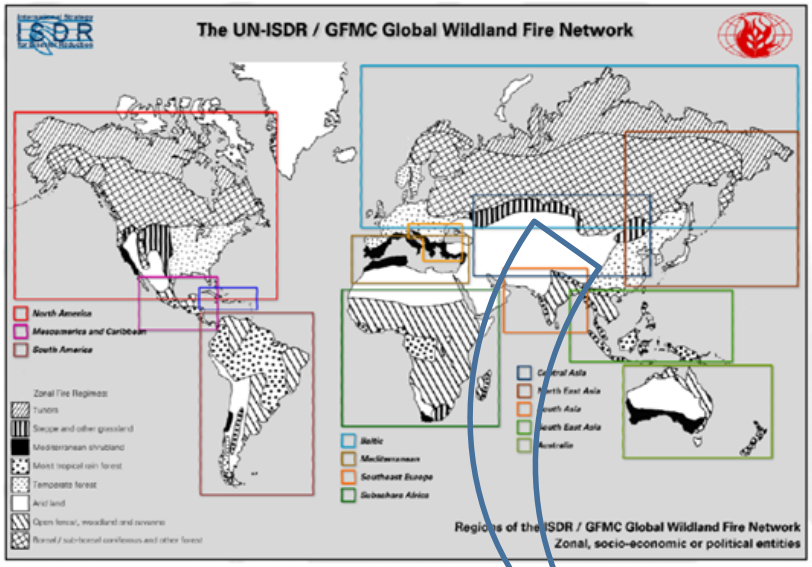
- Common problems
- Challenges for Central Asian region

GFN



CENTRAL ASIAN COUNTRIES

Countries:

- Armenia
- Azerbaijan
- Belarus
- Kazakhstan
- Kyrgyzstan
- Tajikistan
- Turkmenistan
- Uzbekistan
- Part of Russia
- Afghanistan
- Islamic Republic of Iran
- Iraq
- Mongolia
- Part of China

Specifications of CA region:

- A fire prone forest environment
- Largest area in the World with high contamination of radionuclide
- Not declining wildfire occurrences
- Most of Fires are Human induced

Forest covers & fires in the CA region

Basic data on forest cover and wildland fires in Central Asian countries compiled from national FRA-2005 reports.

Country	FRA 2005 Total Forest Cover		FRA 2005 Other wooded land	FRA 2005 Other land	FRA 2005 Forest fire database (years, periods)	FAO FRA 2005 Average area annually burned in 5-yr-periods (ha)	
	(ha)	%	(ha)	(ha)		1990 (1988-92)	2000 (1998-02)
Azerbaijan	936 000	11	54 000	7 270 000	1988-2003	26	147
Kazakhstan	3 337 000	1.2	15 622 000	251 011 000	1990-2000	30 900	179 000
Kyrgyzstan	869 300	4.3	312 800	17 997 900	2000	--	60
Tajikistan	410 000	2.9	142 000	13 444 000	1987-2003	100	1 100
Turkmenistan	4 127 000	8.5	0	42 866 000	--	--	--
Uzbekistan	3 295 000	7.4	904 000	37 225 000	1991-2002	73	70
China	197 290 000	20.6	87 615 000	647 837 000	1988-2002	44 200	50 700
Mongolia	10 252 000	6.5	2 388 000	144 010 000	1980-2003	225 000	418 000
Russian Federation	808 790 000	47.4	74 185 200	805 874 800	1988-2002	681 100	1 267 500
Georgia	2 760 100	39.6	50 300	4 138 600	1998-2002	14	237
Armenia	283 000	9.5	45 000	2 492 000	1998-2003	--	103
Belarus	7 894 000	38.0	914 000	11 940 000	1998-2002	--	6 400
Ukraine	9 575 000	15.9	41 000	48 319 000	1988-2002	2 000	4 000
Iran	11 075 000	6.7	5 340 000	147 205 000	1988-2002	9 800	6 500
Iraq	822 000		927 000	41 988 000		--	--
Afghanistan	867 000	1.3	--	64 342 000		--	--
Pakistan	1 902 000		1 389 000	73 797 000	1990-2000	49 000	41 000

Forest changes in the World

Progress towards sustainable forest management by subregion, 1990–2010

Themes and variables	Africa						Asia						Asia			Europe				North and Central America						Oceania		
	Eastern and Southern		Northern		Western and Central		East		South and Southeast		Western and Central			Total Europe		Europe excl. Russian Federation		Caribbean		Central America		North America					
	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2		R1	R2	R1	R2	R1	R2	R1	R2	R1	R2		R1	R2	
Extent of forest resources																											
Area of forest	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●
Growing stock of forests	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	–	–	–
Forest carbon stock in living biomass	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	–	–	–
Forest biological diversity																											
Area of primary forest	H	●	●	H	●	●	L	●	●	H	●	●	H	●	●	H	●	●	–	–	–	M	●	●	M	●	●	H	●	●	H	●	●
Area of forest designated primarily for conservation of biodiversity	H	●	●	H	●	●	M	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	L	●	●	H	●	●	–	–	–
Area of forest within protected areas	H	●	●	–	–	–	L	●	●	H	●	●	H	●	●	L	●	●	H	●	●	H	●	●	L	●	●	–	–	–	H	●	●	–	–	–
Forest health and vitality																											
Area of forest affected by fire	L	●	●	–	–	–	–	–	–	H	●	●	H	●	●	L	●	●	H	●	●	H	●	●	M	●	●	–	–	–	H	●	●	–	–	–
Area of forest affected by insects	–	–	–	–	–	–	–	–	–	H	●	●	–	–	–	L	●	●	H	●	●	M	●	●	–	–	–	–	–	–	H	●	●	–	–	–
Productive functions of forest resources																											
Area of forest designated primarily for production	H	●	●	H	●	●	M	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	L	●	●	H	●	●	H	●	●
Area of planted forest	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	H	●	●	H	●	●	H	●	●
Total wood removals	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	H	●	●	H	●	●
Protective functions of forest resources																											
Area of forest designated primarily for protection of soil and water	H	●	●	H	●	●	M	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	L	●	●	H	●	●	–	–	–
Socio-economic functions of forests																											
Area of forest under private ownership	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	L	●	●	H	●	●	–	–	–
Value of total wood removals	–	–	–	H	●	●	L	●	●	H	●	●	M	●	●	M	●	●	–	–	–	H	●	●	L	●	●	–	–	–	H	●	●	–	–	–
Employment in primary production of goods	L	●	●	–	–	–	–	–	–	H	●	●	L	●	●	M	●	●	H	●	●	M	●	●	–	–	–	L	●	●	L	●	●	H	●	●
Legal, policy and institutional framework																											
Forest area with management plan	M	●	●	–	–	–	L	●	●	H	●	●	L	●	●	L	●	●	H	●	●	H	●	●	L	●	●	–	–	–	L	●	●	–	–	–
Human resources in public forest institutions	H	●	●	H	●	●	L	●	●	H	●	●	M	●	●	L	●	●	–	–	–	M	●	●	–	–	–	–	–	–	–	–	–	–	–	–
Number of students graduating in forestry	M	●	●	H	●	●	L	●	●	H	●	●	L	●	●	L	●	●	–	–	–	M	●	●	L	●	●	L	●	●	M	●	●	–	–	–

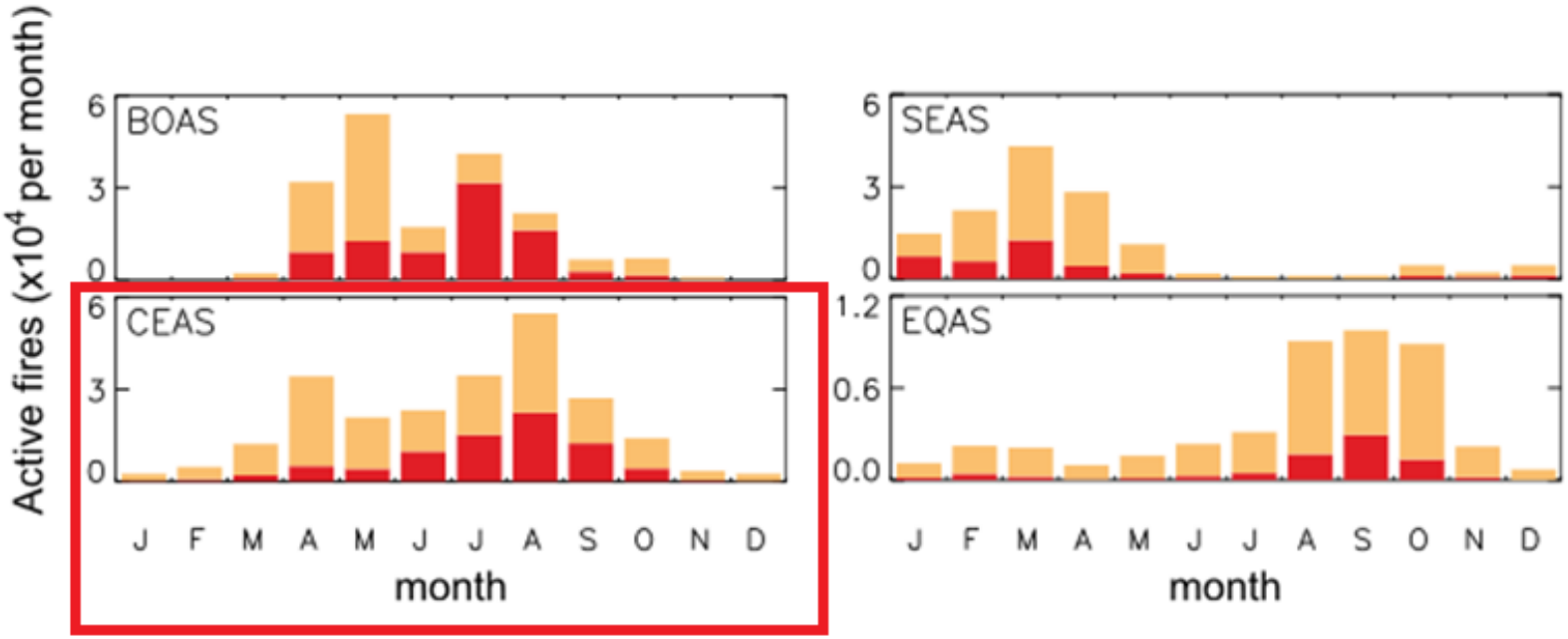
Notes:
R1 = Reference period 1: 1990–2000 with a few exceptions, see Notes to Table 1
R2 = Reference period 1: 2000–2010 with a few exceptions, see Notes to Table 1

H = High (reporting countries represent 75–100% of total forest area)
M = Medium (reporting countries represent 50–74% of total forest area)
L = Low (reporting countries represent 25–49% of total forest area)

● = Positive change (greater than 0.50%)
● = No major change (between -0.50 and 0.50%)
● = Negative change (less than -0.50%)
– = Insufficient data to determine trend

R1: 1990 – 2000
R2: 2000 – 2010
Change: from negative to positive

Number of Active Fires in Asian regions



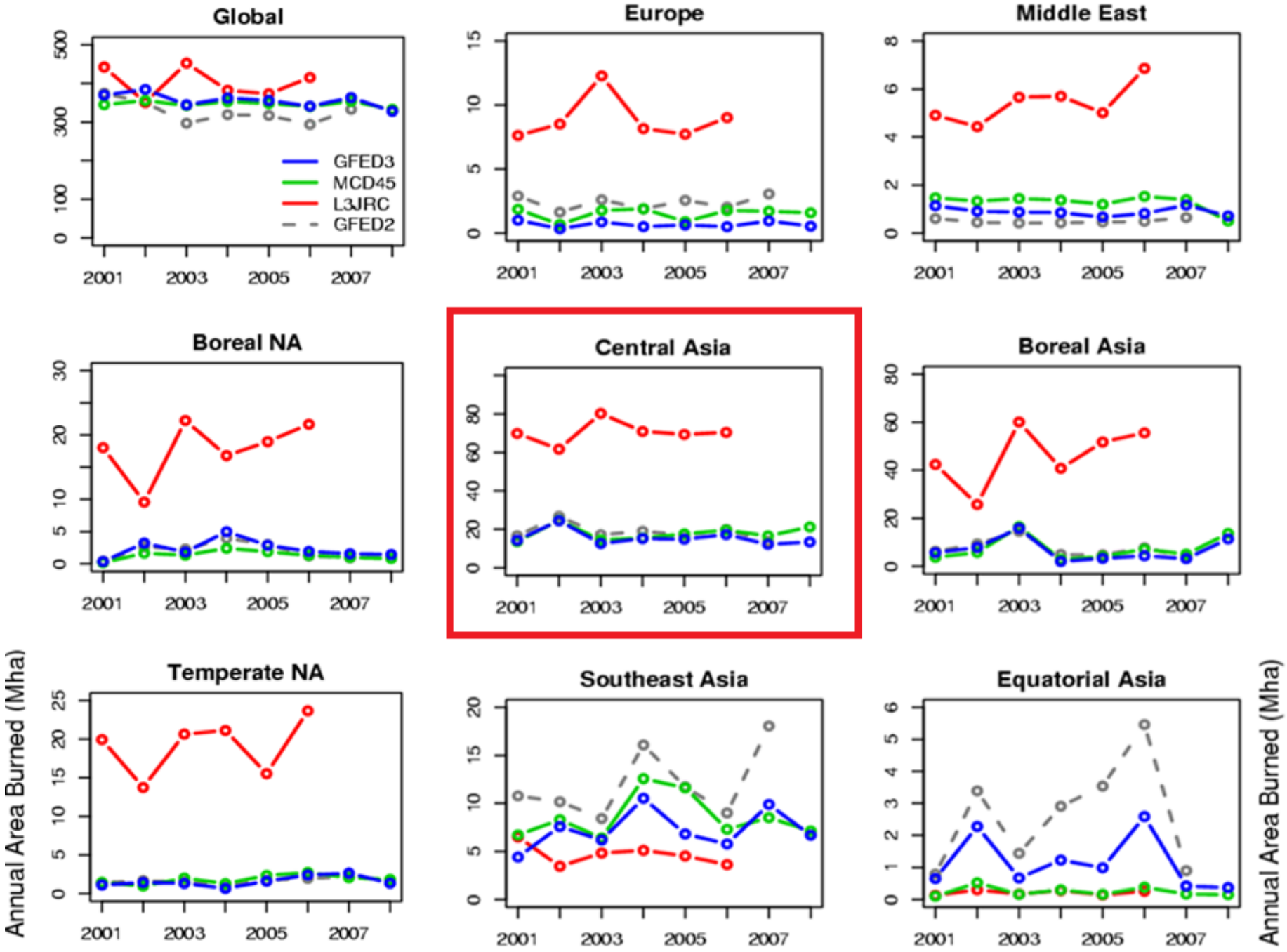
The number of active fires within or near burned areas (FC_{in}, red bars) or outside of burned areas (FC_{out}, light orange bars) during 2001–2010. The burned area observations used to define FC_{in} and FC_{out} are from the 500 m MCD64A1 product, and data on the active fires are from the Terra MOD14A1 product. The FC_{out} estimates are stacked on top of the FC_{in} estimates, so their sum (the height of the total bar) is equal to FC_{total}. Different continental-scale regions are abbreviated as follows:

Boreal Asia (BOAS), Central Asia (CEAS),

Southeast Asia (SEAS), Equatorial Asia (EQAS)

Source: Randerson et al.: Burned area from small fires

Annual Burned Areas (Mha)



Burned areas in the region

Wildland fire data contained in the database of the Global Fire Monitoring Center (GFMC) and the satellite-derived global assessment for the year 2000 "Global Burnt Area – 2000" (GBA2000) initiative.

