

Black Carbon Emissions from Biomass Burning in Northern Eurasia: 2002 – 2012

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Objectives

- Develop high spatial (**500 m x 500 m**) and temporal (**daily**) distribution of black carbon emissions from fires in Northern Eurasia from 2002 to 2012
- Identify the major sources of fires in different regions: forest, grassland, shrubland, and agriculture
- Analyze seasonal and interannual variability of sources, transport and deposition of black carbon from fires in Northern Eurasia to Arctic ice

Computation

$$E = A \times FL \times \alpha \times EF$$

E: amount of emitted black carbon at any spatial and temporal scales

A: area burned

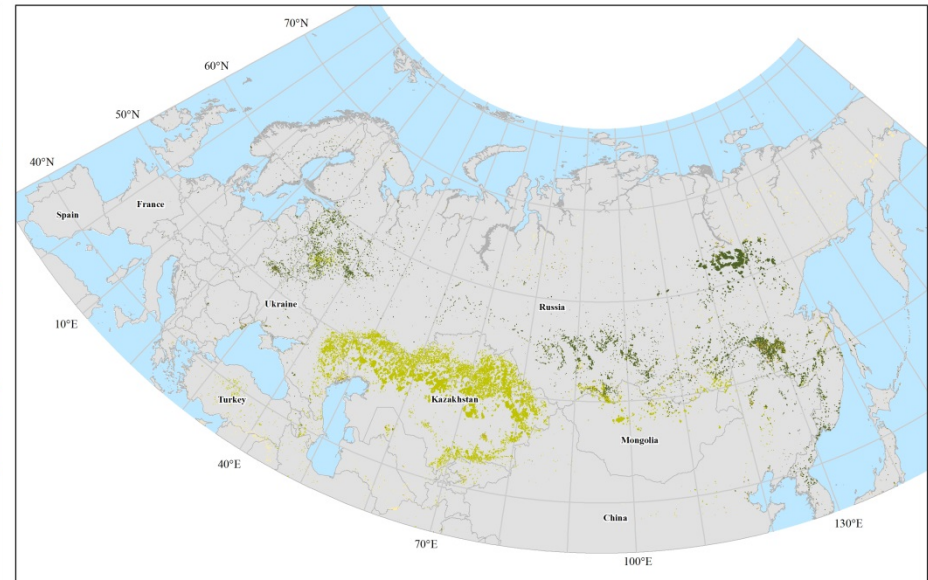
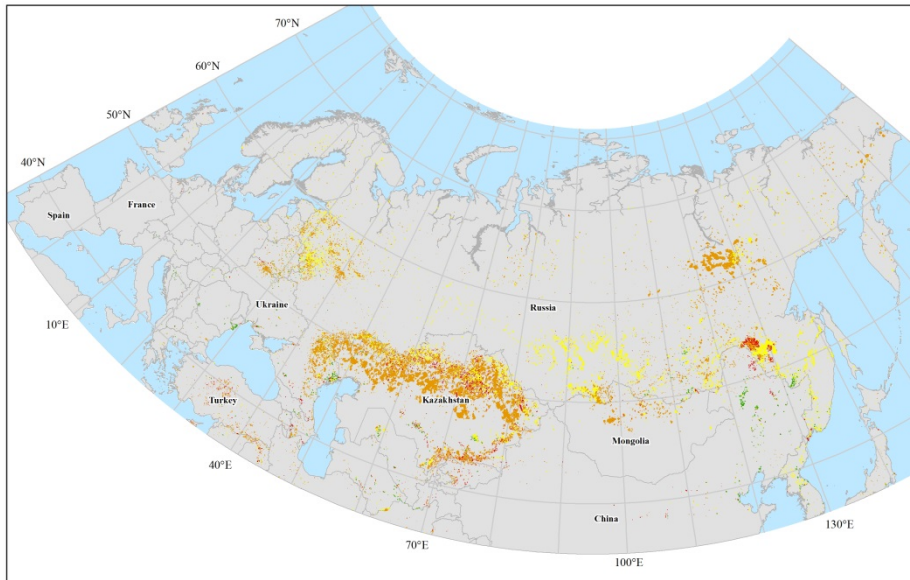
FL: fuel loading, or the amount of fuel to be burned

α : combustion completeness, or % of biomass burned

EF: emission factor of black carbon

Northern Eurasia 2002

Burned Area by Months and Land Cover Type



Months

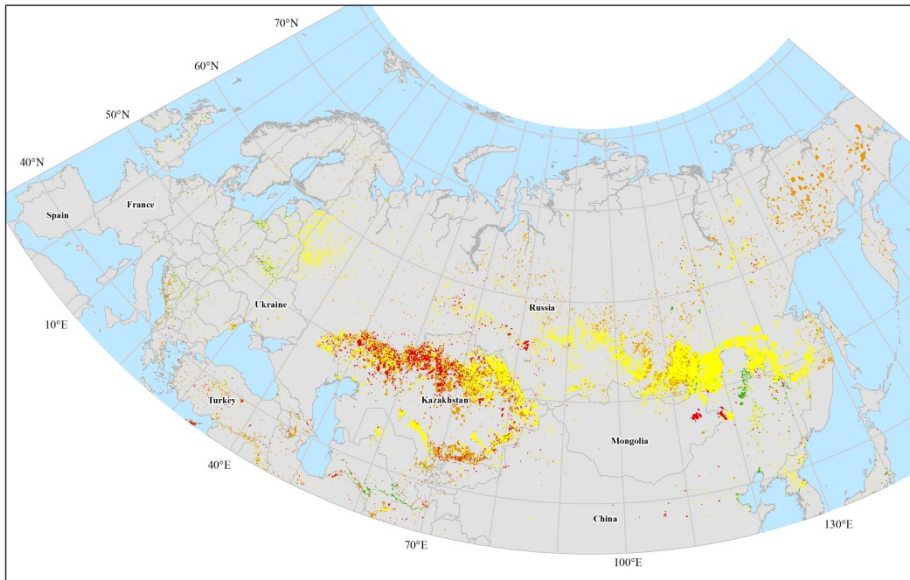


Land Cover Type

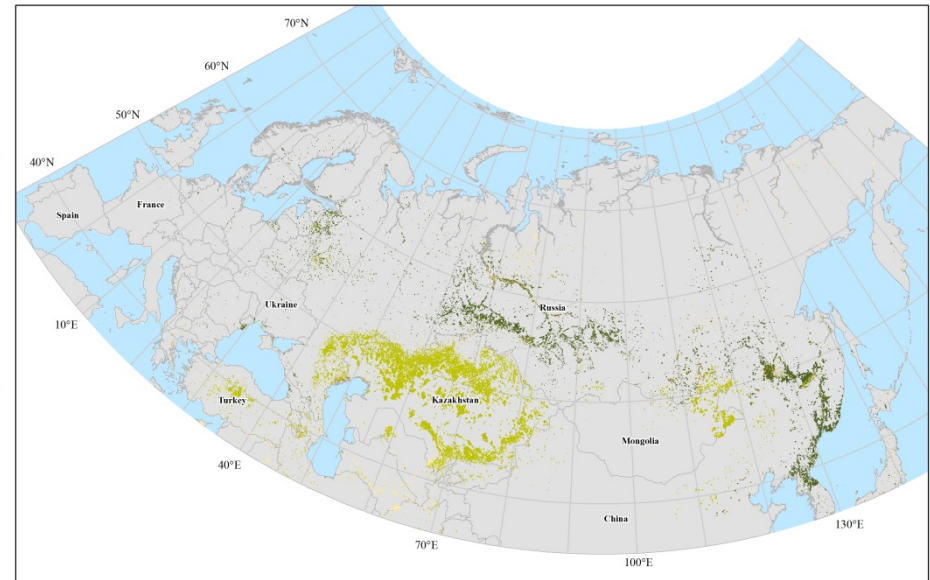


Northern Eurasia 2003

Burned Area by Months and Land Cover Type



Months

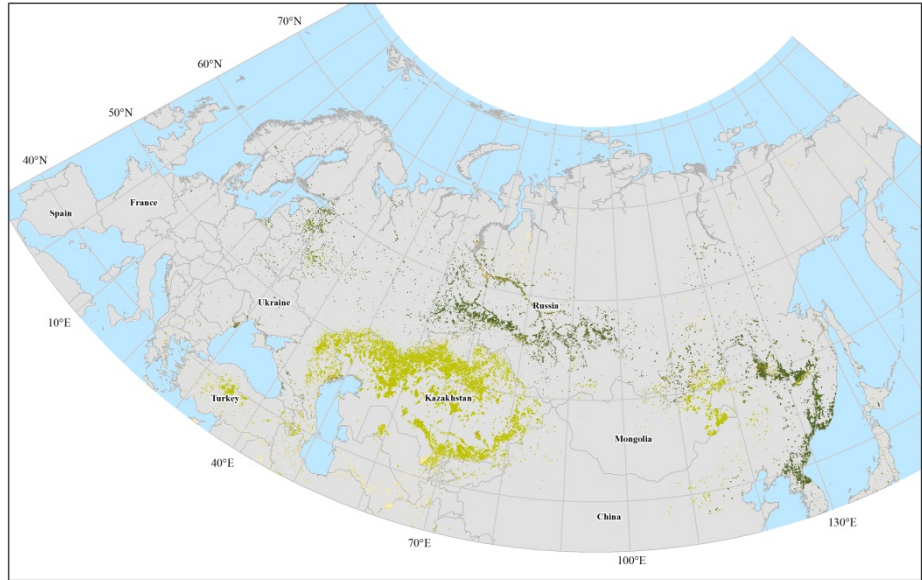
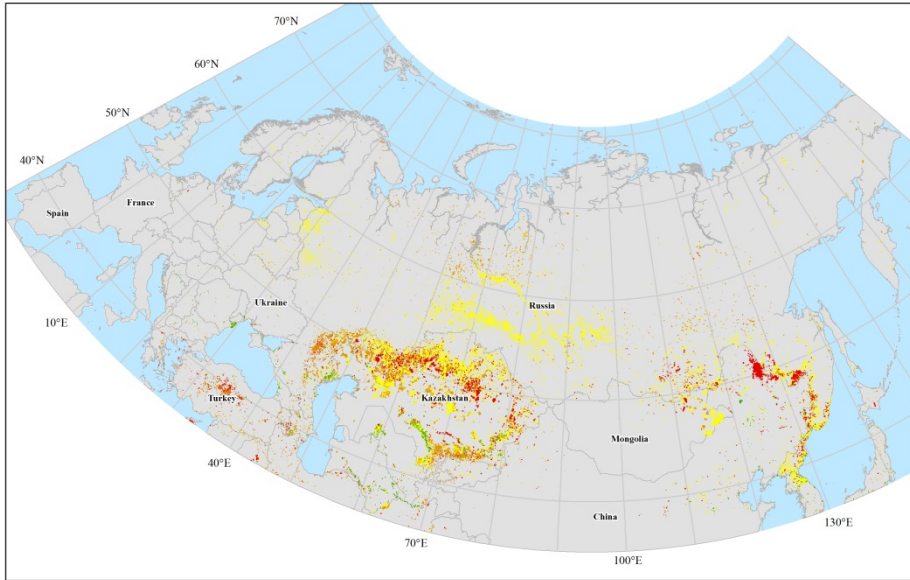


