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International Meeting on Open Burning and the Arctic: Causes, Impacts, and Mitigation Approaches

St Petersburg, Russia, 8-9 November 2010

In early November 2010, over seventy policymakers, scientists, activists, and academics from Russia, Europe and North America met in St Petersburg, Russia, for a two-day conference to discuss the causes and impacts of set fires in forests, peatlands, croplands, and steppe in Northern Eurasia and North America.

Open burning in Northern Eurasia is a particularly important source of soot or black carbon (BC) in the Arctic, which is warming at nearly twice the rate of the rest of the planet. BC from these fires is likely an important warmer of the Arctic climate, particularly in spring when ice and snow are melting. These fires, often set intentionally on croplands, rangelands, steppe, and woodlands, can also have negative health, safety, and economic effects. Laws on burning vary widely from place to place, with gaps between laws, enforcement, and practice.

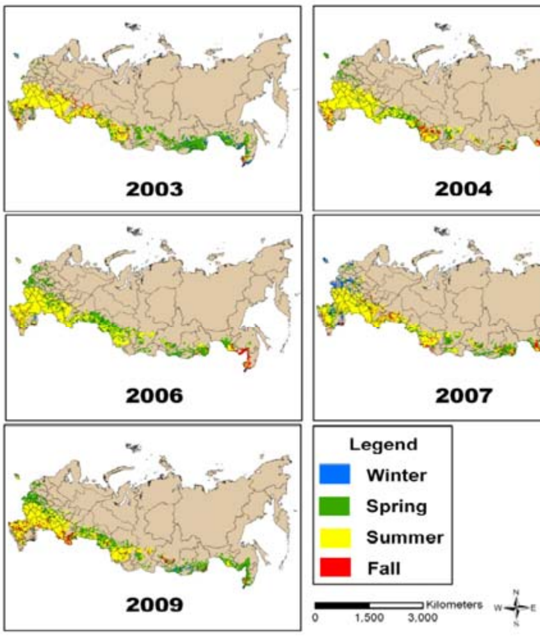
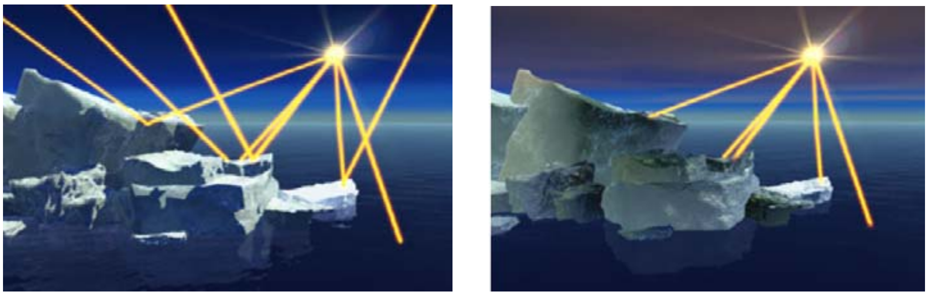


Figure 1. Seasonal cropland burning in the Russian Federation from cropland burning as detected by the MODIS Burned Area Product (MCD45A1) for years 2003-2009. Definition of croplands used: IGBP croplands class from the MODIS 1 km Land Cover data set. Figure courtesy J. McCarty.

The conference explored both the emissions from these fires and their impacts on the Arctic, and uses of these fires, their impacts on health and safety, and approaches to reducing fires and fire impacts. Participants included representatives of a very diverse set of organizations, such as agencies of the governments of Russia, Canada, and the United States, the United Nations Economic Commission for Europe (UNECE), and officials from U.S. State governments; scientists from a wide variety of disciplines and institutions; representatives from Russian and U.S. non-governmental organizations; and farmers and firefighters.



Figures 2 and 3. Symbolical drawing: Ice and snow reflect solar radiation (left). Black carbon deposits darken surface and reduce reflectivity (right). Source: NASA/GISS

The meeting agenda, presentations, and other materials are available at the meeting website.[1] This report summarizes the conclusions of the meeting.

Emissions from Fires and Impacts on the Arctic

Scientists studying fires, Earth's atmosphere, forests, and geography met in one track of the meeting to consider what we currently understand about the

- Sources of BC in the Arctic
- Contribution from open fires
- Location, timing, and fuel of those fires.

This group concluded:

- The most important climate-warming pollutant, even in the Arctic, is carbon dioxide.
- Global climate impacts of BC remain quite uncertain, particularly when considering co-emitted pollutants and the interactions between these pollutants and clouds / precipitation. However, atmospheric BC, when deposited to snow in the Arctic during late winter and spring, adds a definite positive forcing (warming) to that of carbon dioxide, because it darkens snow, so that it absorbs more incoming radiation.
- Vegetation fire emissions (VFE) in Eurasia make a significant contribution of BC to the Arctic lower-atmosphere and snow surface.
- Transport of aerosols to the Arctic is more efficient from Eurasia than from North America, especially in winter and spring when Arctic BC concentrations are highest. As a result of this and the greater extent of snow and ice cover in the springtime, BC from spring fires in Eurasia affects Arctic climate more than BC from summer fires, despite the larger extent of the summertime fires.
- Eurasian VFE plumes reach the North American side of the Arctic, but it is not clear what fraction of these plumes remains aloft and what fraction reaches the lower atmosphere where BC can be deposited to snow.
- Fires produce other light-absorbing particles (i.e., "brown" organic carbon) as well as BC, which also darken surface snow. Mitigation of open burning would reduce both types of light-absorbing particles.
- BC from spring VFE may also impact climate forcing by reducing albedo of seasonal snow at mid-latitudes (40° - 60° N). The resulting mid-latitude warming may in turn contribute to Arctic warming, as well as reducing snow cover at mid- to high-latitudes. These effects need more examination in model investigations; studies which quantify the climate effects (including effects on snow and ice cover) of realistic BC mitigation measures would be particularly useful.