Country	Fire information in GFMC database (years) [1]	GBA 2000 Total area affected by fire (ha) [2]	GBA area burned Coniferous/Mixed stands		GBA area burned Broadleaved Stands		GBA area burned Woodland/Shrubland		GBA area burned Grassland/Cropland		GFMC Average forested area annually burned in 5-yr-periods (ha) [3]	
			(ha)	%	(ha)	%	(ha)	%	(ha)	%	1990	2000
Azerbaijan	2000	53 100	4 400	1.4	4 500	1.9	33 700	0.6	10 900	0.4	--	--
Kazakhstan	1981-2003	8 162 200	8 900	1.0	800	1.0	7 409 800	4.6	683 500	0.8	2 679	16 981
Kyrgyzstan	2000	106 700	2 500	1.7	400	2.1	69 500	0.7	33 400	0.5	--	--
Tajikistan	2000	44 900	--	--	--	--	33 700	0.7	11 000	0.2	--	--
Turkmenistan	2000	23 300	--	--	--	--	17 800	0.4	6 300	0.0	--	--
Uzbekistan	2000	50 600	--	--	--	--	36 100	0.3	15 700	0.1	--	--
China	1950-2001	6 238 800	880 100	1.5	166 900	1.4	2 354 300	0.7	2 888 900	0.7	106 254	--
Mongolia	1981-2000	2 655 600	121 700	3.5	300	1.2	1 661 800	2.9	810 800	1.0	2 348 200	--
Russian Federation	1981-2005	22 380 000	2 984 600	0.8	116 200	1.0	10 111 800	4.0	9 023 700	0.9	1 835 220[3]	1 158 838[4] 5 334 800[5]
Georgia	2000	18 100	4 200	0.5	100	0.0	6 600	0.2	5 600	0.2	--	--
Armenia	2000	7 900	1 100	1.3	400	1.5	3 000	0.2	5 600	0.8	--	--
Belarus	1959-2003	43 500	400	0.0	--	--	30 600	0.2	15 100	0.2	5 784	6 497
Ukraine	1996-2002	2 193 800	10 200	0.9	5 900	2.6	294 000	3.2	1 880 900	4.1	--	1 760
Iran	1982-2000	104 200	21 100	2.3	7 400	2.4	32 000	0.1	39 500	0.2	1 273	--
Iraq	--	6 500	--	--	--	--	3 400	0.0	3 100	0.1	--	--
Afghanistan	--	--	600	1.5	--	--	34 400	0.3	33 600	0.1	--	--
Pakistan	2000	44 900	5 000	1.3	600	3.6	11 000	0.1	24 100	0.1	--	--

[1] Statistical information from various sources (sources cited within the database)
[2] GBA 2000: See introduction and links in: http://www-gvm.jrc.it/tem/Disturbance_by_fire/products/burnt_areas/global2000/global2000.htm
[3] Forest only for comparison with GBA coniferous / mixed / broadleaved stands
[4] Data provided by the Aerial Fire Protection Service *Avialesookhrana*
[5] Satellite-derived data (details see Table 2)

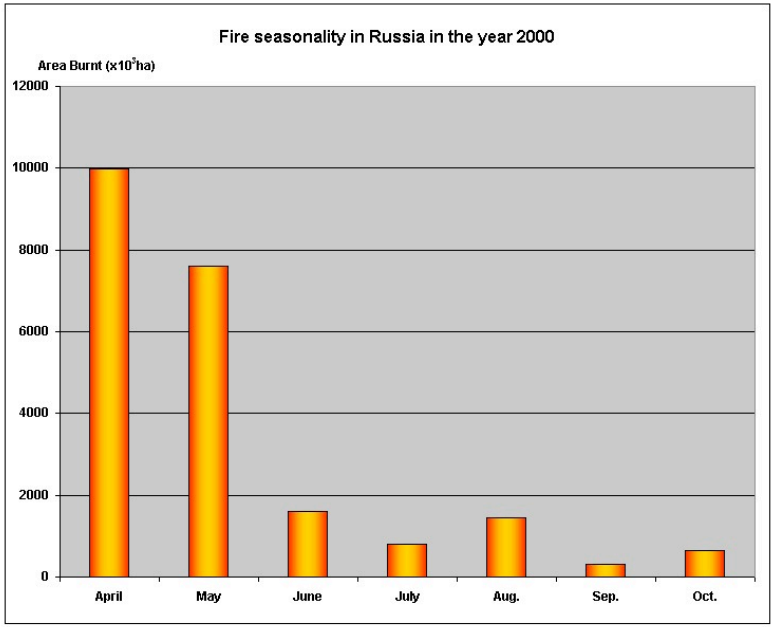
J. Goldammer

Fires in Russia

There are several reasons why fire is a major natural disturbance in Russian forests:

1.About **95 percent** of the forests are **boreal** forests, and a major part of them is dominated by **coniferous** stands of high fire hazard;
2.A significant part of the forested territory is practically **unmanaged** and **unprotected** – large fires (>200 ha) play an important role in this region;
3.Due to slow decomposition of plant material, the forests contain large amounts of **accumulated organic matter**;
4.A major part of the boreal forest is situated in regions **with limited amounts of precipitation** and/or frequent occurrences of **long drought** periods during the fire season.

The **duration of the fire season** is geographically dependent and ranges from **90-100 to 200-250 days per year**. There is a clear zonal gradient in the seasonal distribution of fire (Korovin, 1996).

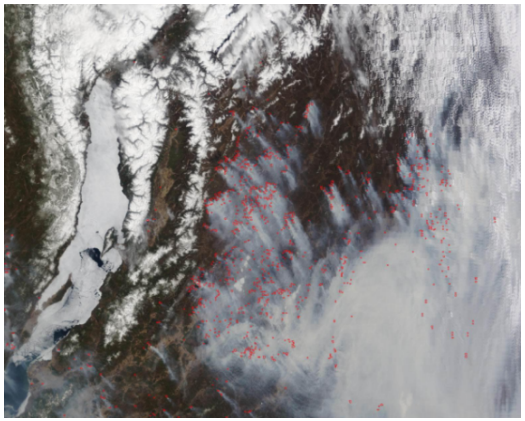


Fires in Russia

Instruments:

For detection of active fires along with better estimation of areas burned and impact used:

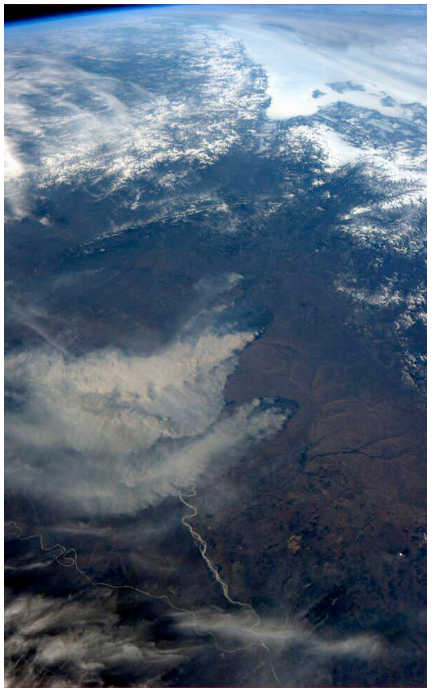
NOAA/AVHRR
Terra/Aqua/MODIS
ENVISAT/MERIS
Terra/ASTER

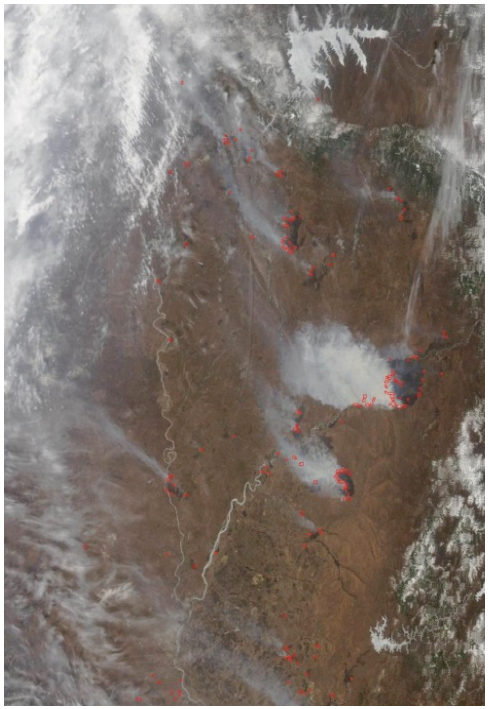


Fire statistics:

20,000 and 40,000 fires occur annually affecting an area of 2 to 3 million hectared of forest and other lands.

They are detected and controlled only in protected forests and protected pasture lands.





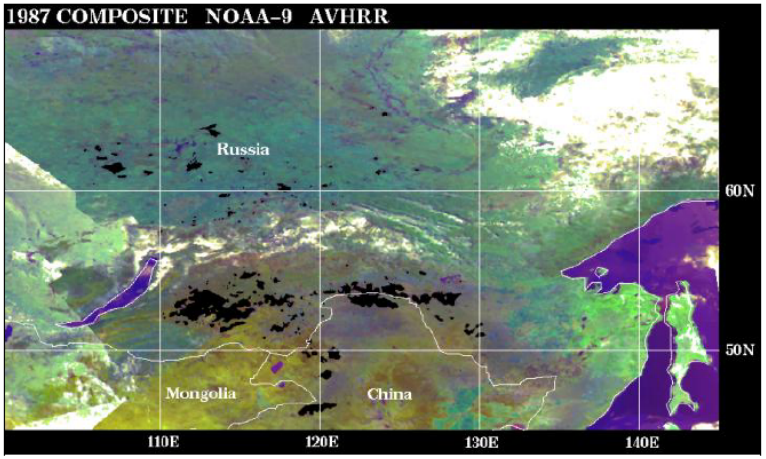
Fires in Russia

Burned areas:

Before 1980s fires annually burned 1.5 million hectares in the boreal forests.

In boreal zone fires burned annually average of 8 million hectares.

In 1987 satellite image evaluation revealed a total area burned in the East-Asian regions of Russia of about 14 million hectares.



NOAA-AVHRR-derived burn scar map of the fire season of 1987 (Cahoon et al. 1994).

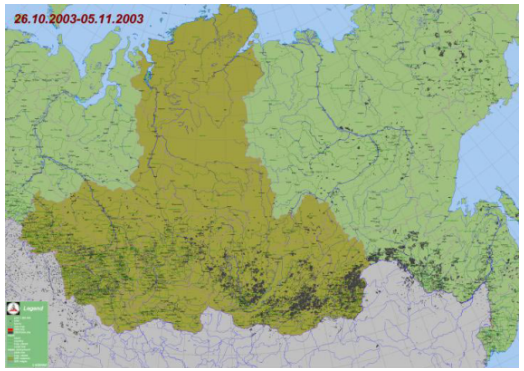
In 2000:

22.38 mln ha

3.11 mln ha of forest,
3.31 mln ha of woodland,
5.3 mln ha of grassland,
10.66 mln ha of other land
(7 mln ha croplands).

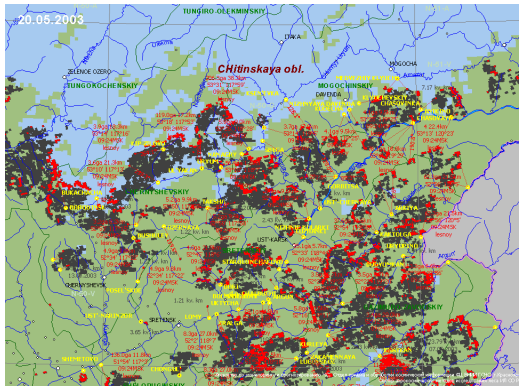
In 2003:

20.2 mln ha forest & other lands



NOAA-AVHRR-derived burn scar map of the fire season of 2003.

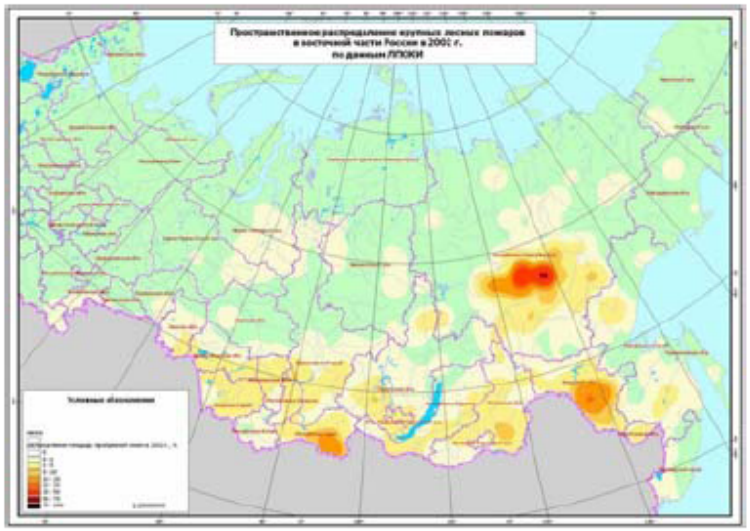
Source: Sukachev Institute for Forest



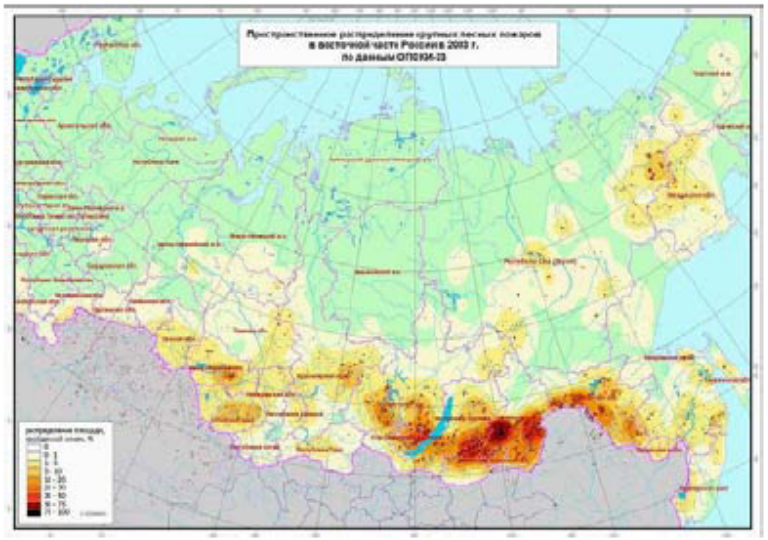
NOAA-AVHRR daily burn scar map.
Yakutia, 20 May 2003.

Source: Fire Laboratory of Sukachev Institute for Forest.