Land Cover Type



Northern Eurasia 2004

Burned Area by Months and Land Cover Type



Months

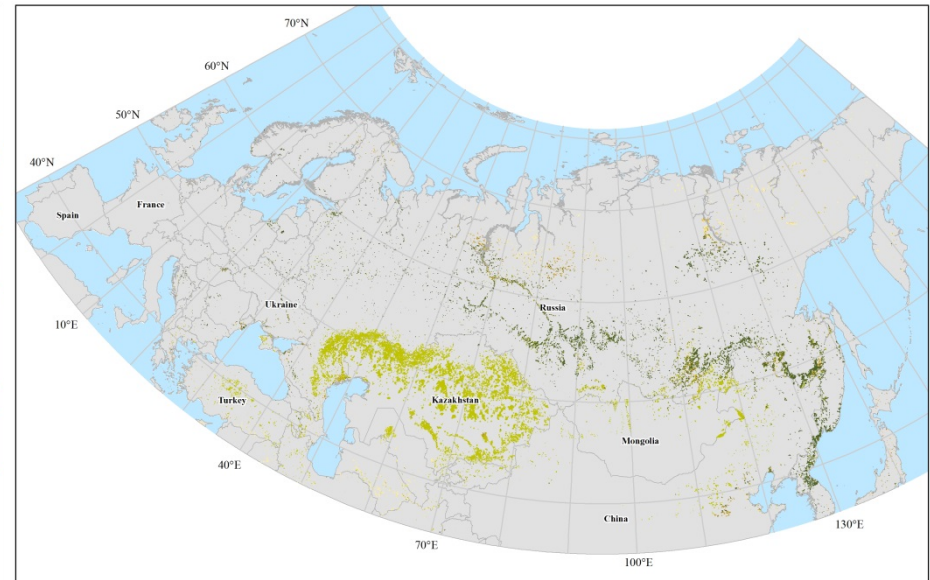
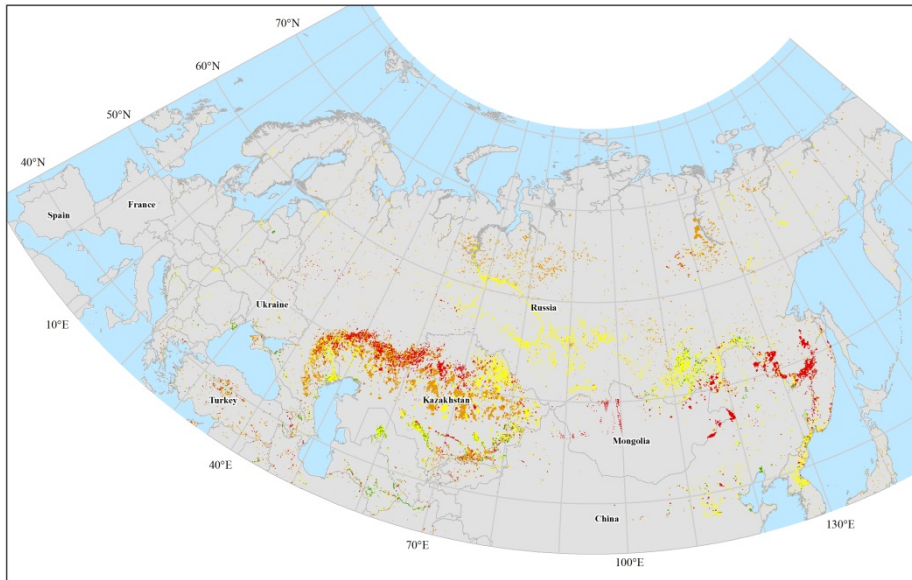


Land Cover Type



Northern Eurasia 2005

Burned Area by Months and Land Cover Type



Months

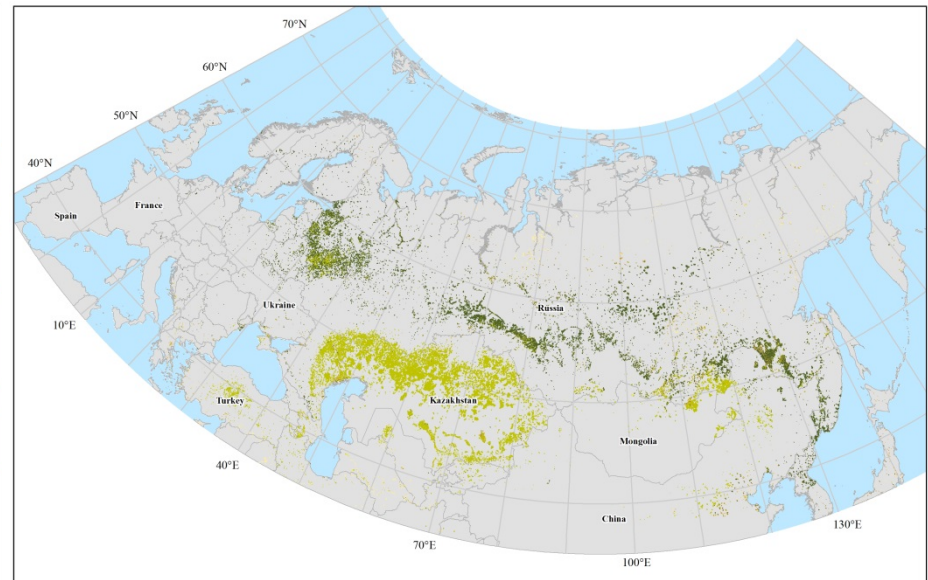
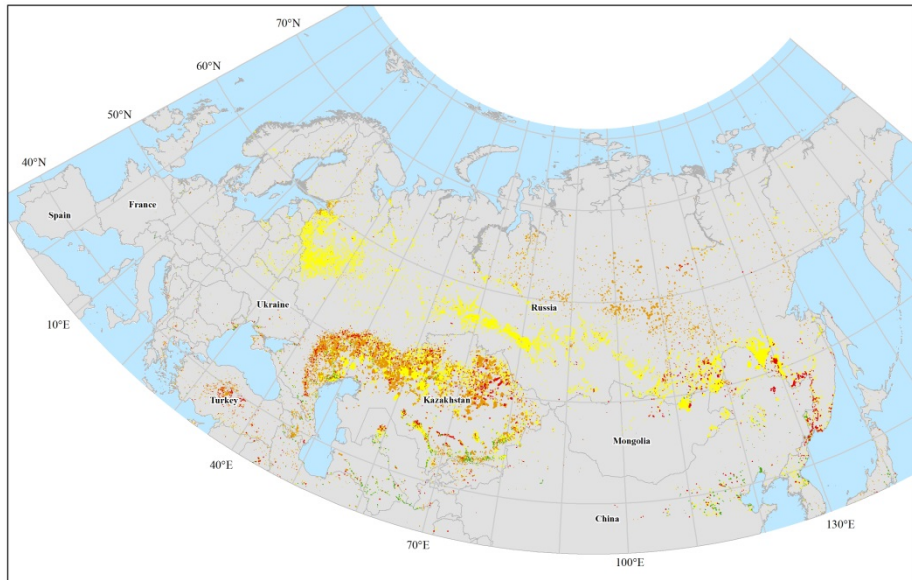


Land Cover Type



Northern Eurasia 2006

Burned Area by Months and Land Cover Type



Months

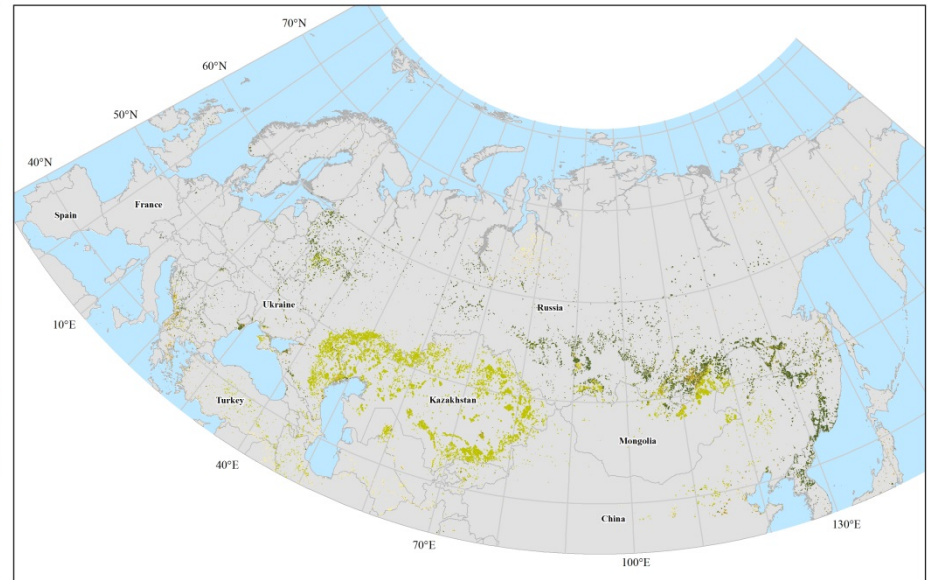
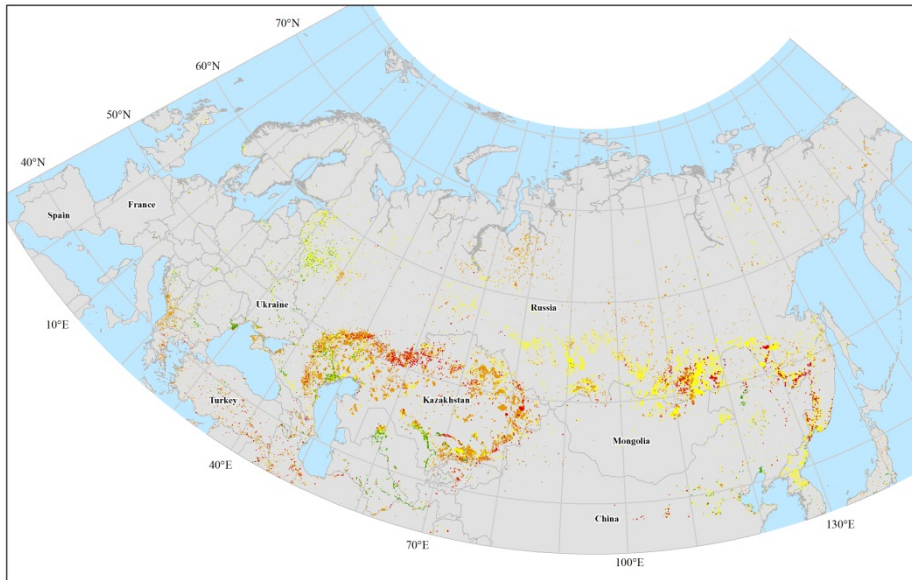