Research likely to significantly improve understanding of open burning as a source of BC in the Arctic over the next one to two years should address:

- Improved monitoring across northern Eurasia of the amount and seasonality of biomass and fossil fuel aerosols in the lower atmosphere.

[1] http://www.fires-and-the-arctic.org

- Land cover and use, such as cropland, rangeland, abandoned land, etc. Current maps lack accuracy and specificity.
- The height to which plumes from springtime fires rise in the atmosphere.
- Fuel loads, burning efficiency, and emission factors for BC and other species, as functions of location, time, fuel type, and type of fire.
- Assessments of area burned for croplands and wildlands after fires.
- Seasonality of fires.
- Model estimates of impacts of BC from set fires on snow and ice cover in the Arctic and mid- to high-latitudes using climate models of different complexity.

Other, more long-term research needs for better quantification of the impacts of open burning on the Arctic, in order of importance:

- Aerosol-cloud-precipitation (indirect) effects of biomass burning emissions on climate.
- Albedo change of mid-to-high latitude temperate zone seasonal snow, including non-pristine and vegetated areas, due to BC deposition.
- Testing models' ability to predict climate response to snow darkening.
- Quantification of open burning vs. biofuels as sources of BC in and near the Arctic.
- Factors controlling rates of wet and dry deposition of BC.
- Black carbon / organic carbon (BC/OC) ratio in fire emissions, and other co-emitted species.
- Vertical profiles of BC and OC in the atmosphere in the Arctic and along primary transport routes from sources.
- Emissions from flaming vs. smoldering fires, and techniques to distinguish them with data from satellites.
- Effects of weather conditions before and during fires on emissions.
- The height of smoke plumes from fires in the winter and summer.

Uses of Fires, Impacts on Health and Safety, and Approaches to Reducing Set Fires

Fire, agricultural, and forestry scientists, environmental advocates, firefighters, and government officials from state / provincial and national governments met in a second track of the meeting to consider:

- Why fires are set
- Impacts of fires on health and safety
- Effective ways to reduce fire frequency and impacts on human health, safety and climate.

Presentations and discussions covered practices and reasons for burning in various areas; regulations, laws, and management practices which affect the volume of burning; impacts of fire and smoke locally and regionally; alternatives to burning and best practices; and approaches to mitigation.

The group identified several critical land-management and fire prevention issues in the Russian Federation, Ukraine, and other nations in the Commonwealth of Independent States:

- Responsibility for land and land management is ill-defined, especially at the interface of forest and agricultural lands and on lands abandoned in the past 20 - 30 years.
- Fire management should concentrate on preventing accidental wildfires and avoiding unnecessary application of fire in land management.
- Fires often spread from agricultural lands into adjoining lands, where they become wildfires; mitigation programs should address this behavior.

The following steps and approaches were identified as essential to effective efforts to reduce the amount of land burned in Northern Eurasia:

- Develop infrastructure, markets, incentives, and awareness for alternative uses of residues, e.g., biofuel.
- Promote and educate farmers on crop rotation, conservation agriculture practices, organic farming, and other alternatives, and their advantages to crop yields and soil health.
- Educate farmers and the wider public on the negative impacts of burning, particularly local effects, building upon the attention generated by the fires in 2010.

- Focus on unnecessary fires, including on abandoned land, during all seasons.
- Assess impacts of fire on abandoned lands, especially those fires that spread to forests and peatlands.
- Review national legislation hampering effective fire management; e.g. in agricultural areas and at the interface between agricultural lands and forests and rural settlements.
- Expand resources for fire monitoring, fire management decision support, and fire response.
- Promote and support community-based fire management, including participation by civil society, with a balance between local control and enforcement of laws, such as with a fire warden system.
- Test alternatives through regional pilot or demonstration projects.

Next steps

- Planning is underway for six pilot projects in Russia, including some funded by a US government program, to be undertaken in spring of 2011 to test efforts to reduce burning in a variety of locations.
- Preliminary work is underway on a number of collaborations involving scientists and other meeting participants from the US, Russia, Ukraine, and other nations.
- One example is a collaborative effort already underway to provide better fire emissions data from active crop waste fires. The participants in this project are developing a second project to distinguish between abandoned lands and croplands in satellite-based land use classifications.
- Planning is also underway for exchange programs between Russian and US organizations working to reduce agricultural burning.
- The Global Fire Monitoring Center (GFMC), working under the umbrella of the United Nations International Strategy for Disaster Reduction (UNISDR) and the UNECE, will continue to work with Russia and the EECCA countries (East Europe-Caucasus-Central Asia) in developing regional and international

We anticipate a variety of collaborations initiated by discussions at the conference will occur. For further information about the meeting, please contact the conveners David McCabe or Elena Kobets (addresses below).

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