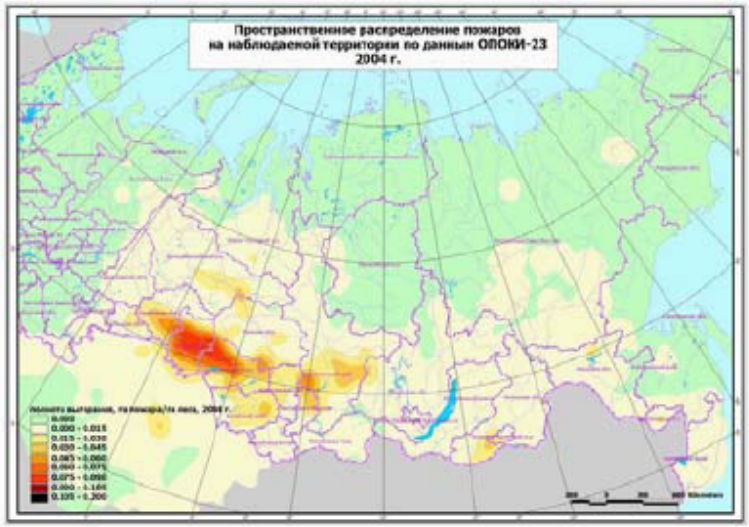
Fires in Russia



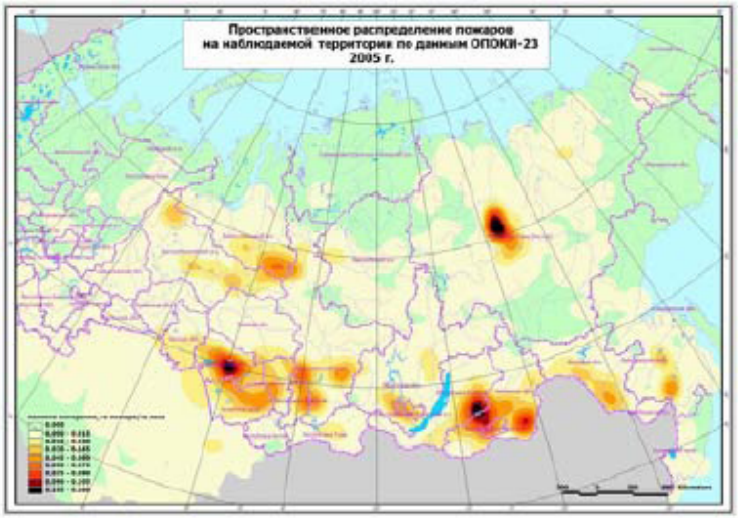
2002



2003



2004

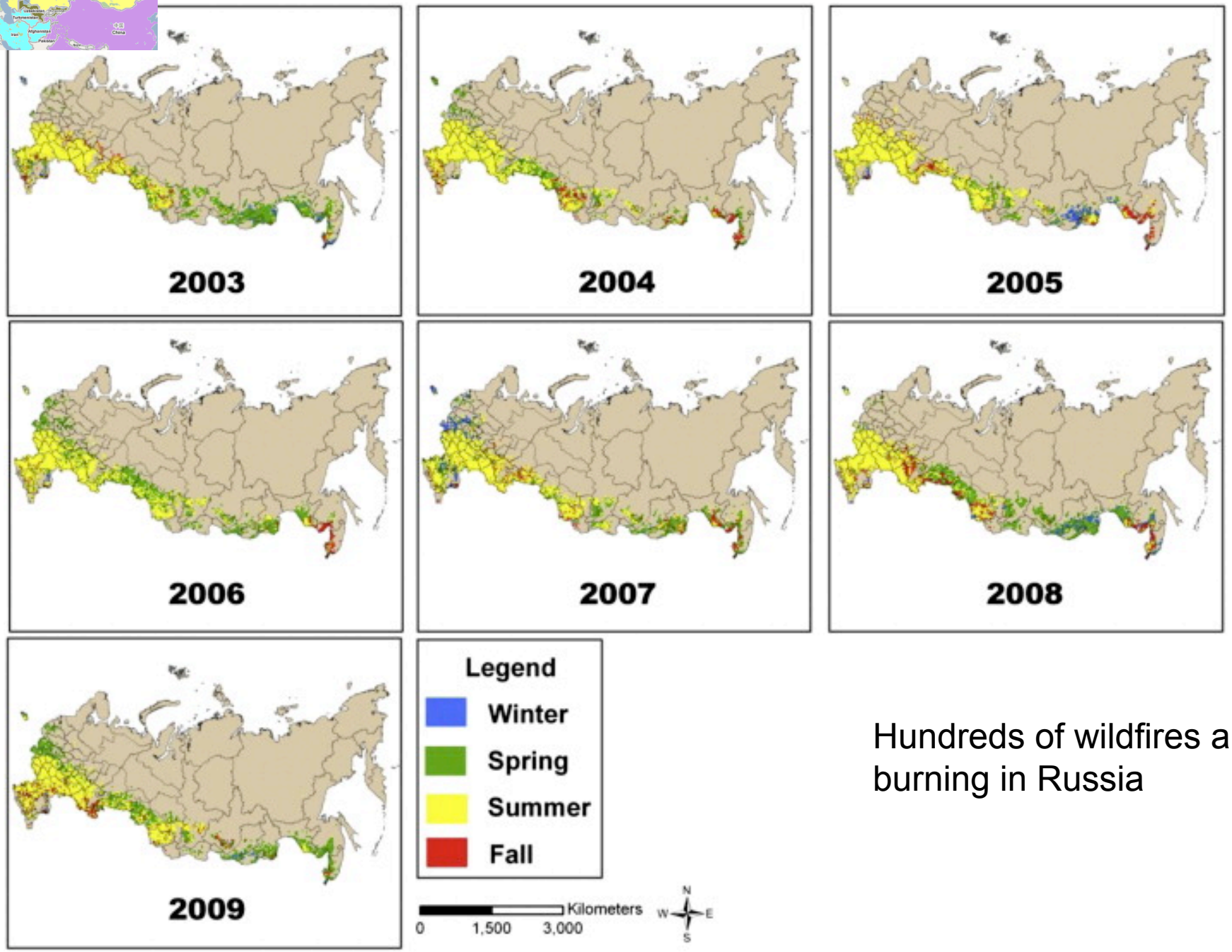


2005

Spatial distribution of burned areas in Central and Eastern Asian part of Russia, 1998-2005

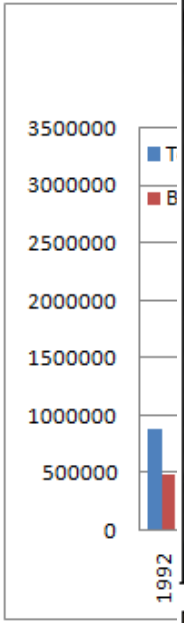
Sources: Sukachev Institute for Forest, Krasnoyarsk, Russia

Fires in Russia



Hundreds of wildfires are burning in Russia

Fires in Russia



A MODIS image shows smoke plumes generated by wildland fires burning in the Transbaikal Region in early May 2003 extended to Sakhalin, Japan, Alaska and Europe.

©Imagery / Photo: NASA

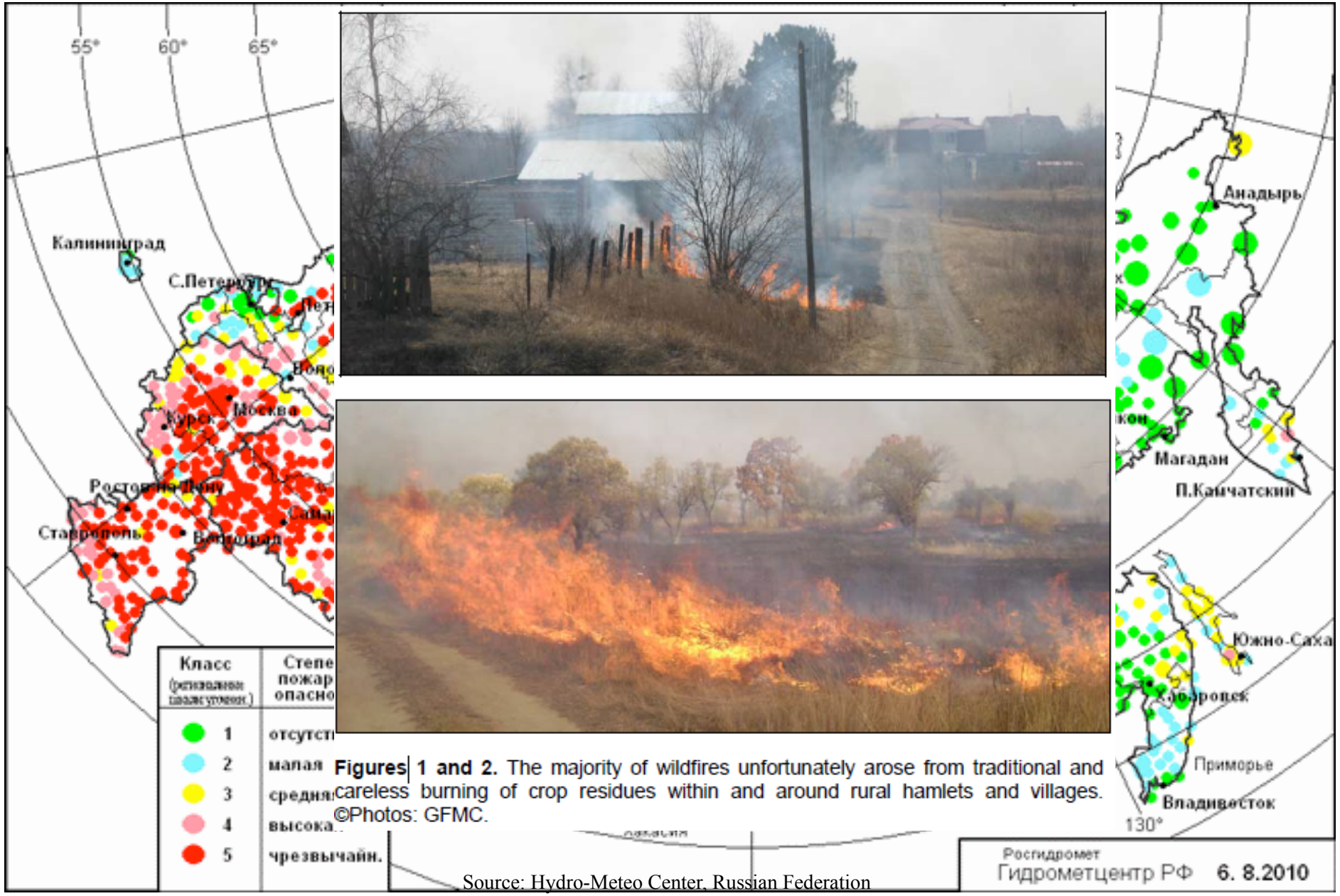
The fire-smoke pollution in Khabarovsk on 11 March 2008.

These extended smoke pollution episodes received limited to none attention outside of the affected regions.

Photo: GFMC.

Latest Fires in Russia

Fire Risks in the Russian Federation (5 August 2010)



Figures 1 and 2. The majority of wildfires unfortunately arose from traditional and careless burning of crop residues within and around rural hamlets and villages. ©Photos: GFMC.

Source: Hydro-Meteo Center, Russian Federation

Latest Fires in Russia

Information on Forest Fires in the Russian Federation (Status: Morning 17 April 2012):

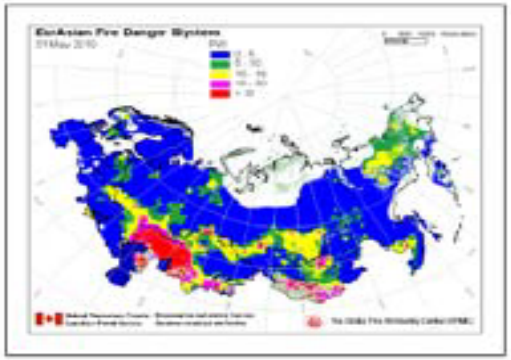
- A total of **165 forest fires** were controlled during the previous day (16 April 2012), including **7 large fires**
- As of morning of 17 April 2012 a total of **91 fires** are recorded which have affected a total territory of **1,966 hectares**, including 1,336 hectares of forests
- There are no threats to settlements and other objects of economy
- For suppression of fires **2,879 people, 594 technical firefighting units** and **16 aircraft** were involved
- The most difficult situation develops in the forests of the **Siberian Federal District**
- Republic of **Buryatiya** - 15 fires, area burned 97 ha
- **Zabaykalsky Krai** - 44 fires, 480 ha
- **Novosibirsk region** - 14 fires, 296 ha

Fire map, 17-18 April 2012.

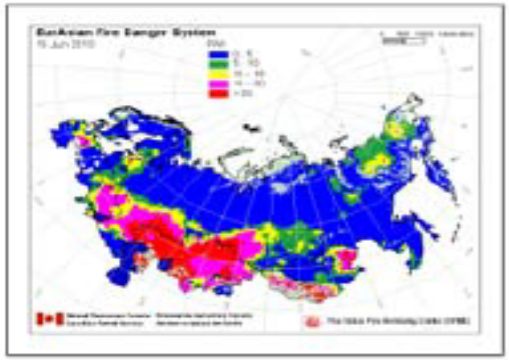
Source: Sukachev Institute for Forest

Fire Danger Rating System for Eurasia (May-August 2010)

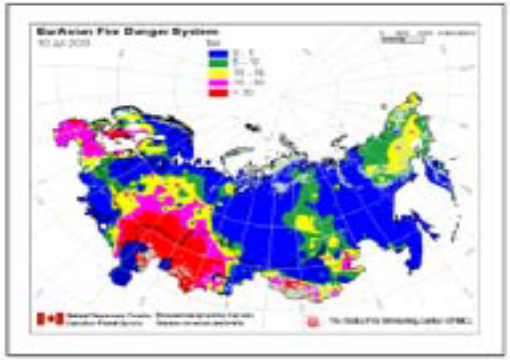
31 May 2010



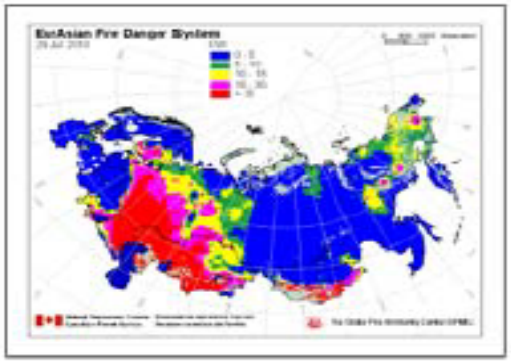
19 June 2010



10 July 2010

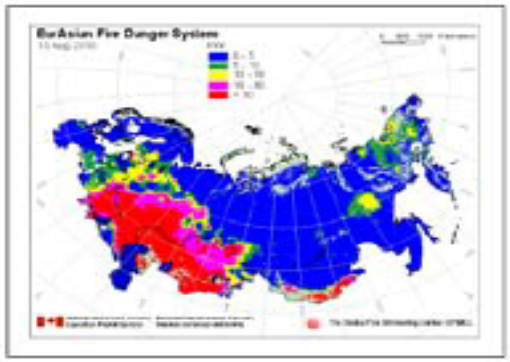


29 July 2010



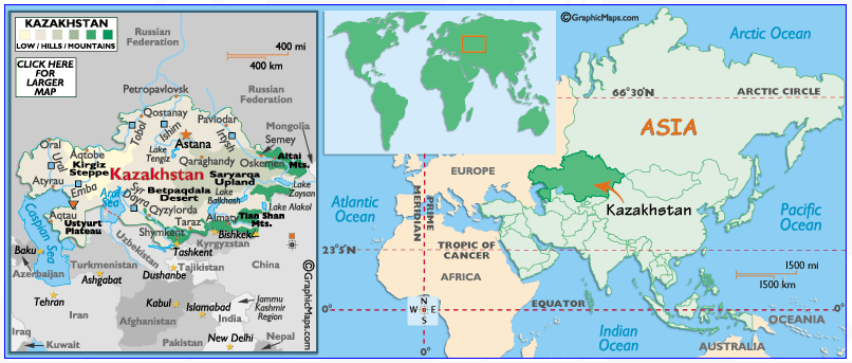
04 August 2010

13 August 2010



The Eurasian Experimental Fire Danger Rating system, a joint venture of the Canadian Forest Service (CFS) and the GFMC, showed increasing fire danger ("Fire Weather Index") starting in May 2010. ©Source: CFS/GFMC (http://www.fire.uni-freiburg.de/fwf/eurasia1.htm).

Fires in Kazakhstan



Specification:

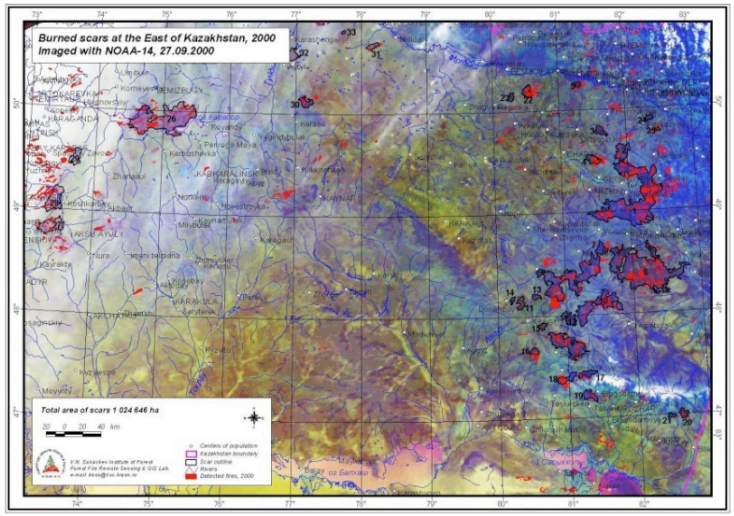
Territory – 2.7 million km^2
Climate – extremely continental
In drought periods, the fire danger increases and the number of wildfires occurring is extremely high.

Causes:

80% by human (public access to forests, burn off vegetation)

Main reasons:

For major increases in severity and extent of fire impacts (i.e. area burned) are the lack of timely fire detection and control systems which deteriorated by financing issues.