Land Cover Type



Northern Eurasia 2007

Burned Area by Months and Land Cover Type



Months

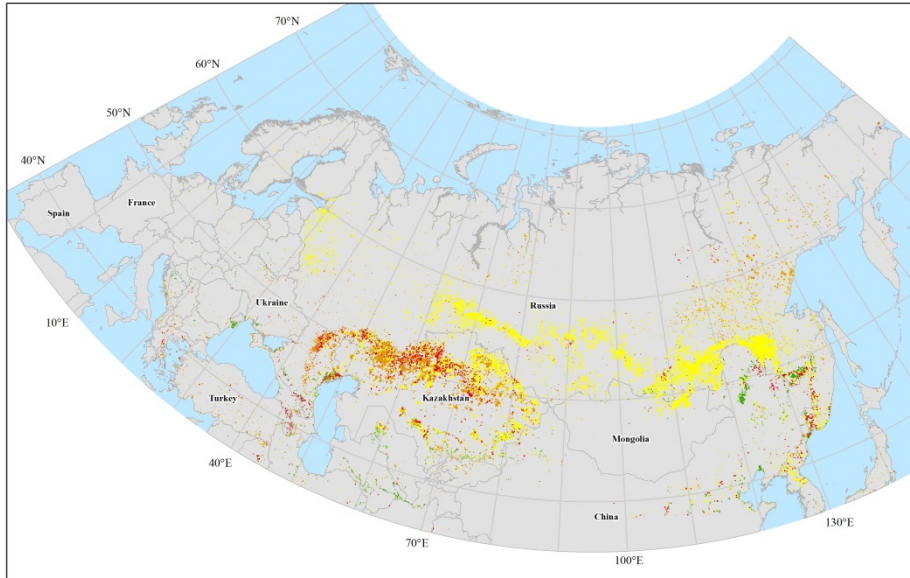


Land Cover Type

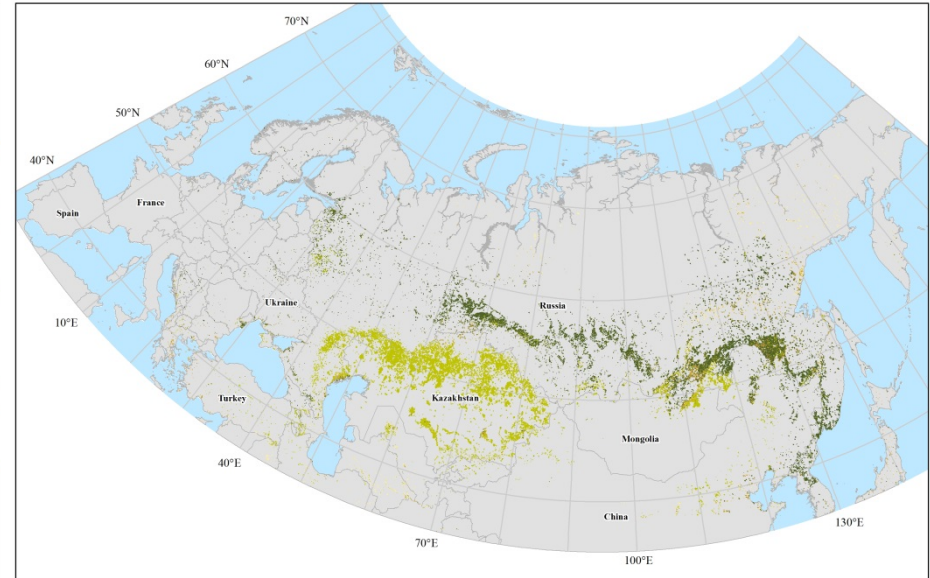


Northern Eurasia 2008

Burned Area by Months and Land Cover Type



Months

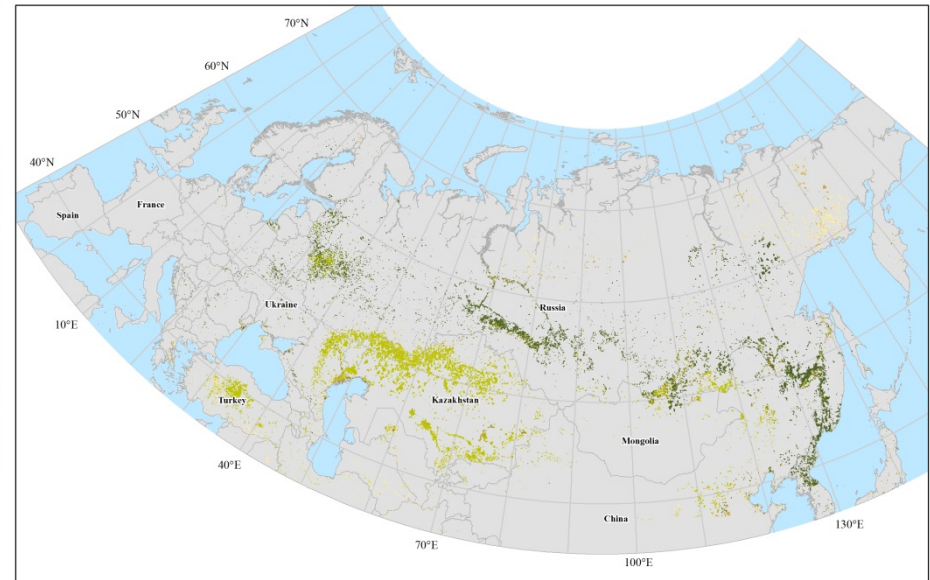
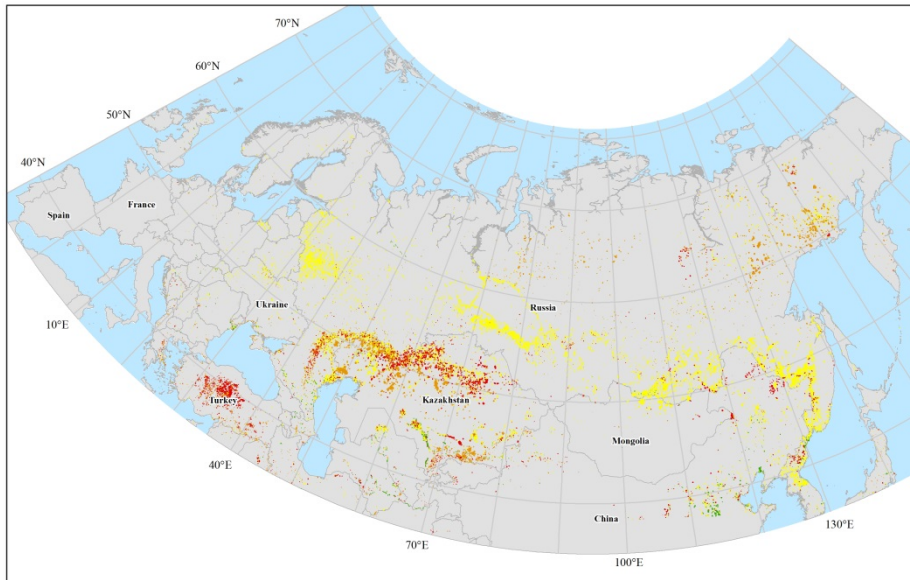


Land Cover Type



Northern Eurasia 2009

Burned Area by Months and Land Cover Type



Months

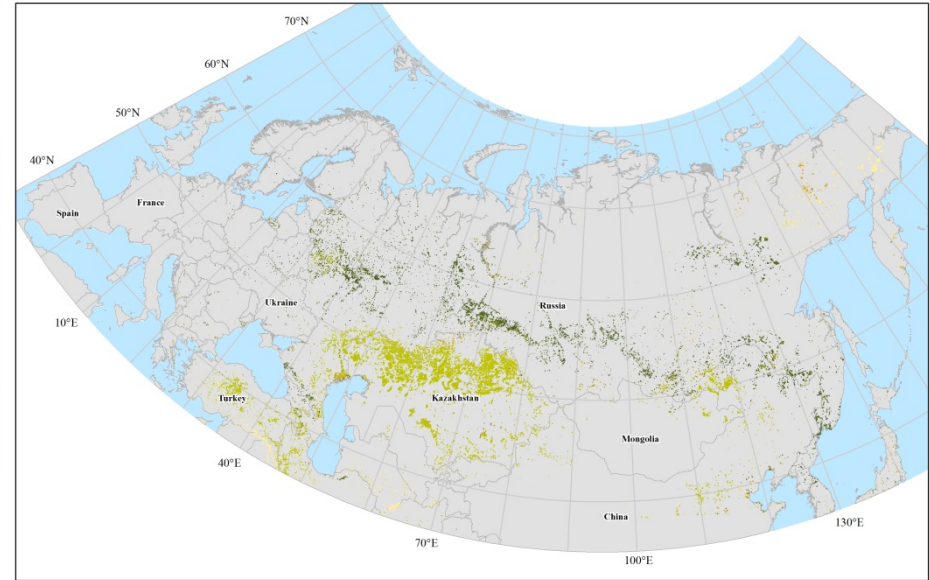
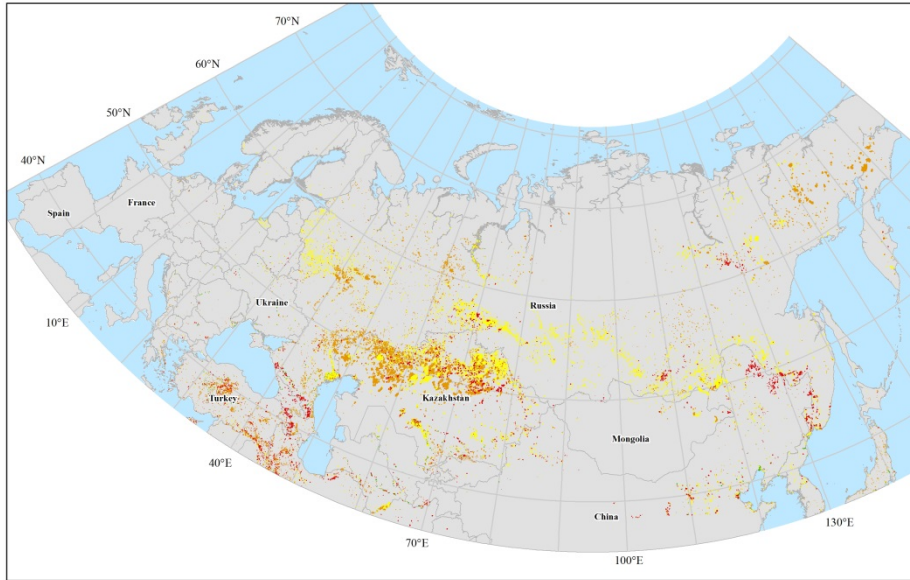