Burned area:

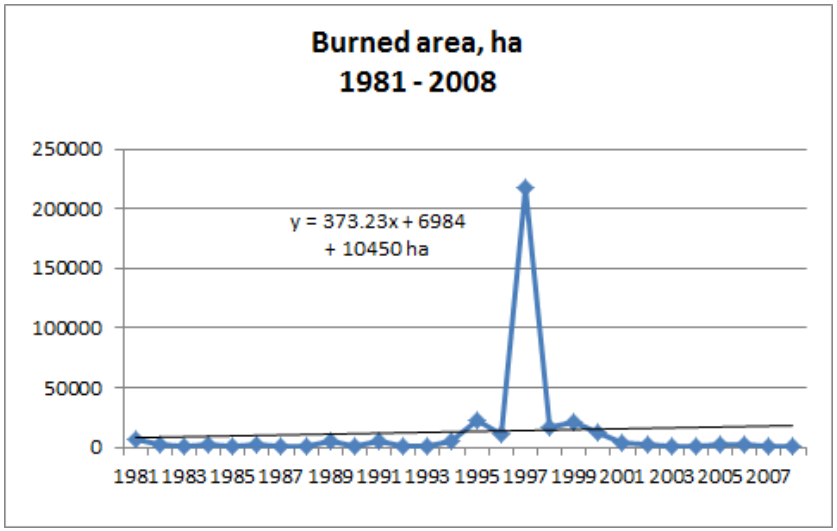
1985-1990: 4,000 hectares
1996-2000: 20,000 hectares
1997: 200,000 hectares (100,000 hectares pine forests of the Irtysh River watershed)

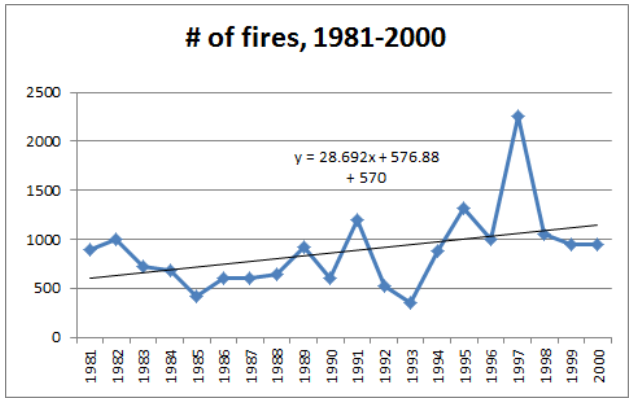
In Kazakhstan fire management has become an increasing concern (Arkhipov et al. 2000).

Fires in Kazakhstan

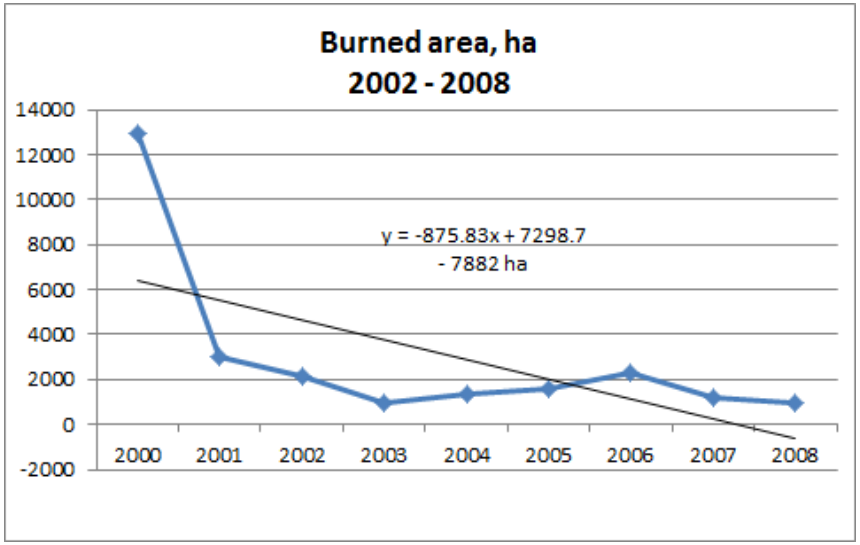
Forest fire statistics of Kazakhstan for the period 1980-2000.

Year	Number of fires	Area burned (ha)	Damages from wood losses (x 1000 US$)
1981	892	5 853	1 697.4
1982	1 004	2 086	604.9
1983	722	992	287.7
1984	685	2 082	603.8
1985	421	692	200.7
1986	605	2 467	715.4
1987	601	652	189.1
1988	641	1 112	322.5
1989	917	4 891	1 418.4
1990	605	1 277	370.3
Total 1981-1990	**7 093**	**22 104**	**6 410**
1991	1 194	4 942	1 433.2
1992	518	1 175	340.8
1993	354	731	212.0
1994	881	5 046	1 463.3
1995	1 320	22 540	6 536.6
1996	1 002	10 305	2 988.5
1997	2 257	216 950	62 915.8
1998	1 053	16 322	4 733.4
1999	948	20 691	6 000.4
2000	943	12 930	5 559.5
Total 1991-2000	**10 470**	**311 632**	**92 183.5**



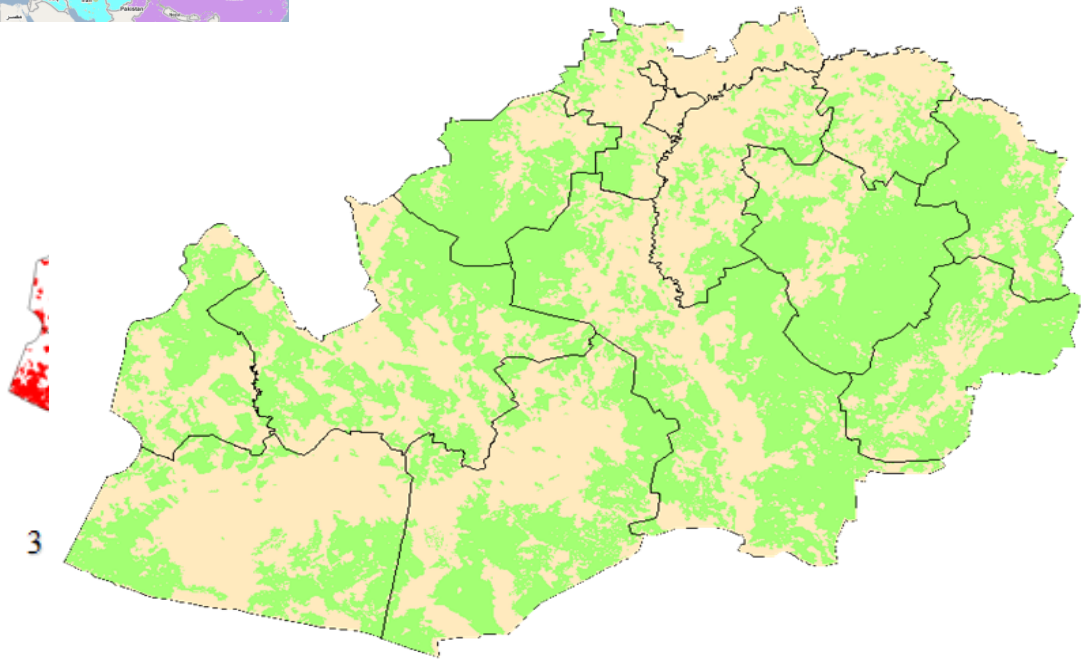


1997 – extreme year
Fire occurrence increase:
by 570 in 20 yrs



Fire danger classes

Fires in Kazakhstan



2004

Fire extent map of Kazakhstan, 2002 – 2008

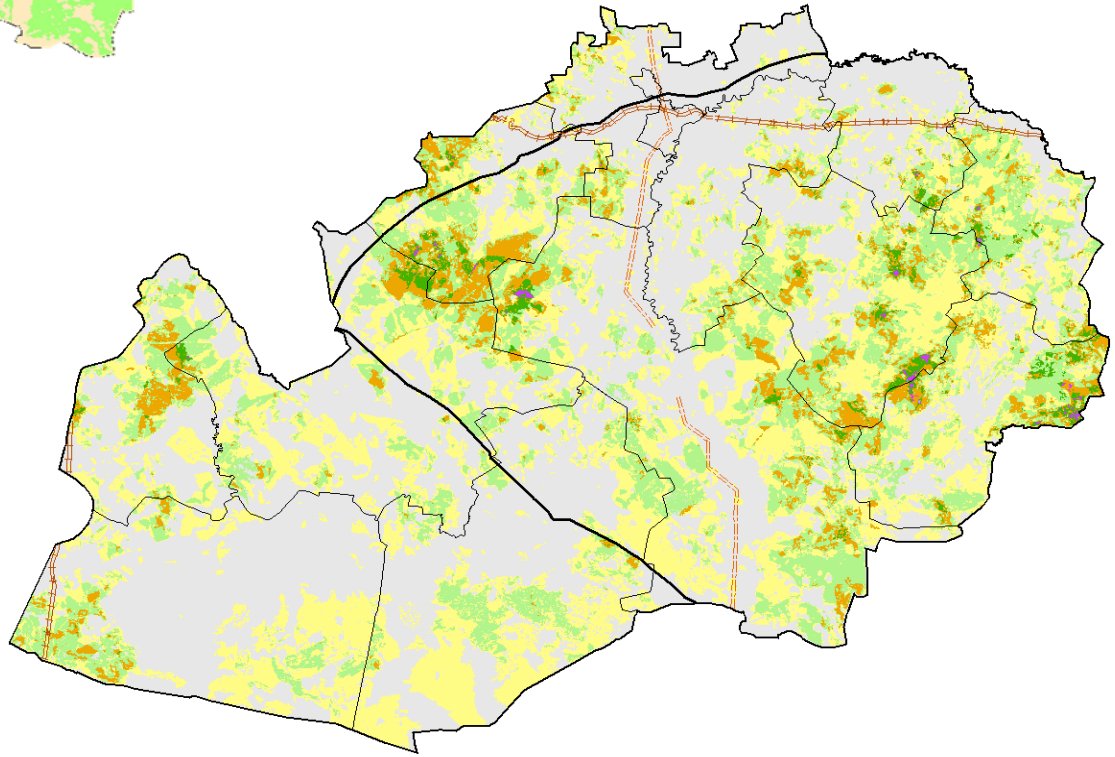
3

2005

2006

7
6
5
4
3
2
1

Fire frequency map of Kazakhstan, 2002 – 2008



1550 ths. ha

2272 ths. ha

Fires in China

Total forest cover – 158.9 million ha (16.55 %)
The potential timber supply – 11267 million stere (m^3)

Highest number and Largest sizes of forest fires occur in the 5 provinces: **Heilongjiang, Inner Mongolia, Yunnan, Guangxi and Guizhou.**

Forest fires: 42.5 % of total fires

In 1950 – 2000:

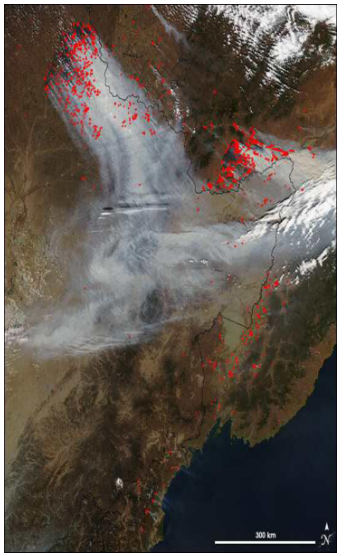
15 000 forest fires occurred & affected more than **20 million ha forest** lands.
The most prominent fire years:
1951, 1955, 1956, 1961, 1962, 1972, 1976, 1977, 1979 and 1987.

Causes:

Across China, humans cause more than **95 percent** of forest fires. In the Northeastern forest regions, lightning accounts for up to 30 percent of fire occurrences in some years.

RS Instruments:

NOAA/AVHRR
MODIS
FY etc.

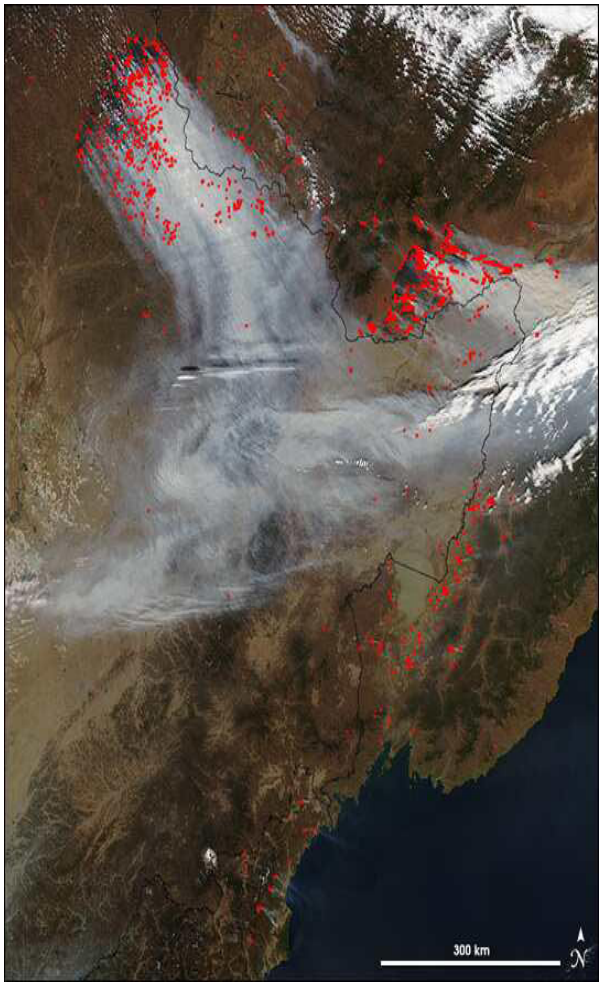


Fires in China

In 1987, a large fire occurred in the Greater Xingan Mountains, Heilongjiang province. (killed 213 persons, burned l.33 million ha area).

Of this area, 890 000 ha were damaged, with a loss of 39.6 million cubic meters of wood volume.

The forest cover rate of these regions has decreased by 14.5 percent from 76 percent to 61.5 percent. The fires caused high mortality to large areas of young, mature, and over mature forest stands.



Summary of major wildfire impacts on people, property, and natural resources during the 1990's (1990-1999) :

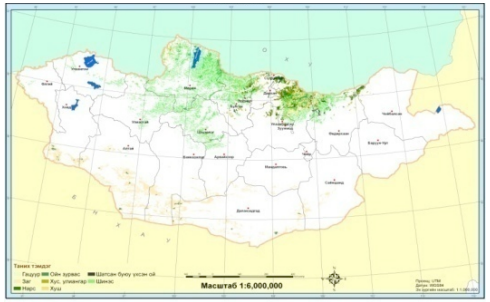
An average annual number of 5324 fires affected forests with an average annual area burned of 122036 ha (non-forest lands are not included in this figure).

Percentage	Northeast China	South and Southwestern
Percentage of forest fires	5	95
Percentage of national fire losses	60	40
Fire season peaks	May, Oct	Jan – Apr

Fires in Mongolia

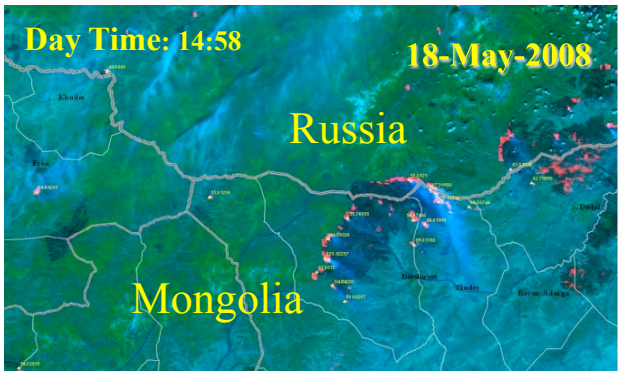
Specifications:

Natural zones: 6 different
(mountain taiga –> gobi desert)
Forest: 8.1 % (6.3% except saxaul forest)
Grassland: other part
Climate: severe continental cold and dry
Drought: 80%



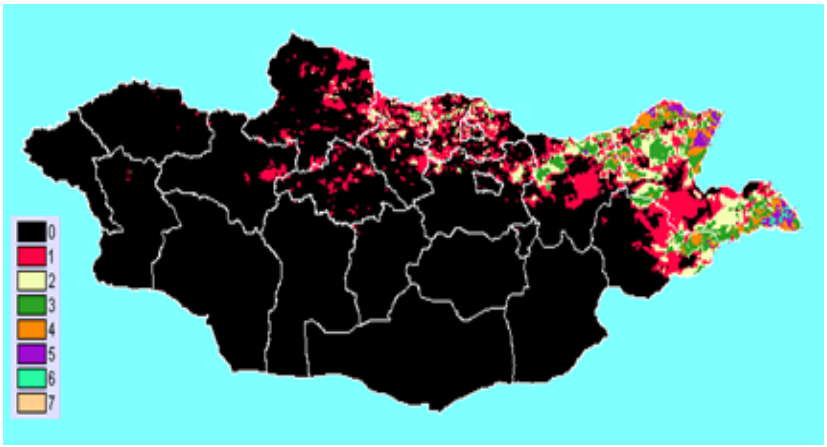
Cause:

90% by human (public access to forests, burn off steppe vegetation)



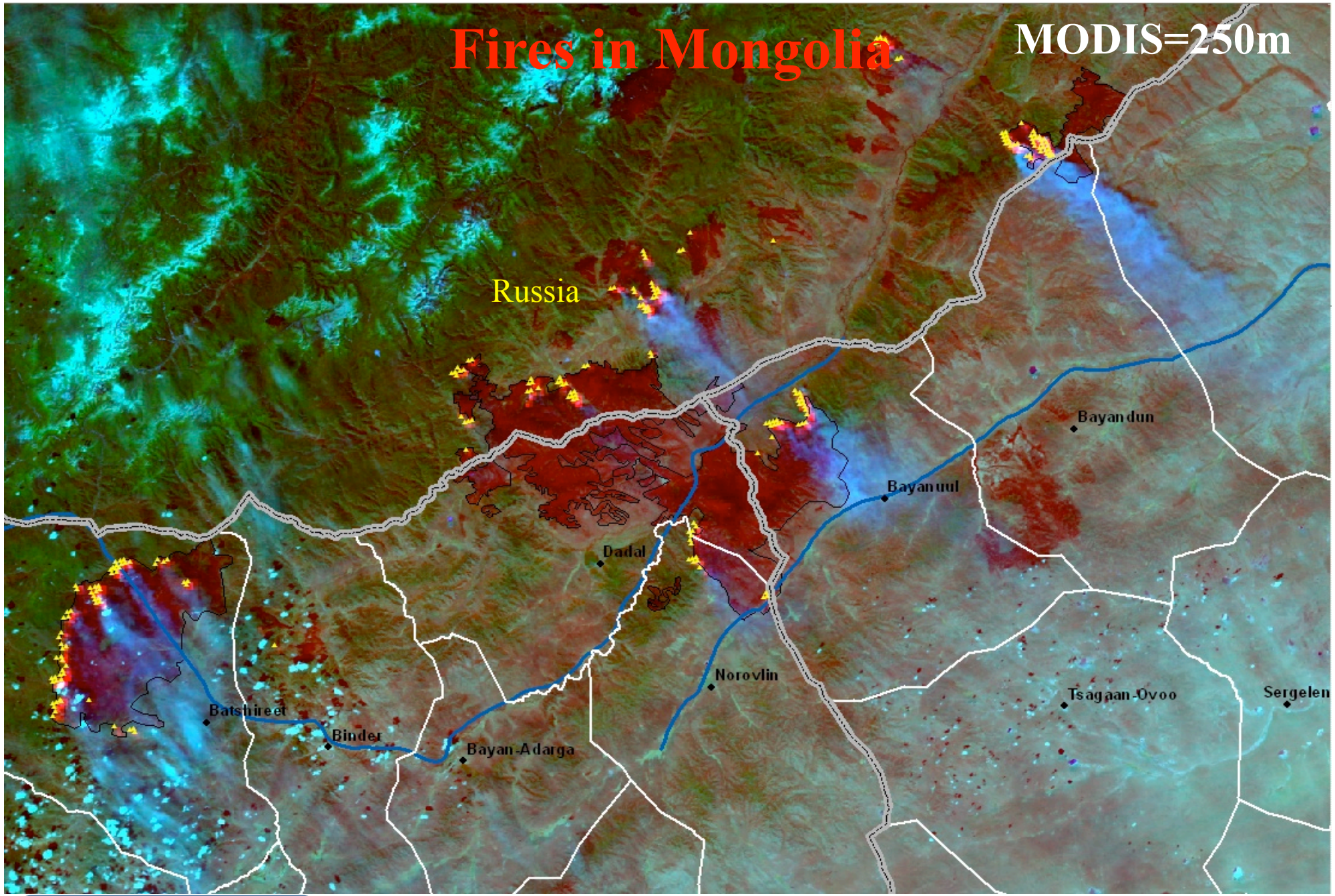
Fire seasons peaks:

80% - spring
5-8% - autumn



RS Instruments:

Since 1996: NOAA/AVHRR
Since 2008: MODIS



23-Apr-2008
Time: 05:17

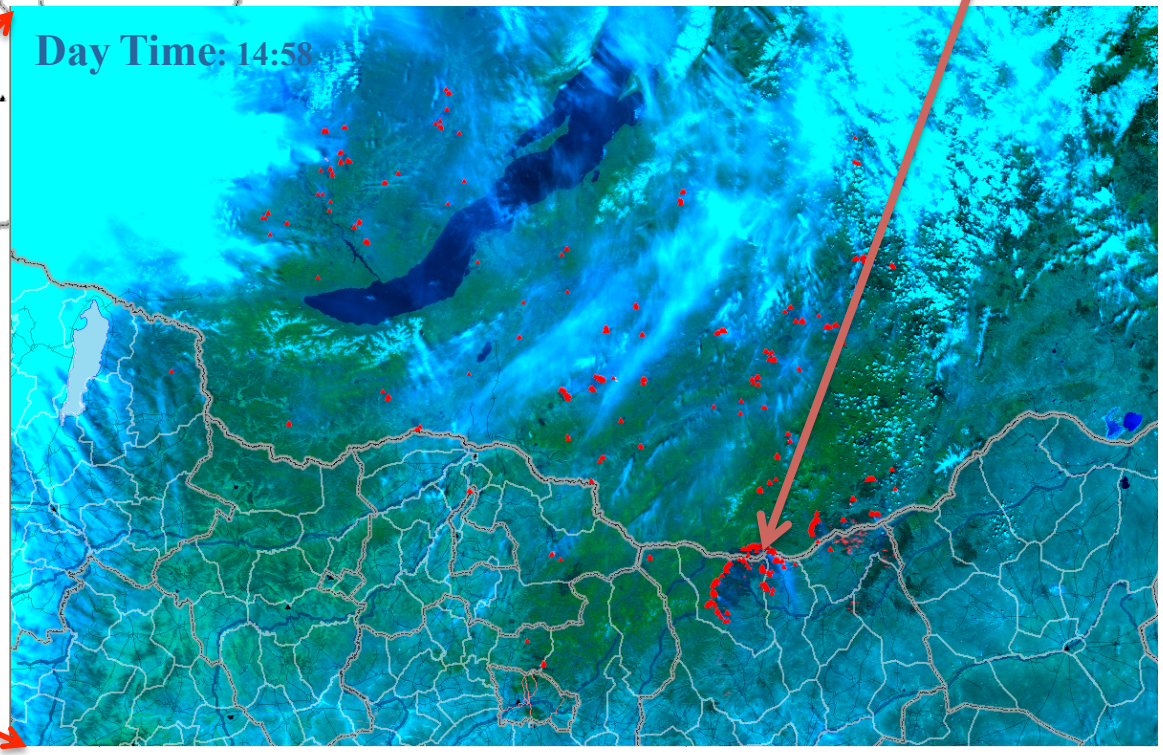
Hec = 47387

Forest and Steppe Fires

Active fires detection technology: by MODIS data

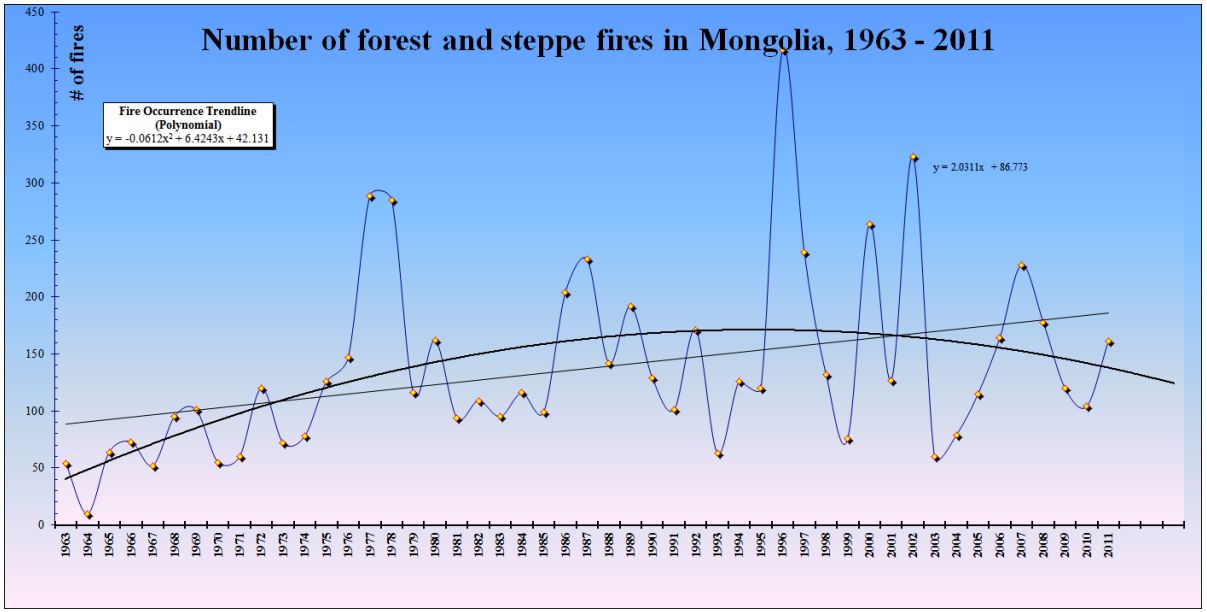
18-May-2008

Product of MODIS:
MOD14
Hot spot's location

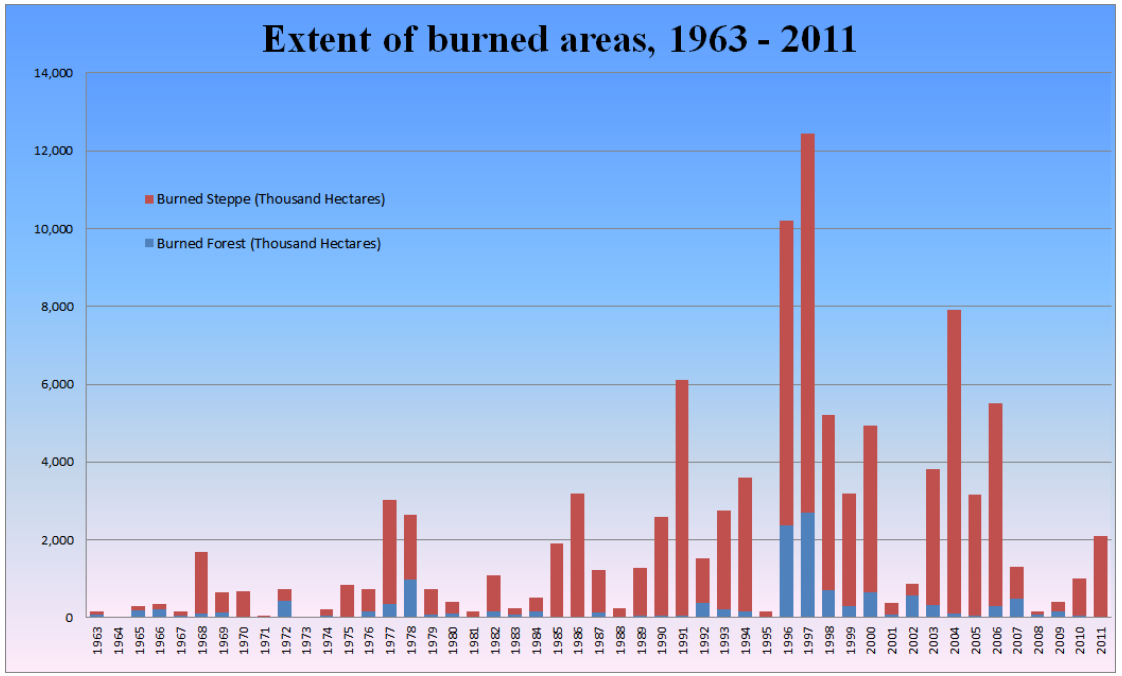


Composite image
R = band21
G = band1
B = band2

Fire Statistics, 1963 – 2011



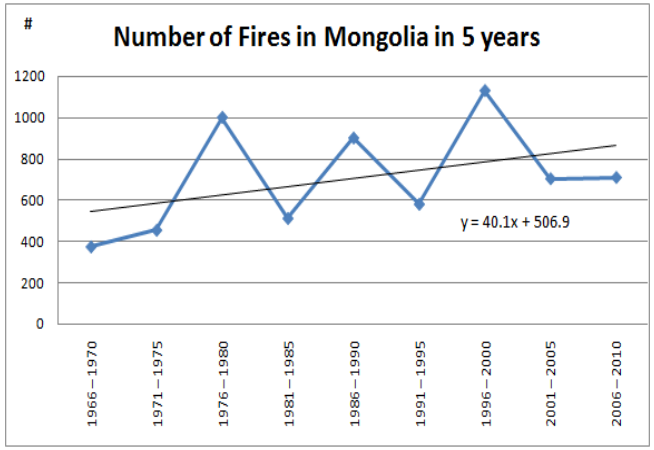
Maximum number of fires:
1996 – 415 fires
Trend: slightly decreasing

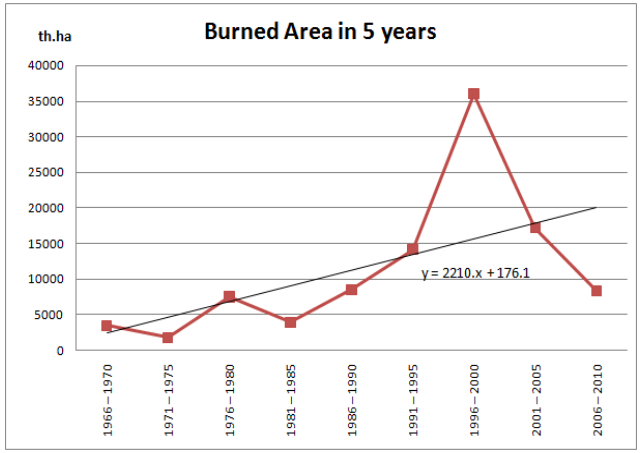


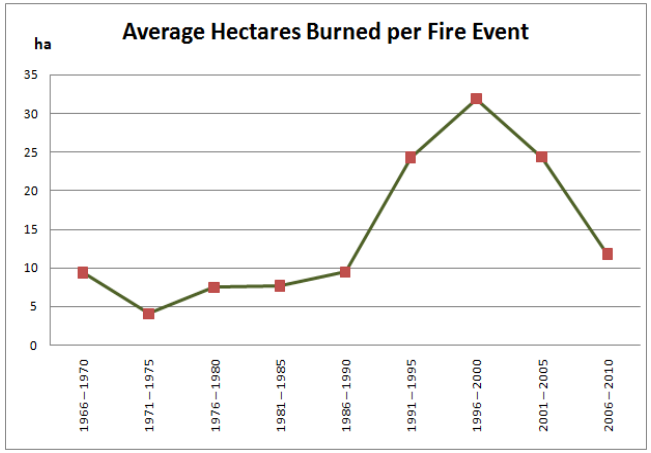
Maximum burned area:
1997 – 12’440’000 ha
Trend: increasing
Total Burned area: 1016039.7 th.ha
Forest: 14%
Grassland: 86%