Land Cover Type



Northern Eurasia 2010

Burned Area by Months and Land Cover Type



Months

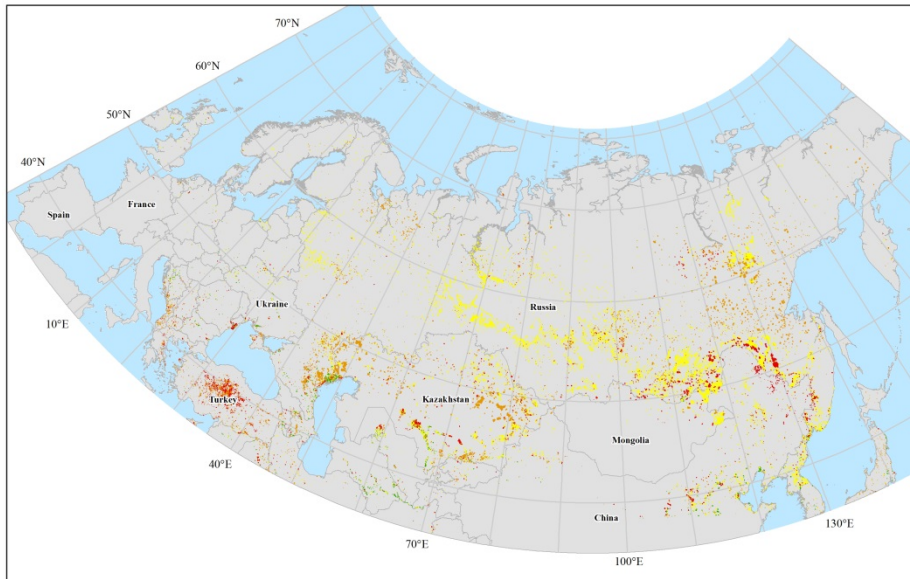


Land Cover Type

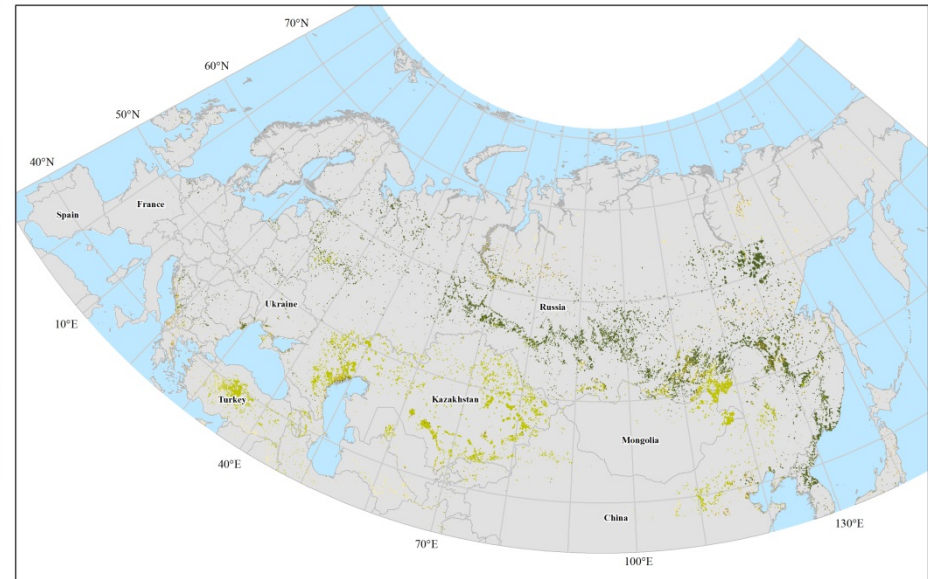


Northern Eurasia 2011

Burned Area by Months and Land Cover Type



Months

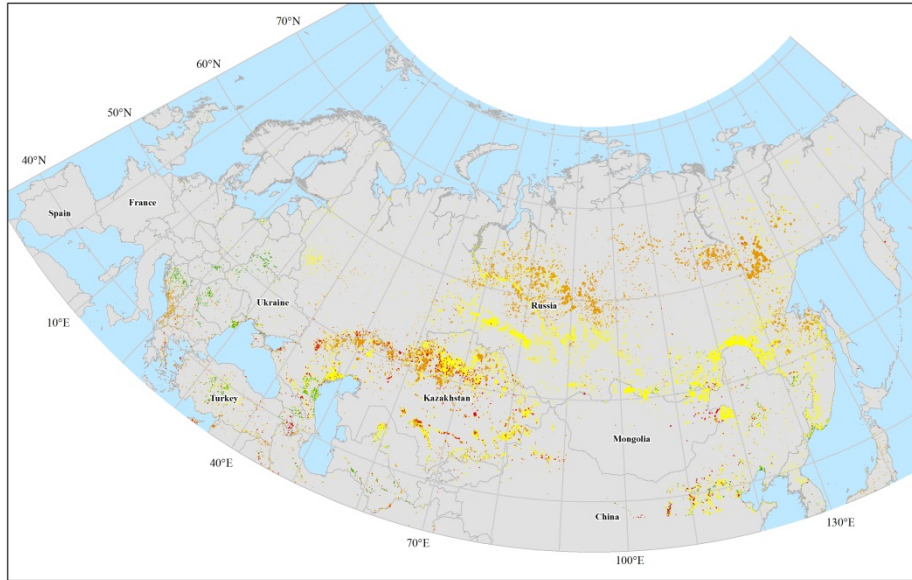


Land Cover Type

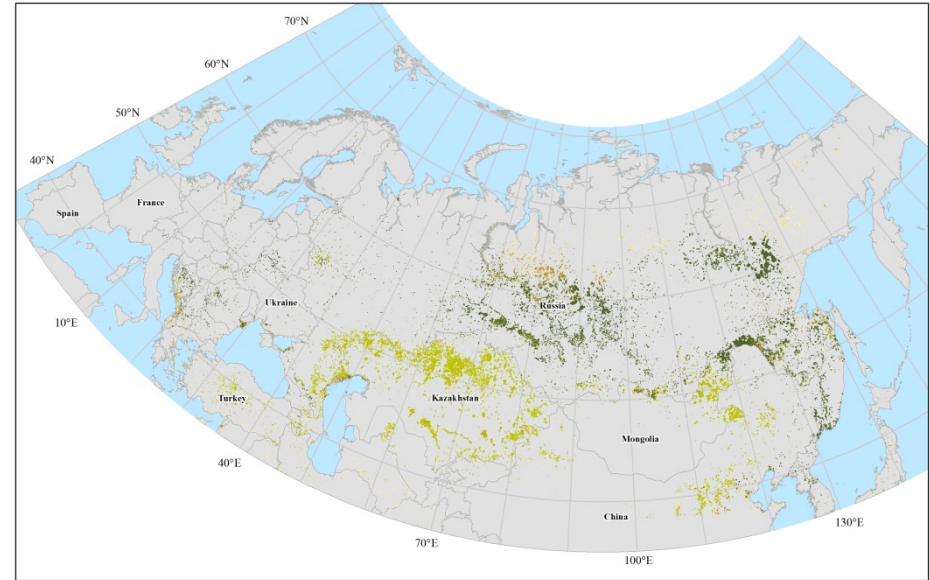


Northern Eurasia 2012

Burned Area by Months and Land Cover Type



Months



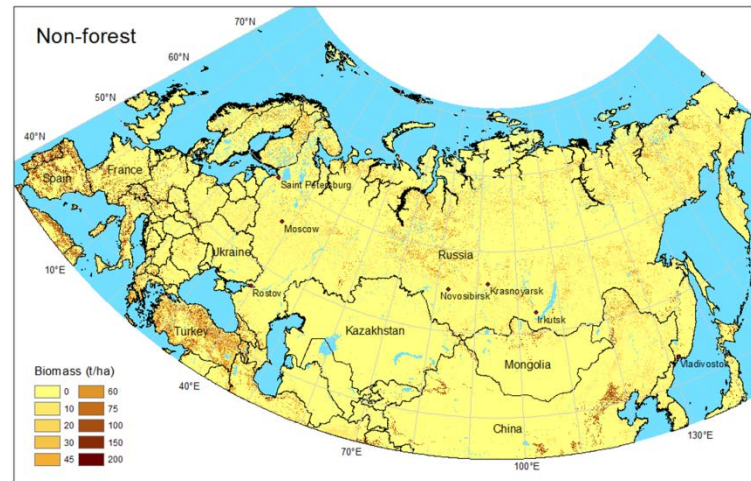
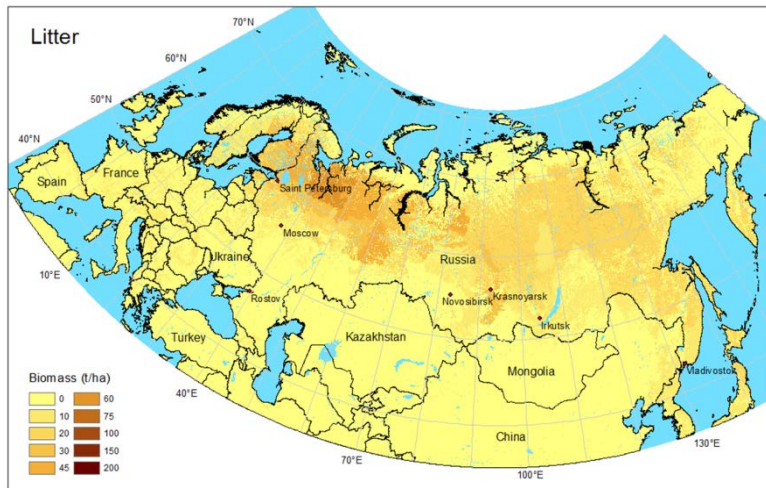
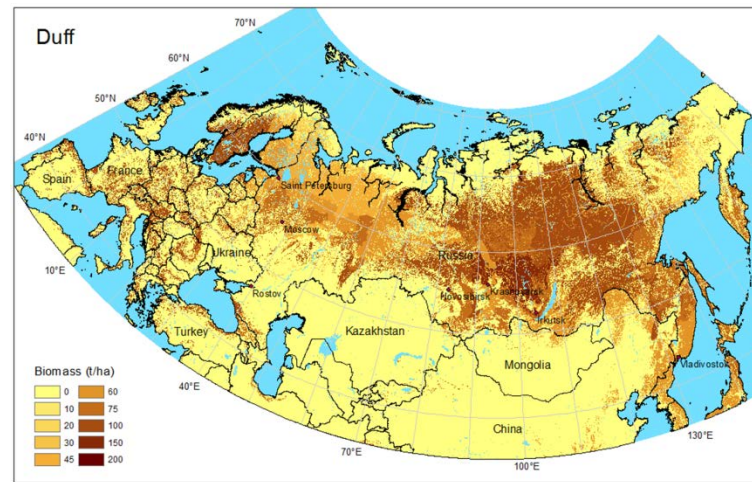
Land Cover Type



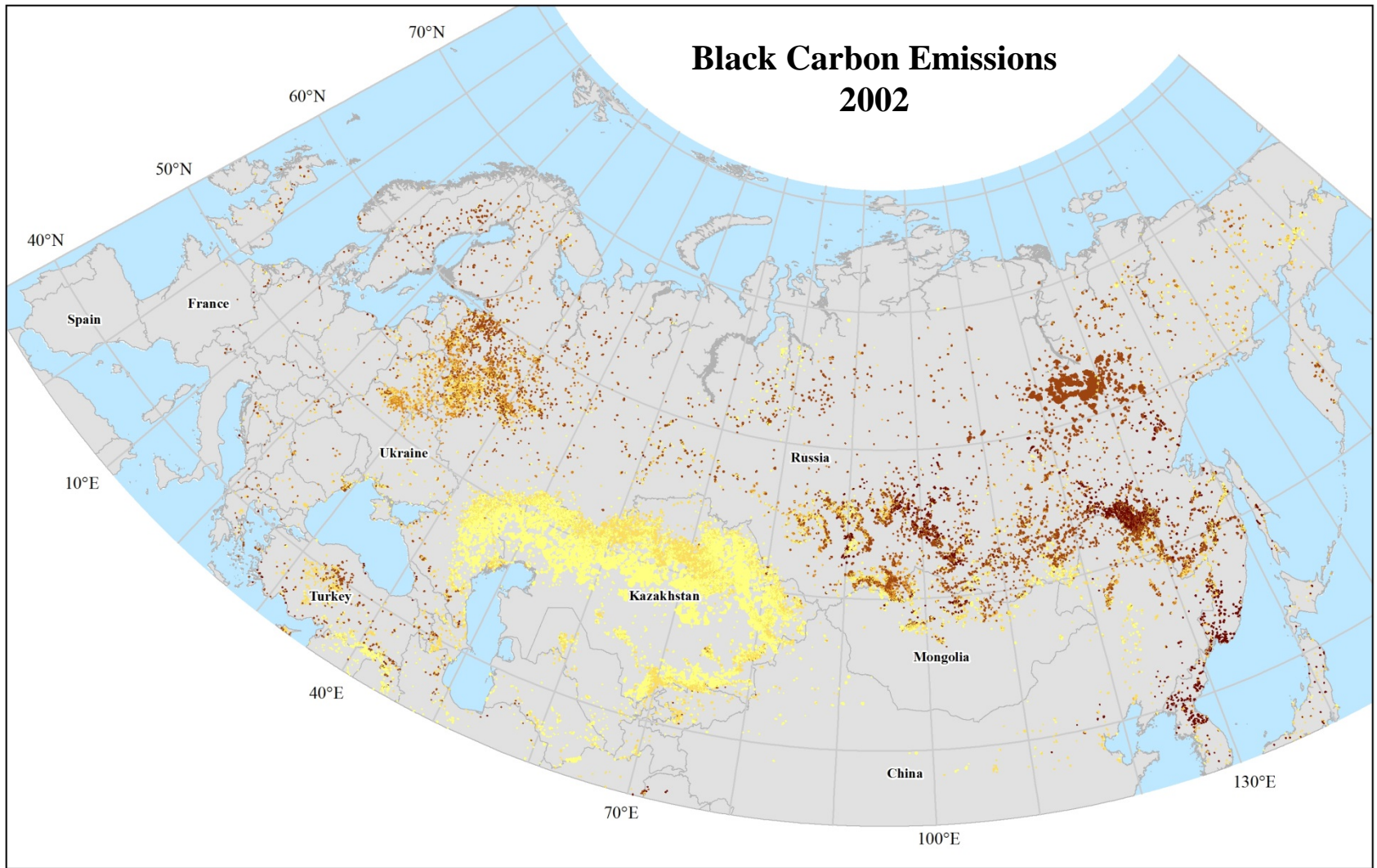
Fuel Loading

- Fuel loading of coarse woody debris, duff, shrub, lower layers over Northern Eurasia at a 500m x 500 resolution
- Data Sources:
 - 2003 Forestry Inventory Survey of Russian Federation
 - MODIS land cover map (MOD12, v5)
 - 2010 land cover map at a 250 m resolution for Russian Federation provided by the Space Research Institute (SRI) of the Russian Academy of Sciences
 - Dominant forest species map for year 2010 at a 250 m resolution over Russian Federation provided by SPI
 - IPCC Tier-1 Global Biomass Carbon Map for 2000