Fire statistics in 5 years

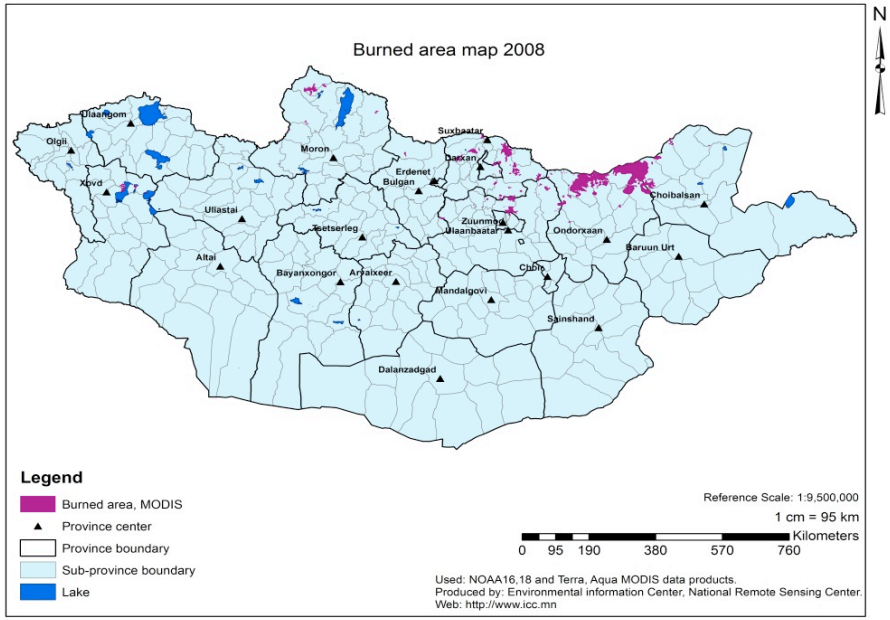
Years	Number of Fires	Total Burned Area (Thousand Hectares)	Average Hectares Burned per Fire Event
1966 – 1970	376	3520.3	9.4
1971 – 1975	456	1856.6	4.1
1976 – 1980	999	7529.0	7.5
1981 – 1985	513	3925.2	7.7
1986 – 1990	900	8516.0	9.5
1991 – 1995	581	14144.6	24.3
1996 – 2000	1128	35979.4	31.9
2001 – 2005	704	17205.6	24.4
2006 – 2010	710	8388.6	11.8

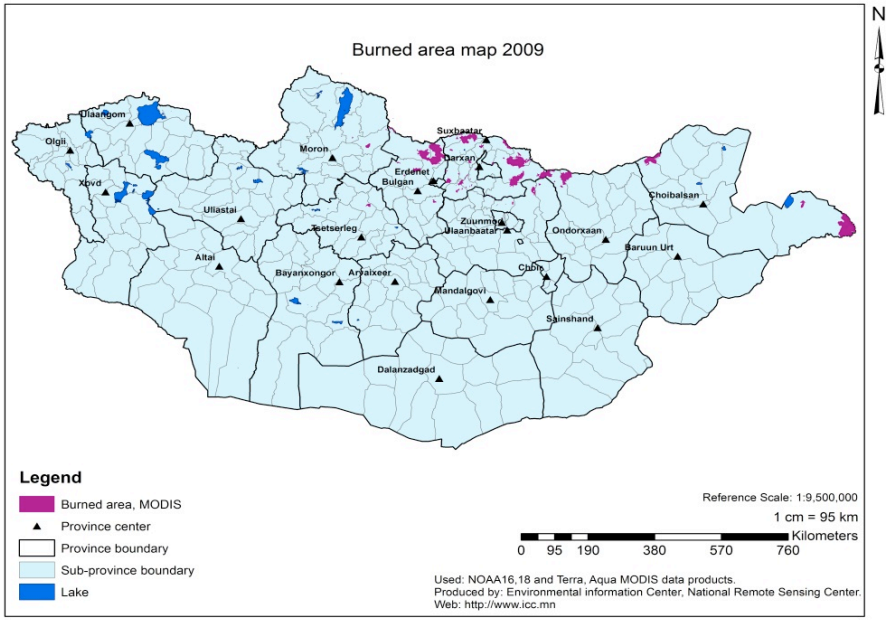


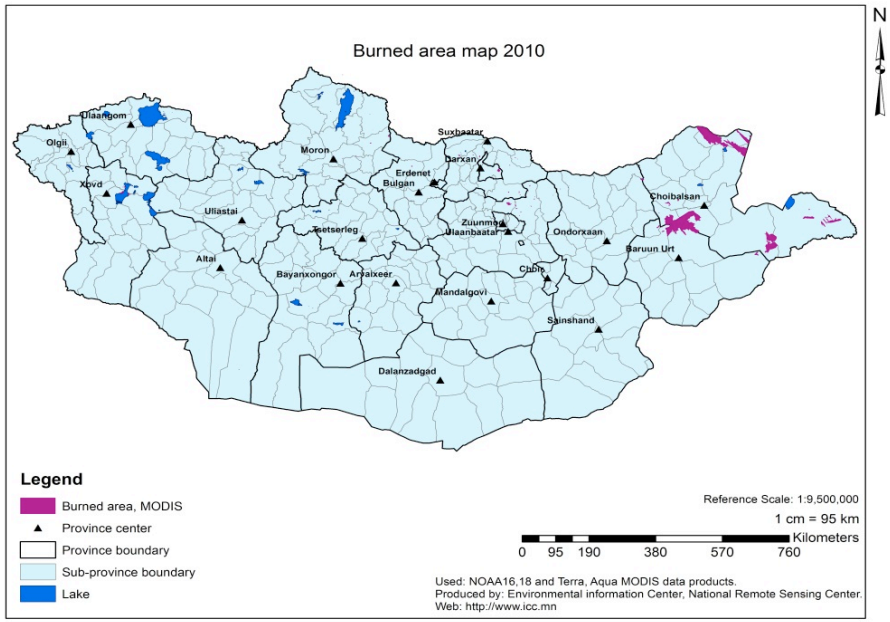


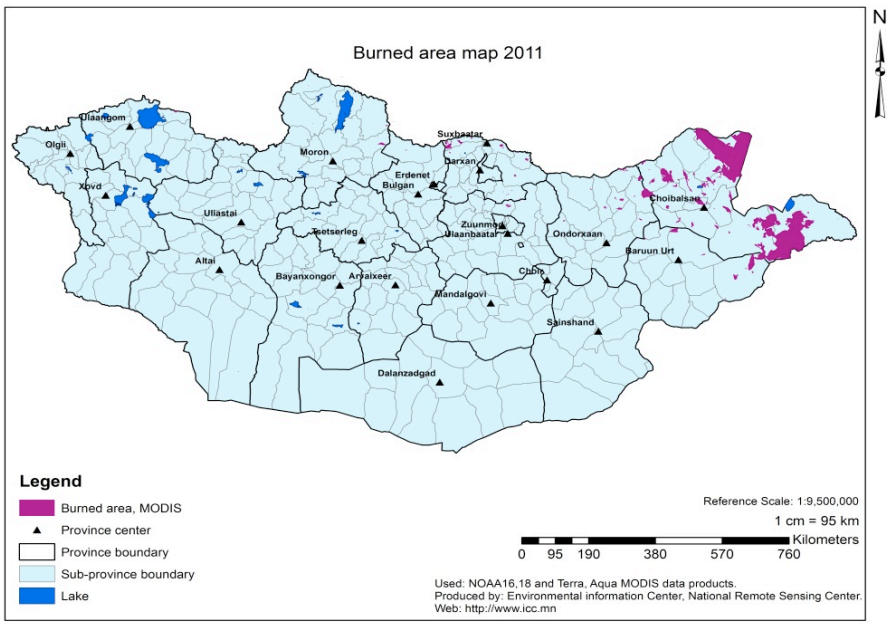


Burned area by NOAA

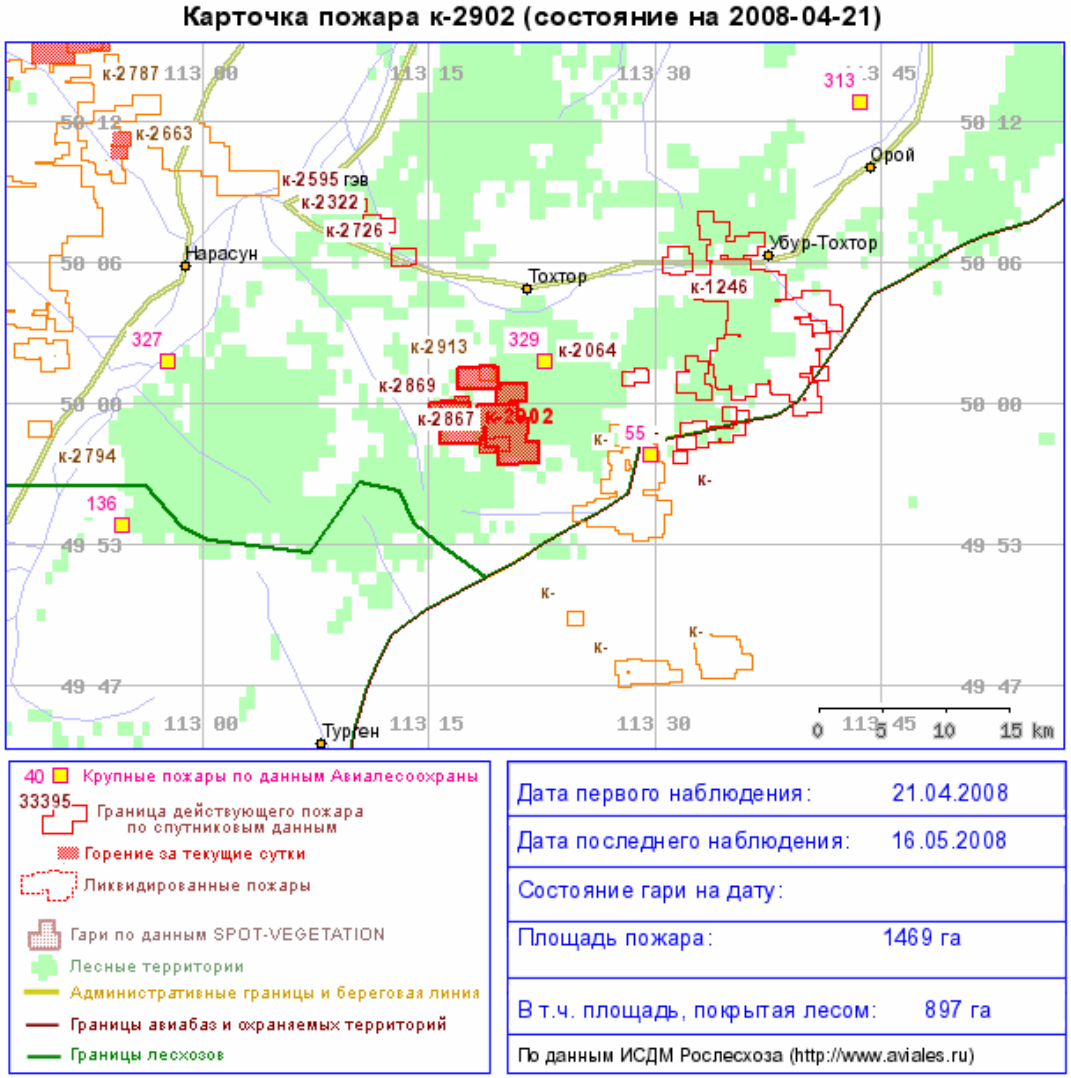




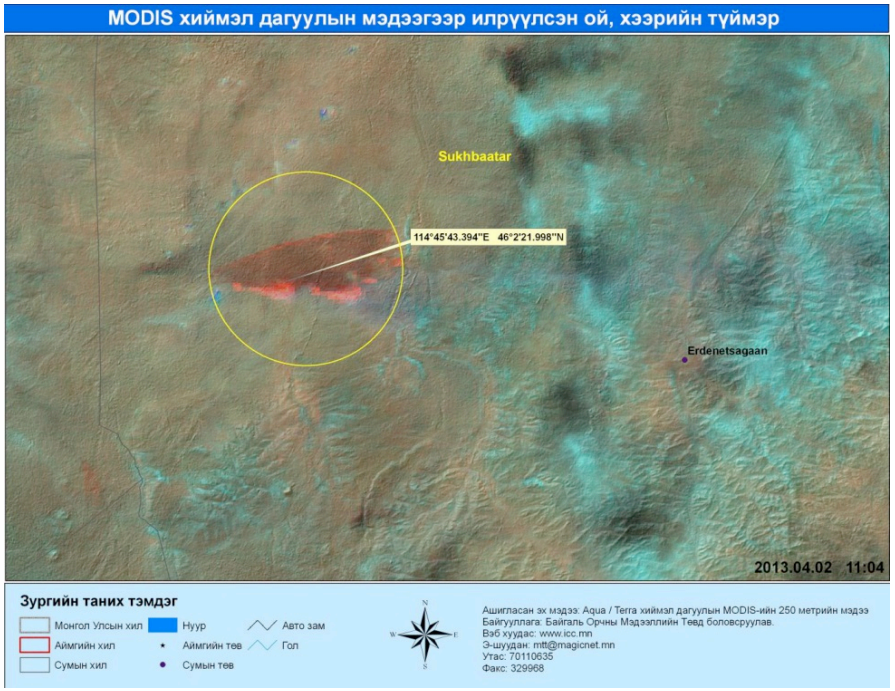




Trans-boundary Fires from Russia



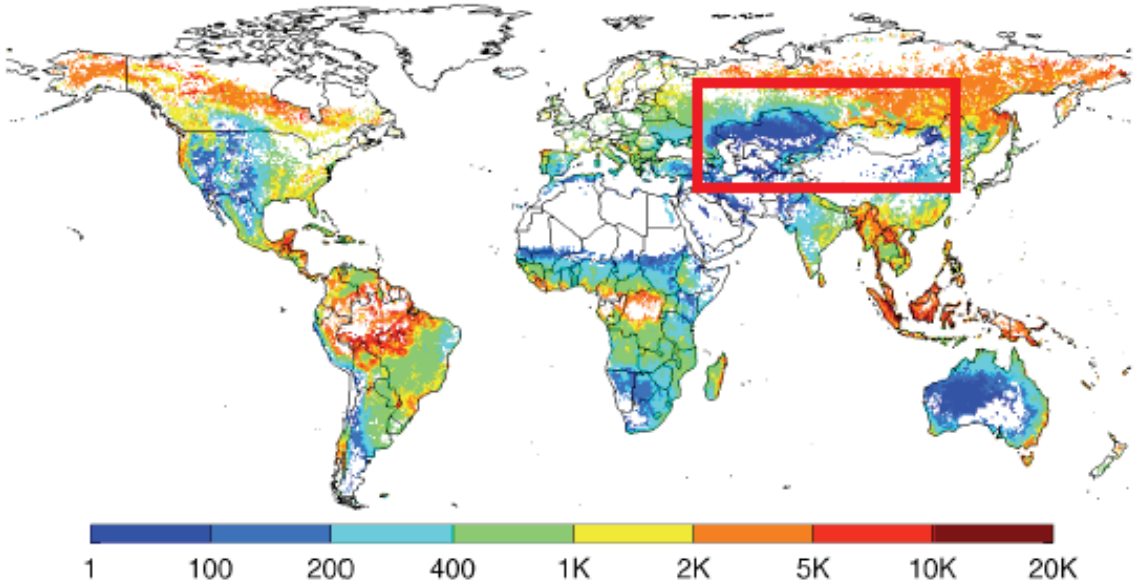
Fires escaped from RUSSIA to MONGOLIA, 21 April 2008



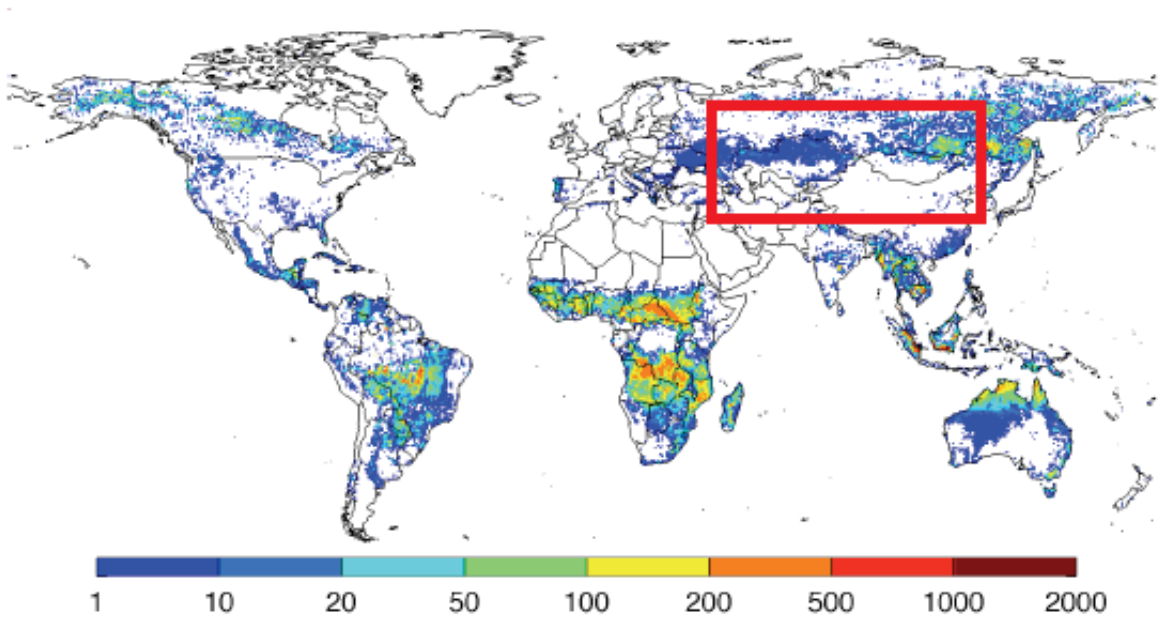
Delivery of operational fire map, 02 April 2013