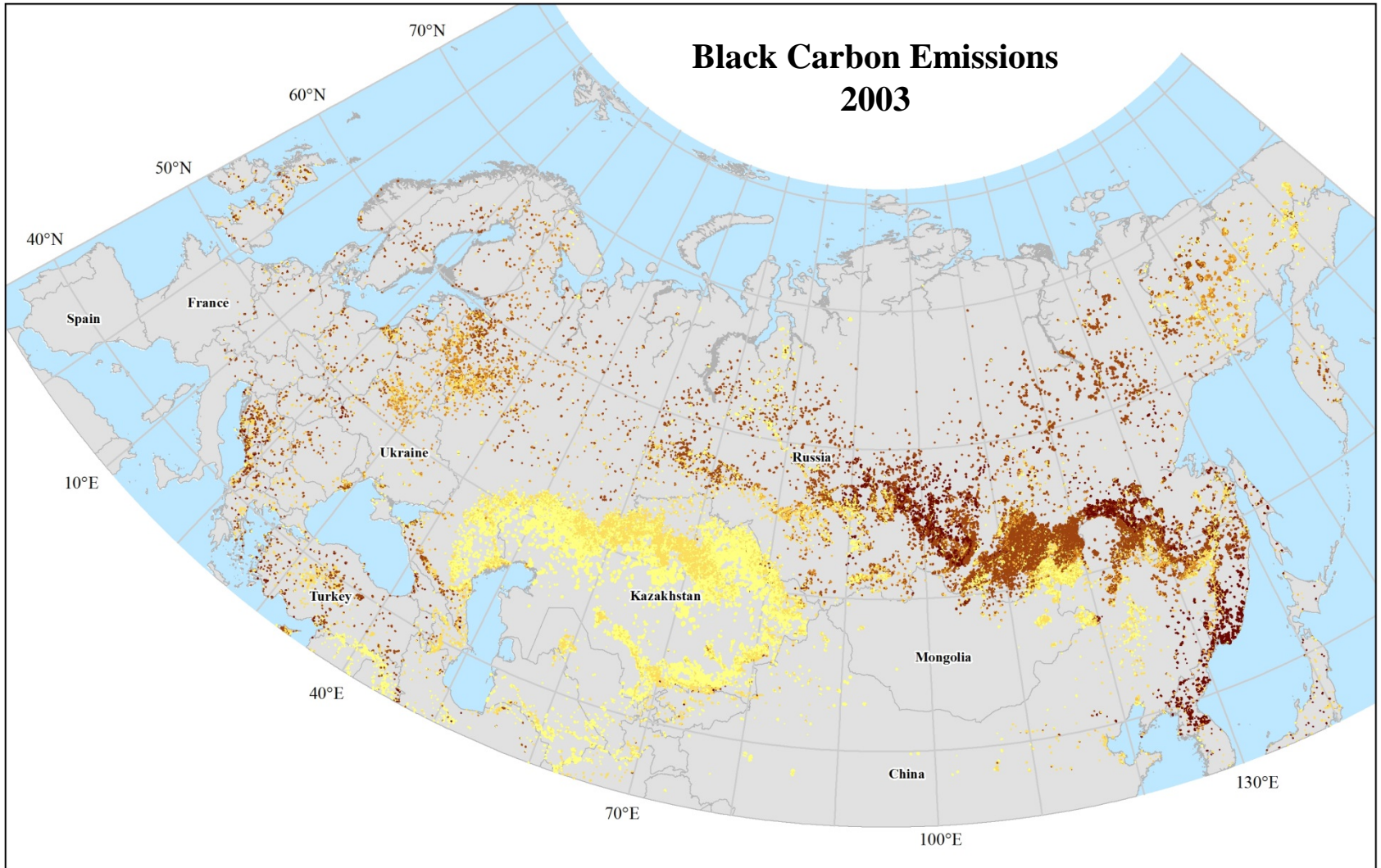
Fuel Loading of Different Categories



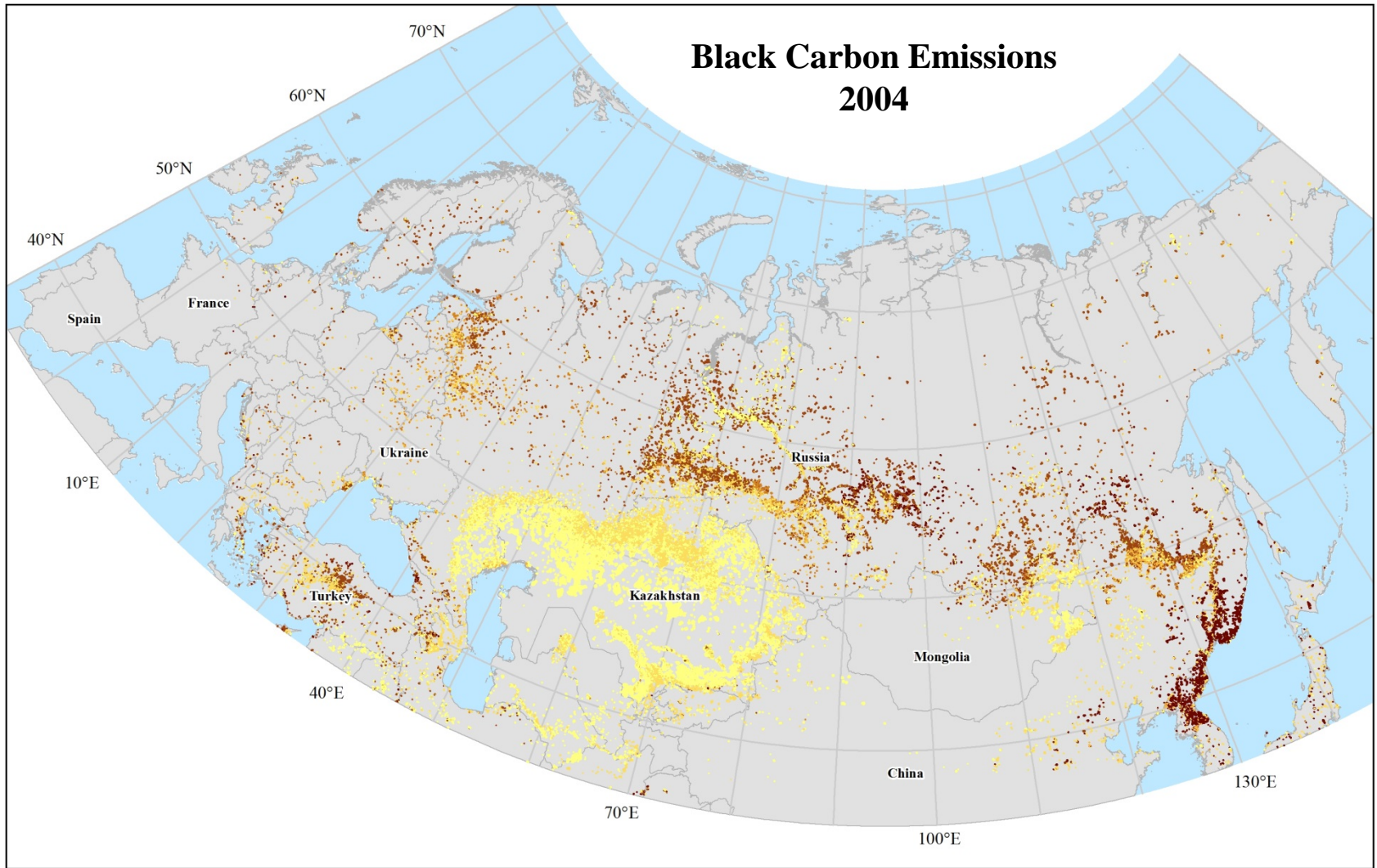
Black Carbon Emissions 2002



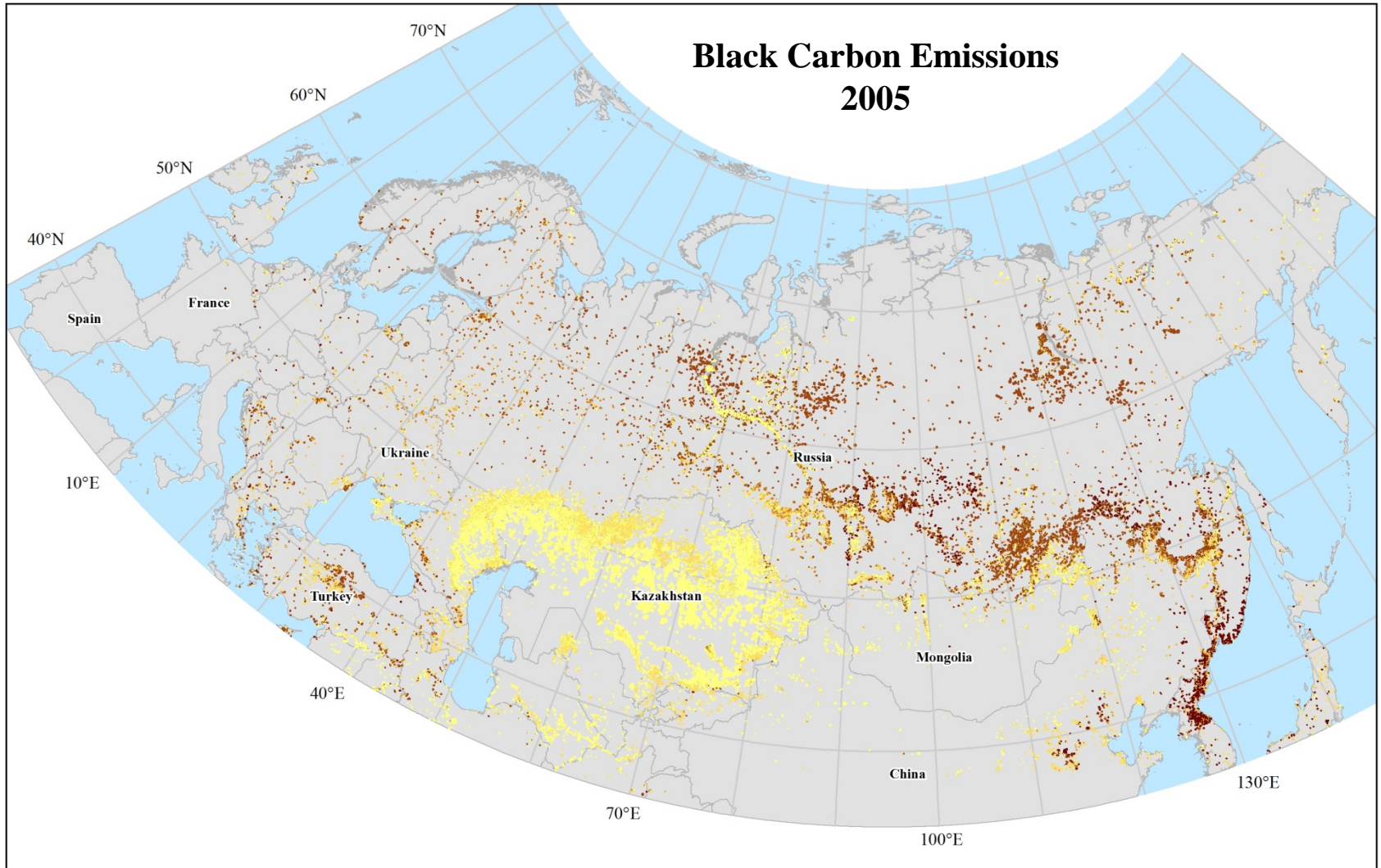
Black Carbon Emissions 2003



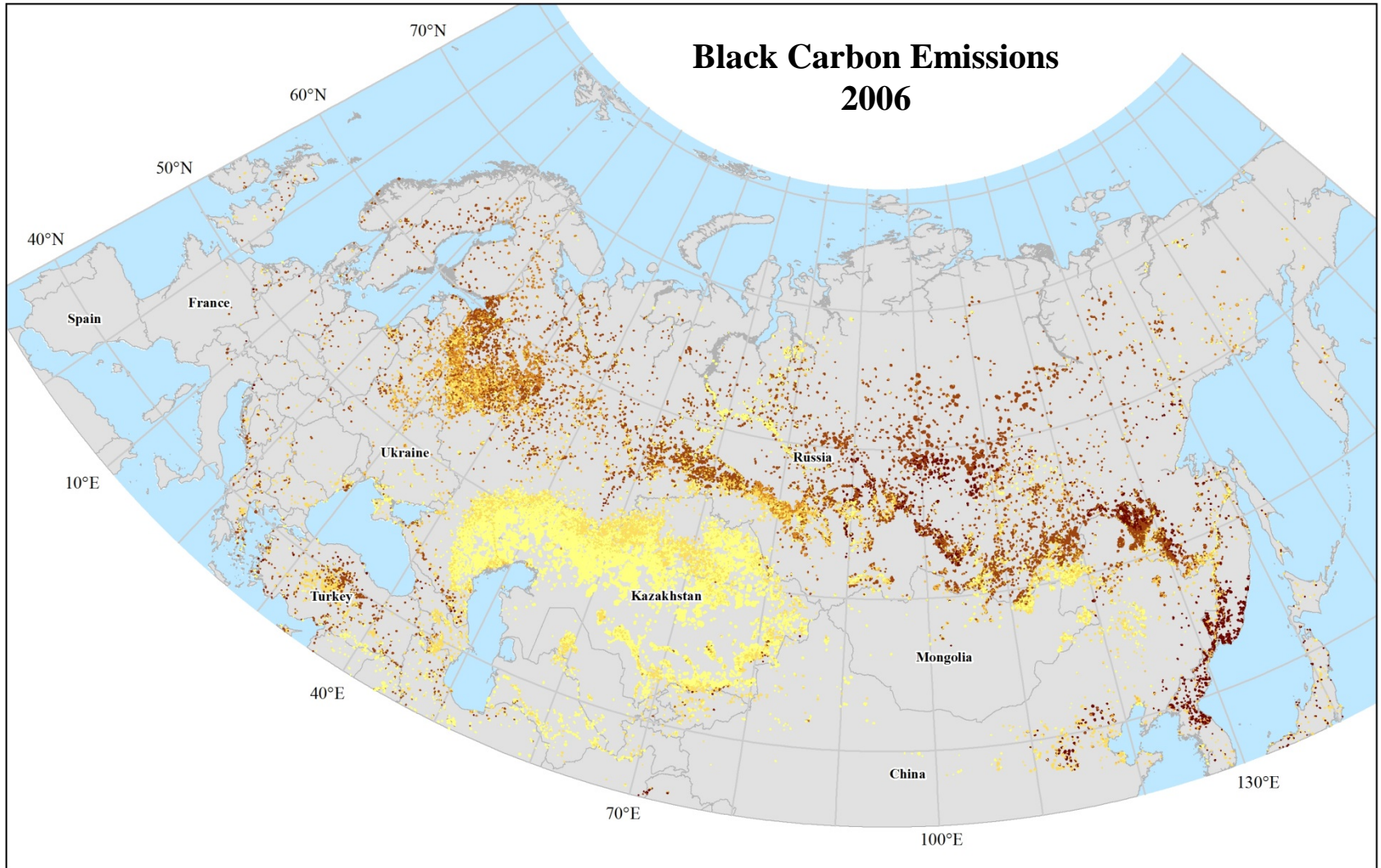
Black Carbon Emissions 2004



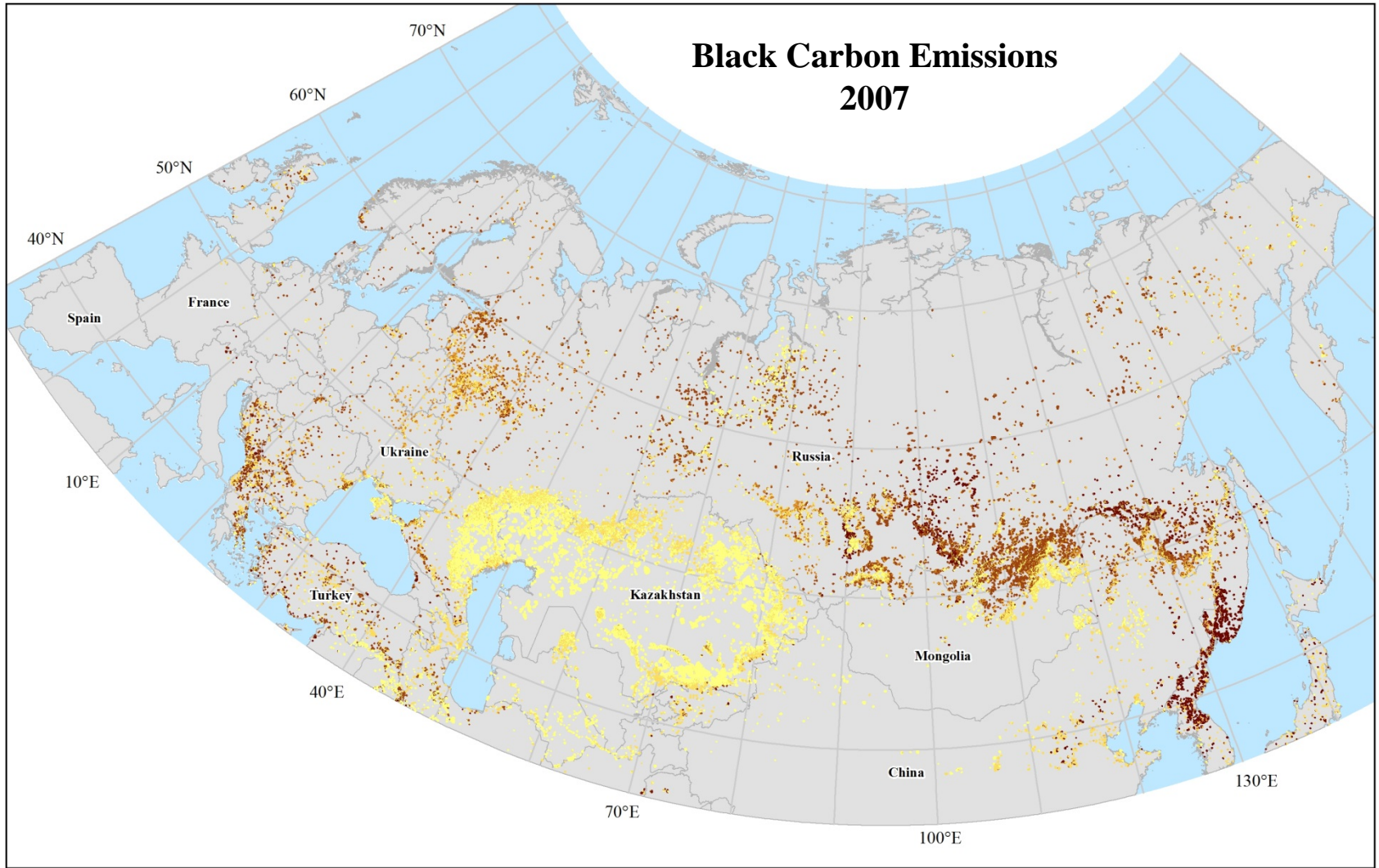
Black Carbon Emissions 2005



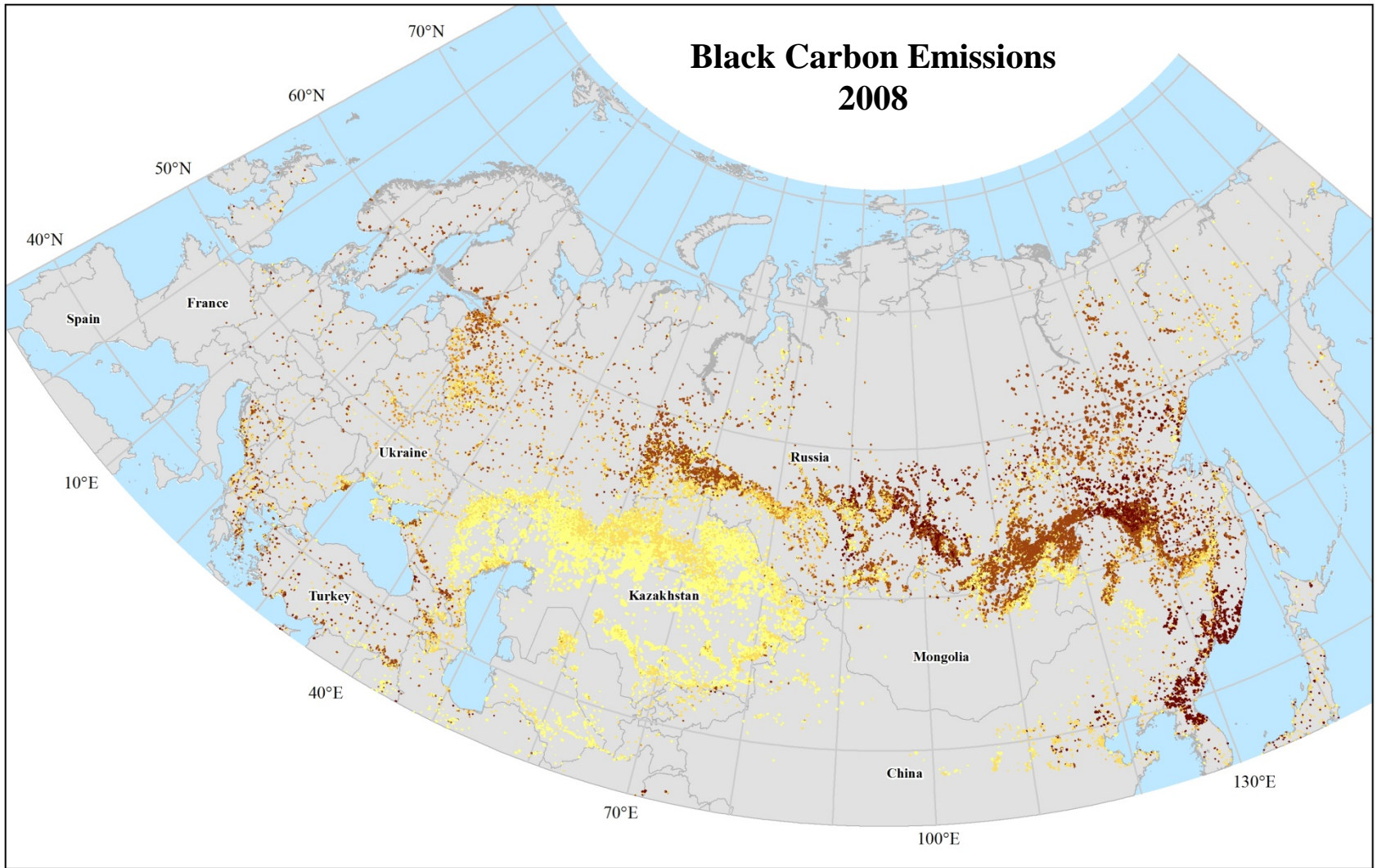
Black Carbon Emissions 2006



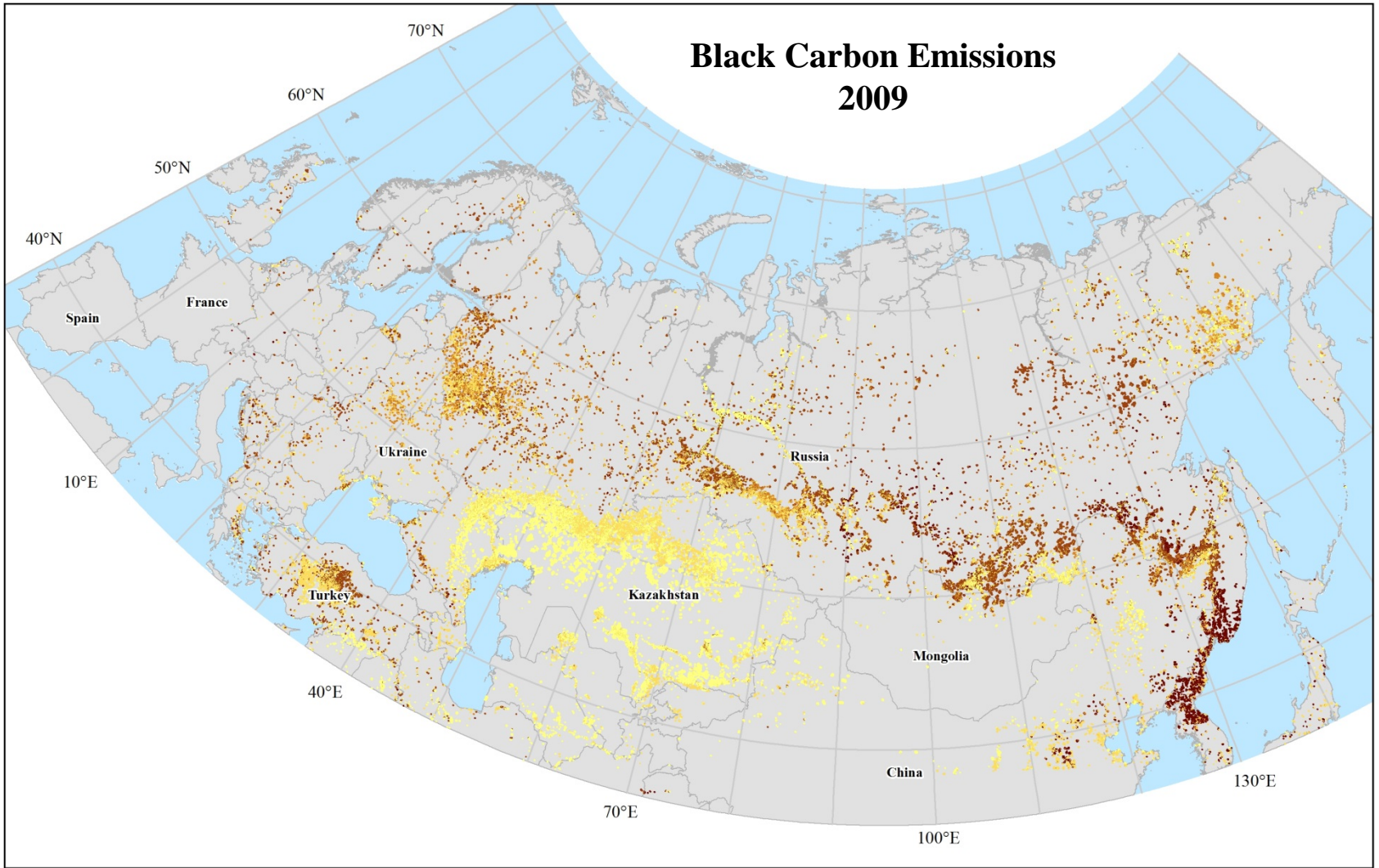
Black Carbon Emissions 2007



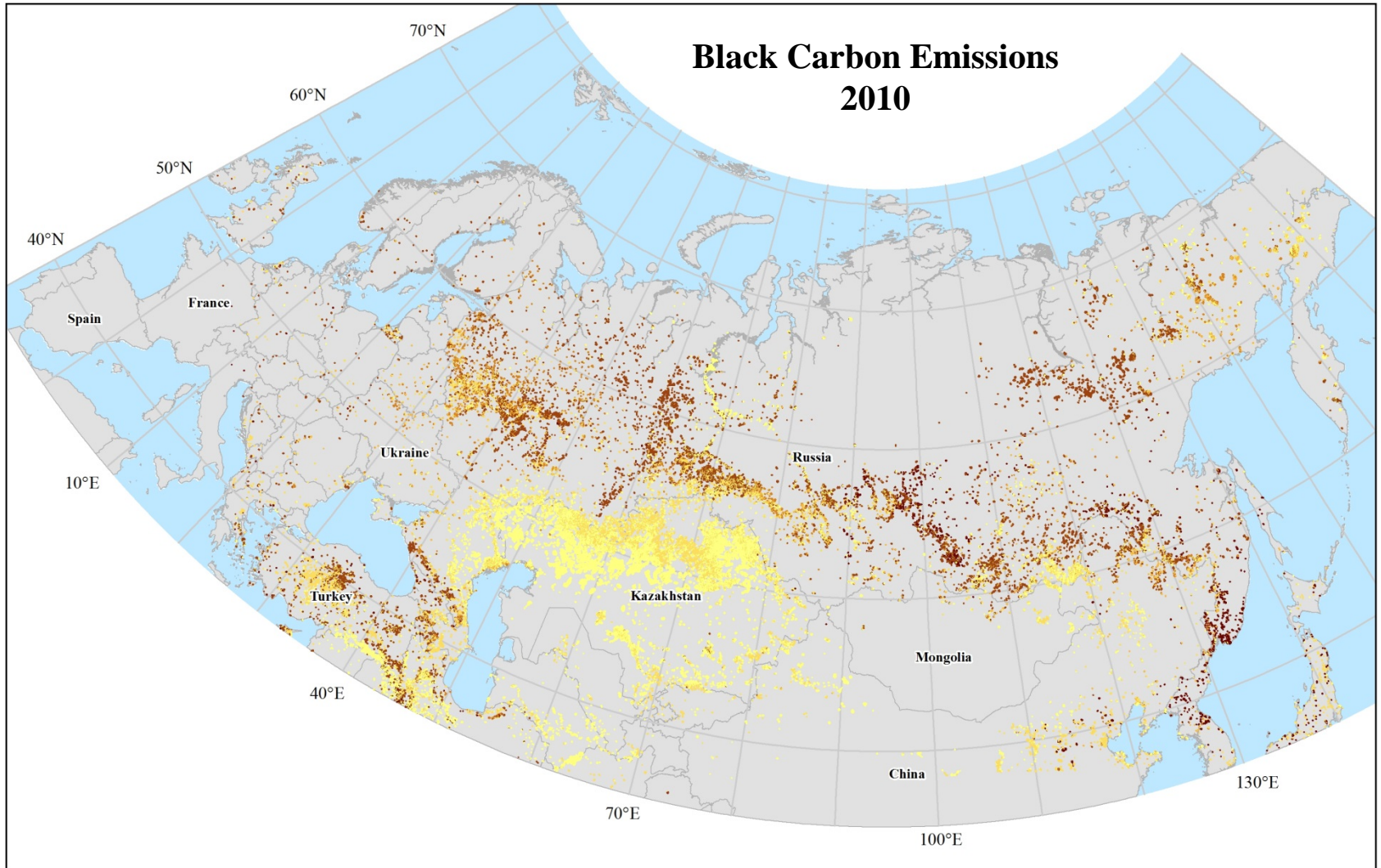
Black Carbon Emissions 2008



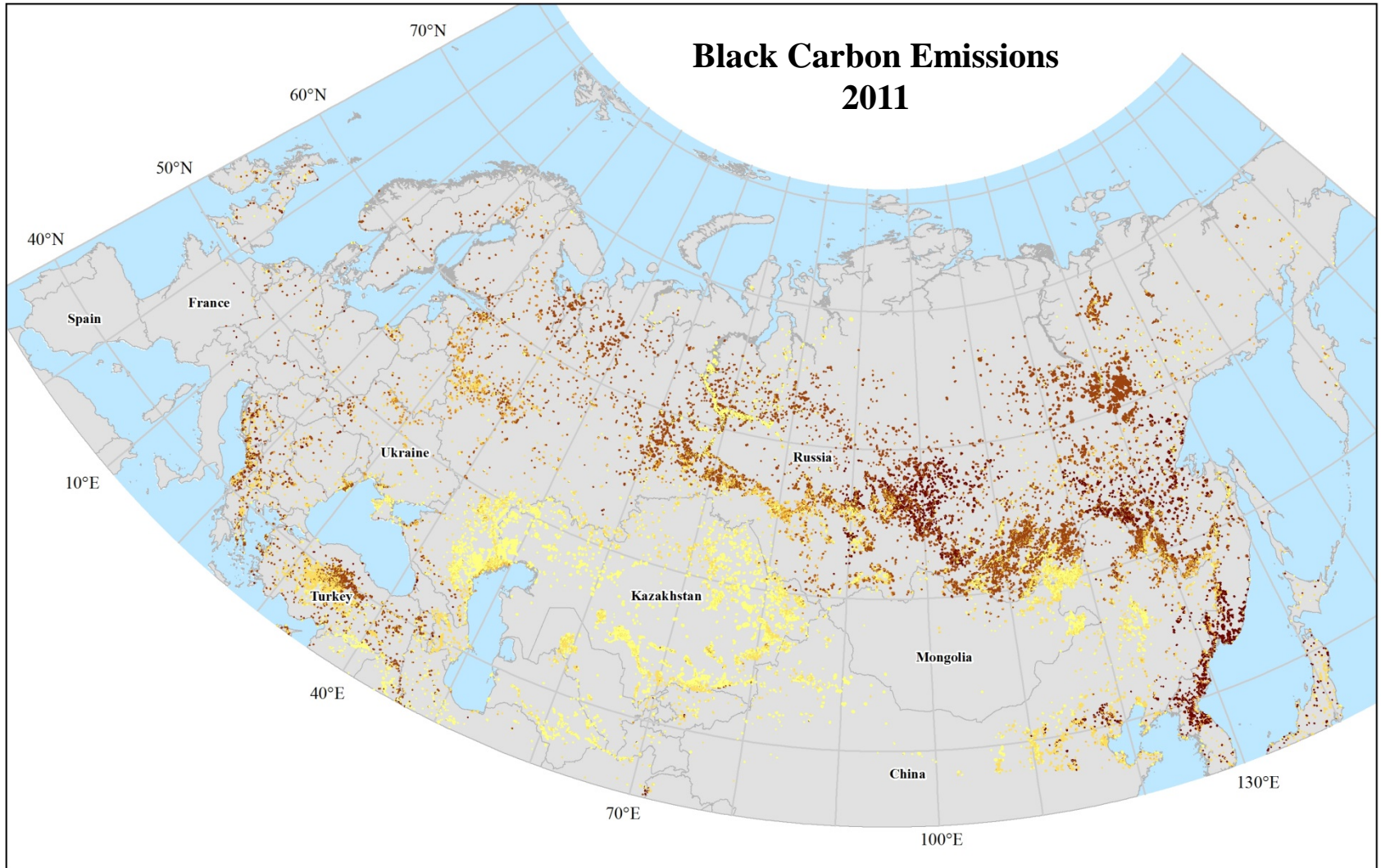
Black Carbon Emissions 2009



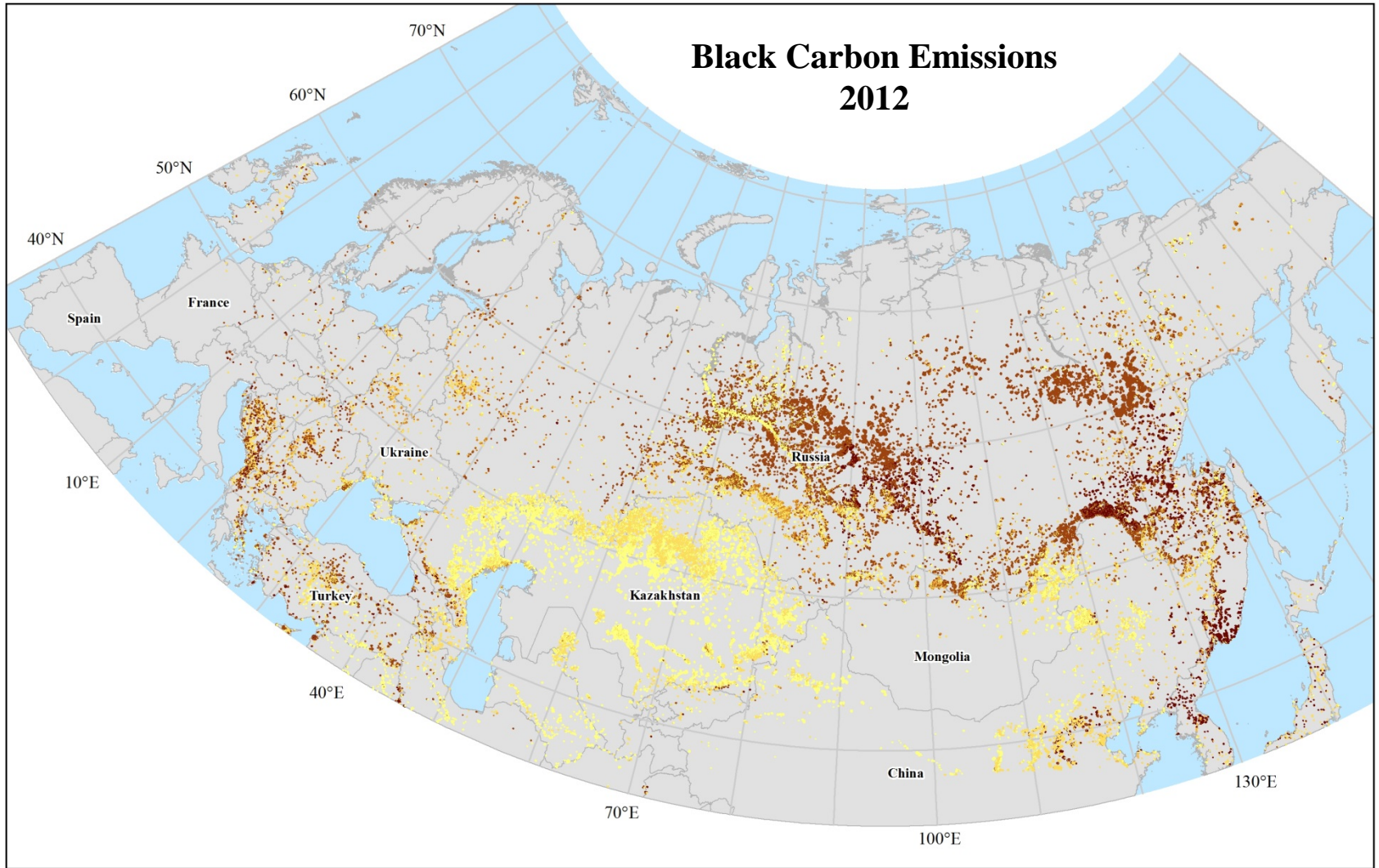
Black Carbon Emissions 2010



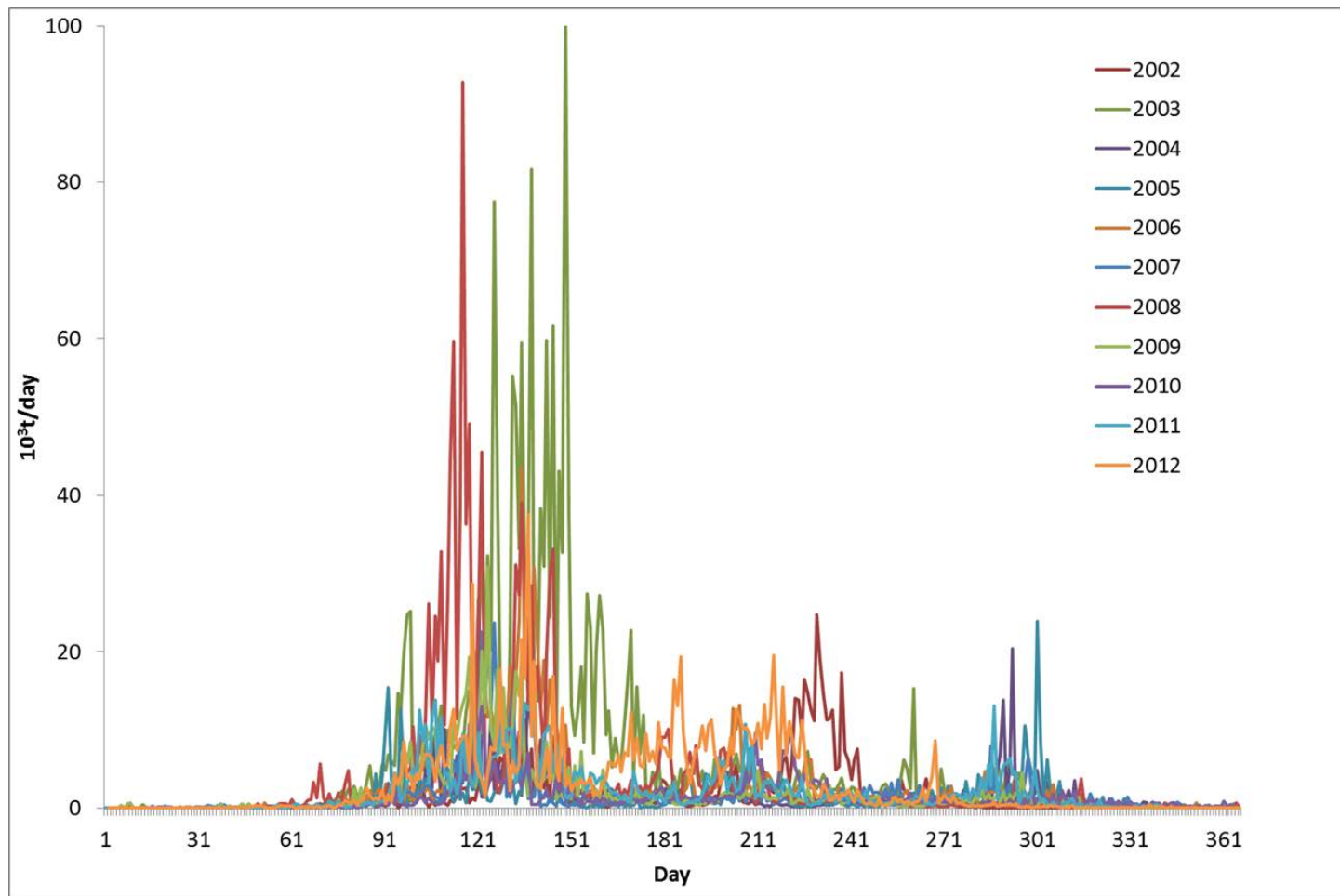
Black Carbon Emissions 2011



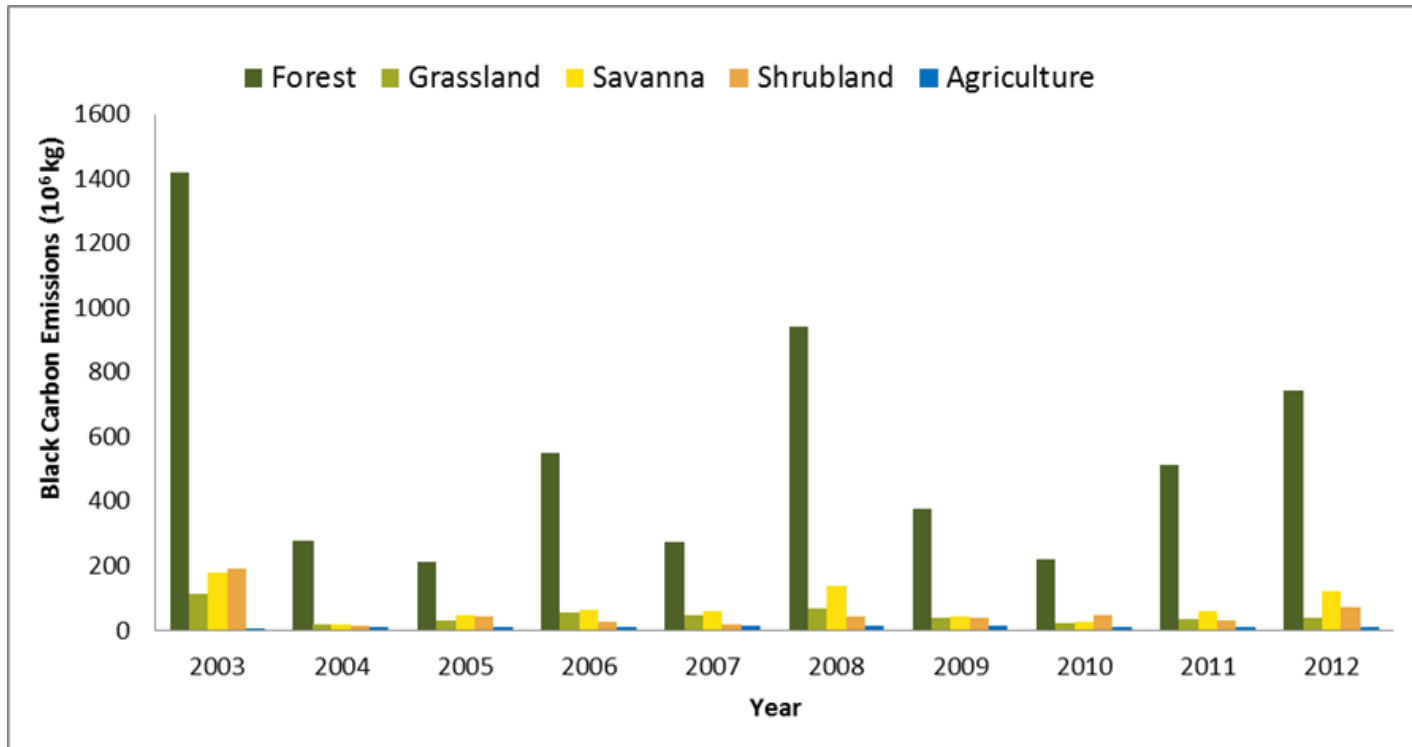
Black Carbon Emissions 2012



Daily Black Carbon Emissions from Biomass Burning in Northern Eurasia : 2002-2012



Annual BC Emissions from Fires in Different Land Cover Types



Conclusion

- BC emissions from fires over Northern Eurasia varied enormously
 - an average of 0.85 ± 0.51 Tg from 2002 to 2012 ($n=11$), accounting for $\sim 11\%$ of the global BC sources.
 - The peak years of BC emissions: 2003, 2008, 2012.
- The majority of BC emissions from fires occurred in March - May
- 68% of the BC emissions occurred from fires in forests, followed by grassland (15%)
- 93% of the BC emissions from forest fires occurred in Russia.
- Central and Western Asia is the major region for BC emissions from grassland fires (53%), followed by Russia (34%)
- Overall, Russia contributed 83% of the total BC emissions from fires in Northern Eurasia.