Trans-boundary Fires from Mongolia to China

Fuel consumption & Fire Carbon Emissions



Fuel Consumption
(g C per m^2 of burned area), averaged over 1997-2009

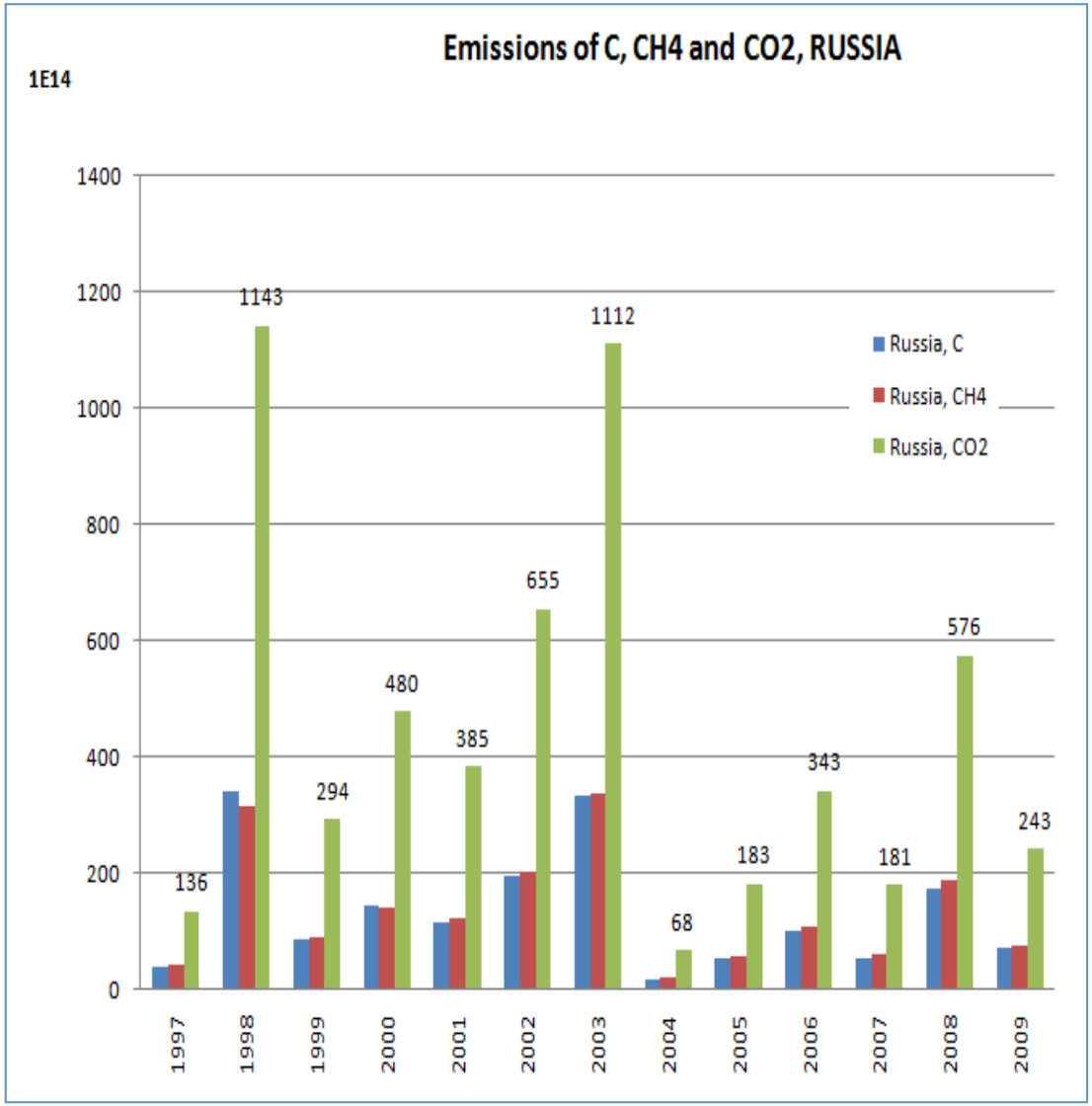


Mean annual Fire Carbon Emissions (g C per m^2 per year), averaged over 1997-2009.

The quantity is the Product of fuel consumption and the burned area within the grid cell, divided by the total area of the grid cell

Source: G. R. van der Werf et al.: Global fire emissions

Emissions of Central Asian countries in GFED3



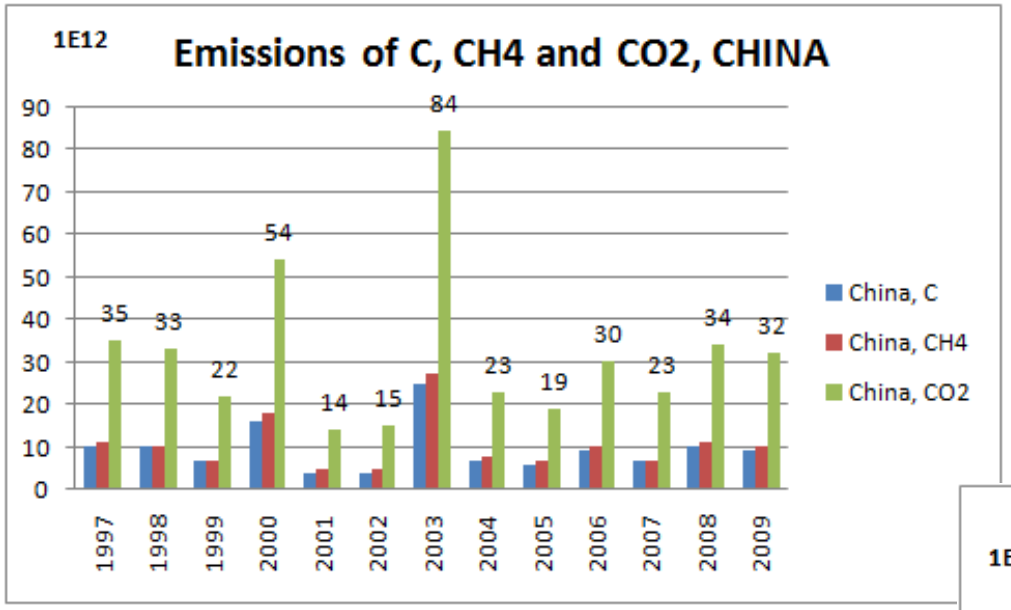
RUSSIA – highest emitting country in the region

Fire in the boreal zone is a significant source of greenhouse gases. Due to different approaches, estimates of **annual carbon emissions** to the atmosphere caused by fires in the early 1990s (for relatively "normal" by fire danger years) ranged from 35 to 93 million tons of carbon (Isaev and Korovin 1999) to 125±21 million tons (Shvidenko and Nilsson 2000), of which post-fire biogenic flux comprised about 50%.

Fire generates from **30 to 40 %** of the total **carbon flux** emitted to the atmosphere by all human-induced and natural disturbances in the northern Eurasian **boreal forests**.

Source: GFED based on van der Werf et al. 2010

Emissions of Central Asian countries in GFED3

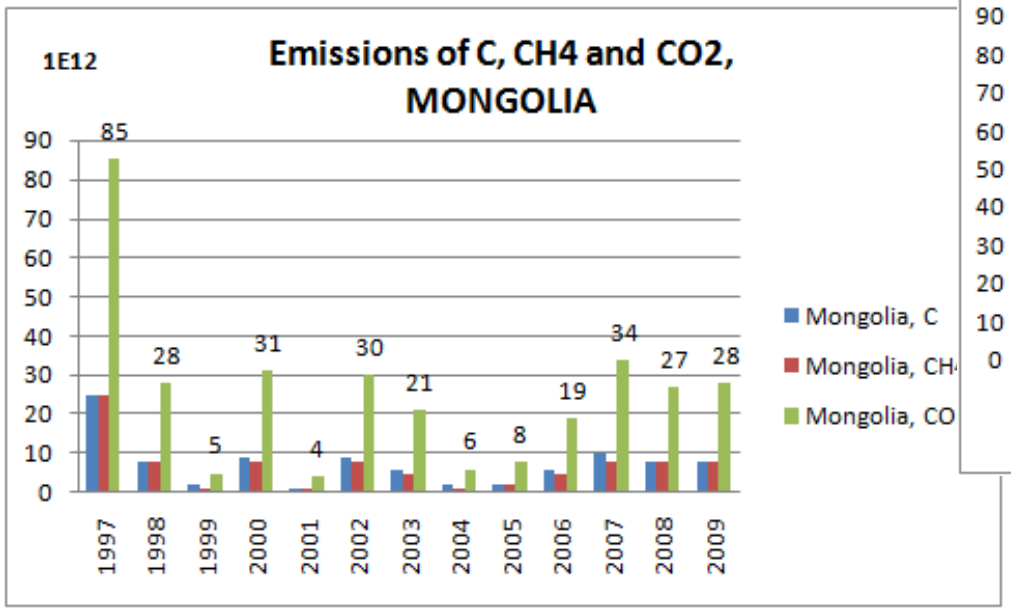


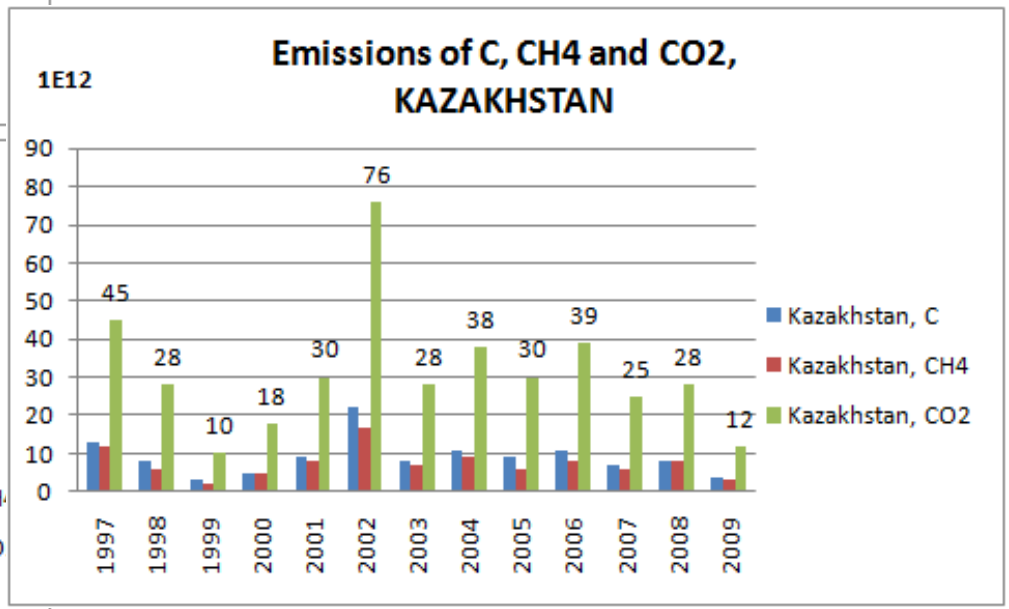
Secondary emitting countries in the region:

China

Mongolia

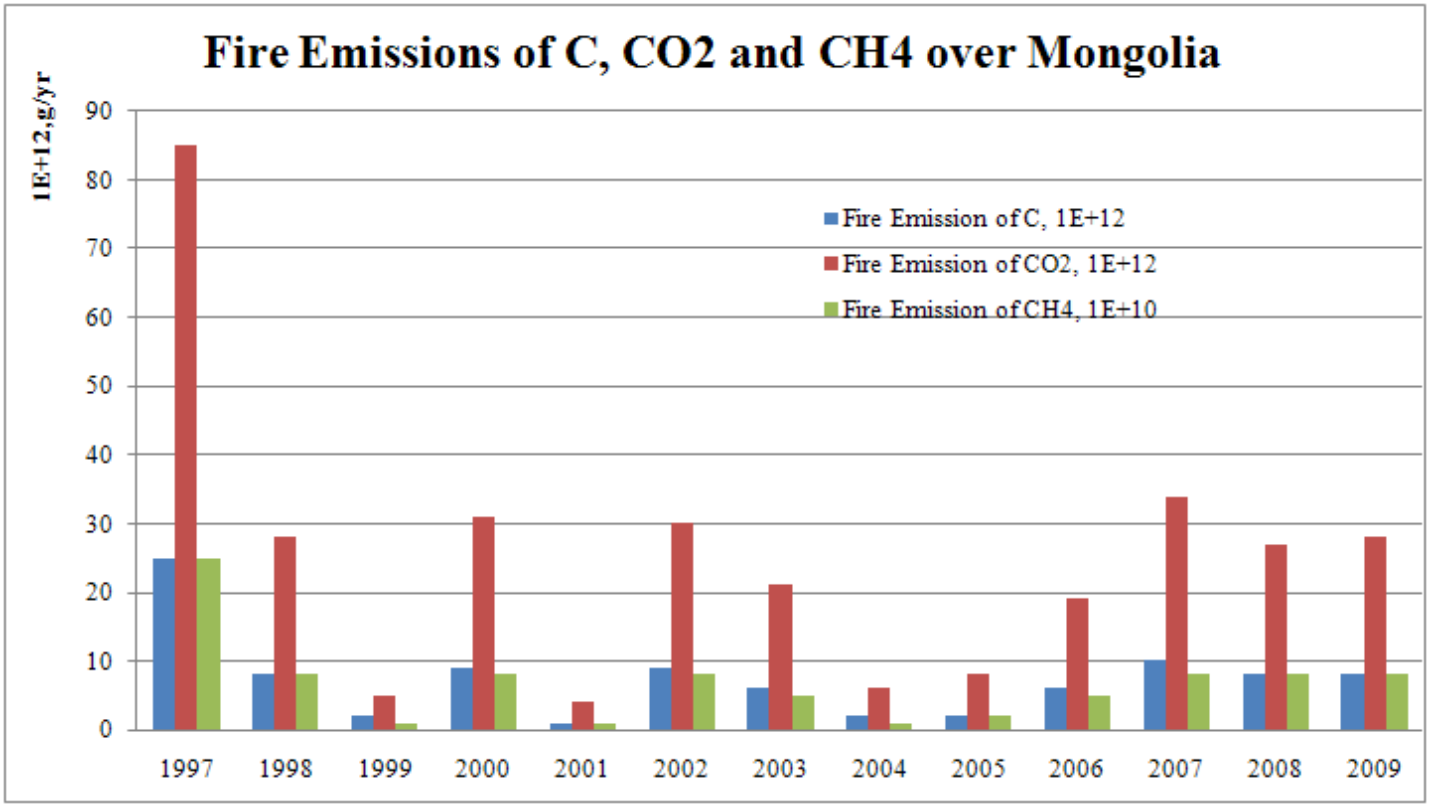
Kazakhstan



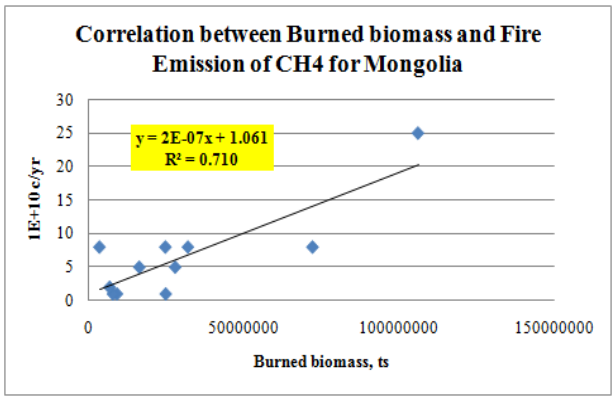


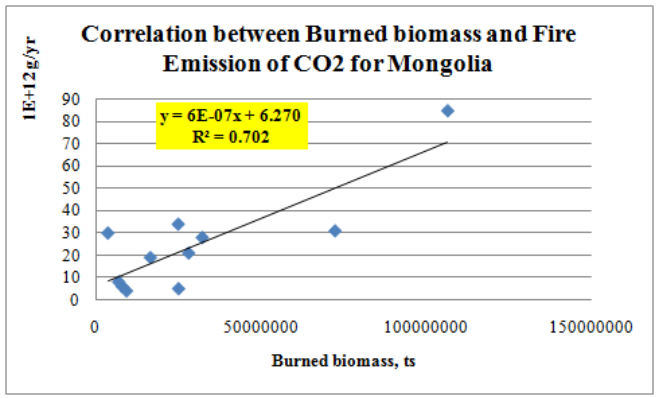
Source: GFED based on van der Werf et al. 2010

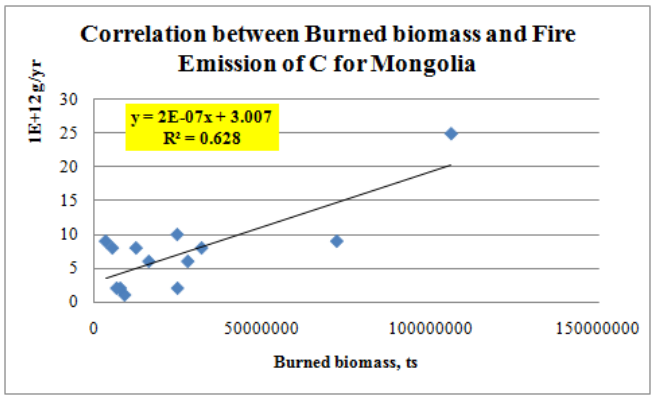
Biomass burning emissions of Mongolia, GFED3



Source: GFED3 based on van der Werf et al. 2010



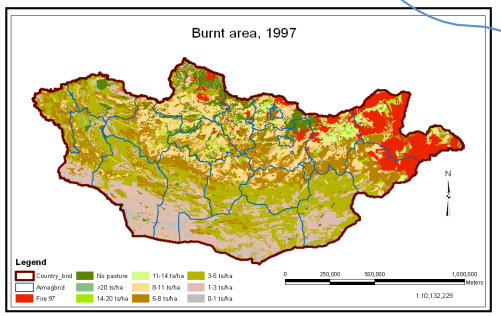


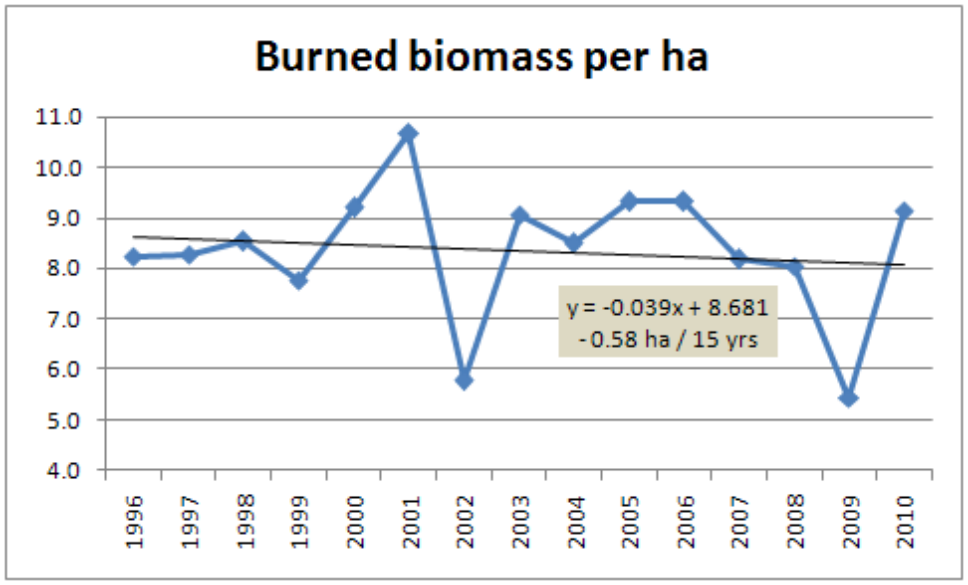


r=0.79-0.84

Burning biomass in Mongolia

Pasture Biomass Map ↔ **Burned Area GIS techniques** → **Burned Biomass Quantity Statistics 1996-2010**



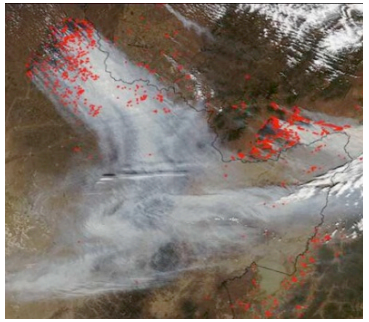


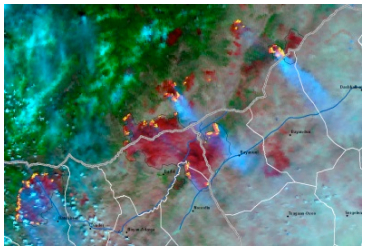
Years	Total burned area, ha	Total burned biomass, ts/ha	Burned biomass per ha area
1996	11,146,582.84	91,900,499.49	8.24
1997	12,840,587.58	106,228,449.24	8.27
1998	3,750,466.88	32,018,024.26	8.54
1999	3,199,709.26	24,857,472.19	7.77
2000	7,847,866.65	72,197,949.68	9.20
2001	855,241.39	9,112,004.08	10.65
2002	603,218.23	3,486,229.58	5.78
2003	3,083,190.77	27,910,489.36	9.05
2004	922,214.32	7,830,604.48	8.49
2005	725,093.30	6,756,216.46	9.32
2006	1,752,419.42	16,330,429.18	9.32
2007	3,026,175.43	24,742,481.26	8.18
2008	1,560,526.49	12,532,639.53	8.03
2009	1,004,219.31	5,475,135.04	5.45
2010	1,005,322.70	9,189,426.40	9.14

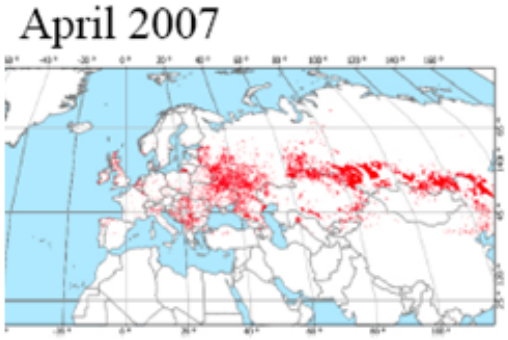
Over 200 types of pasture with more than 2600 species and the yield amount ranges between 0 to 4000 kg/ha.

Common problems of Central Asian countries:

1. **Human caused fire** is dominant and number of fire is increasing
2. **Land covers and Land use** are changing (urban growth, degradation, deforestation, desertification etc.)
3. **Fire management** and **biomass burning monitoring** are limited (institutional weakness, economic constraints), No long term plans or **no Framework** for the Central Asian regional scale
4. **Trans-boundary fire** occurrences are not declining
5. **Lack of awareness**, adequate policies and commitments
6. **Not** full **data collection** of burned area
7. **Lack** of both human and technological **capacities** within the region
8. **No** "close" **collaboration** within the countries of CA region



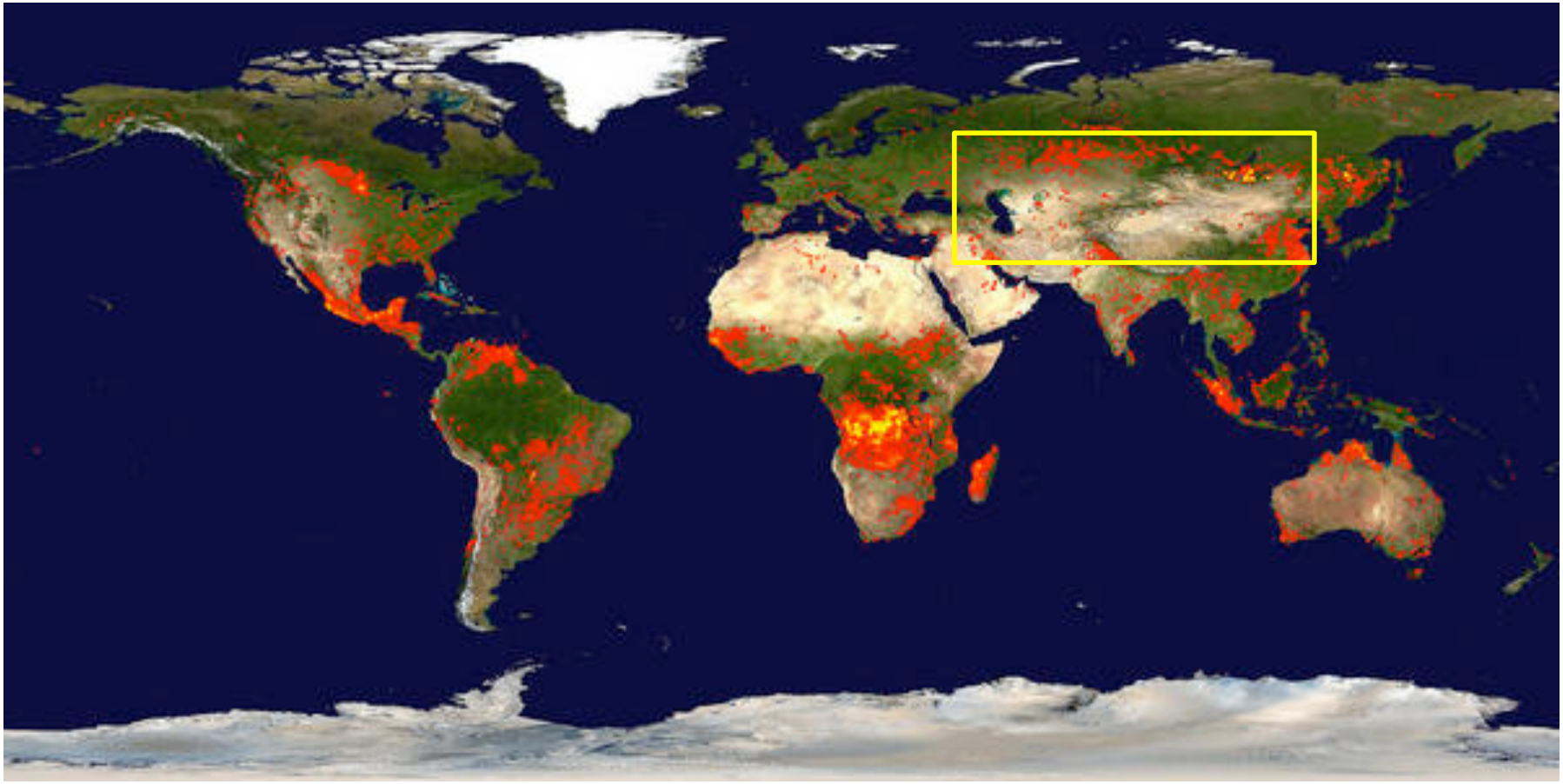




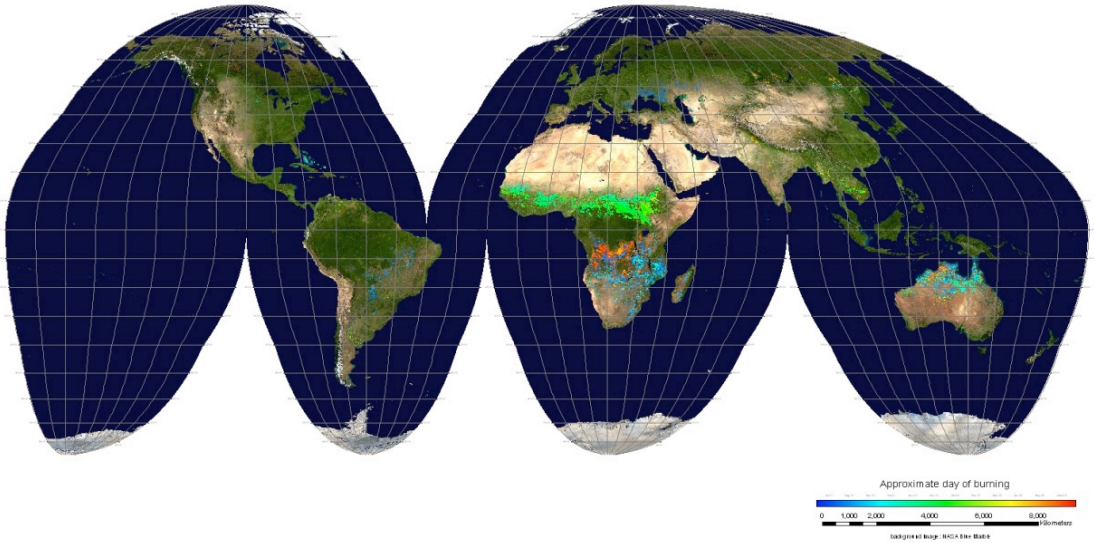
What we need to do for Central Asia ?

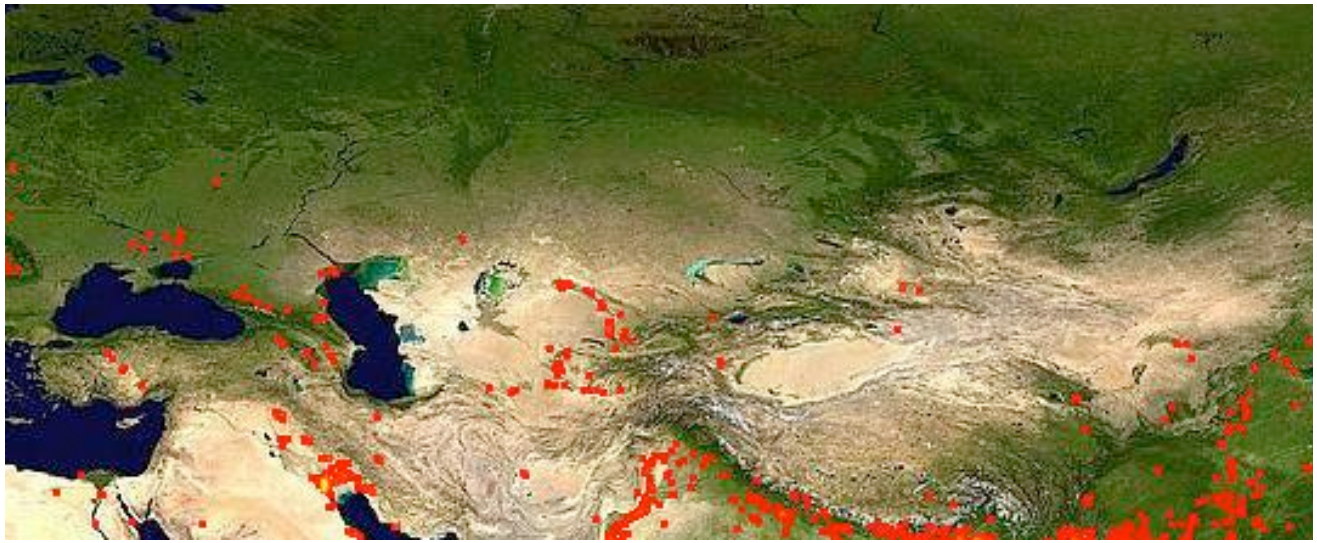
1. To develop shared **information tools/methodology** for sustainable monitoring and estimation capabilities for the wildfire, burning biomass and fire emissions in the CA region
2. To deeply activate or strengthen the international/regional and bilateral **cooperation** to collaboratively address the LCLUC, fire, biomass burning and emission related problems
3. To reduce the incidence and extent of **uncontrolled** fire burning and its adverse **impacts**, especially for reduction of GHG emissions
4. To enhance the **capacity building** in the CA region

Global Fire Map, May 21 – 30, 2000 – 2009



MODIS Rapid Response System





Thank you for your kind attention!