Eastern Fires, Western Smoke

Visit the online issue at wildfiremagazine.org for complete galleries and background.

Preface: Reflecting on 25 years of global fire

The last two essays in *Wildfire Magazine* published by the Global Fire Monitoring Center (GFMC) provided global perspectives of wildland fire – *Local Fires, Global Worries* (January 2016) and *The Global Wildland Fire Network: 2016 in Review* (November 2016). The author, Lindon Pronto – a Californian and second generation wildland firefighter, after working in US forest firefighting for almost a decade – joined the GFMC in early 2015. Since, he has witnessed the agenda and unprecedented pace of global development in cooperation of the international wildland fire community that brought the 6th International Wildland Fire Conference to East Asia – hosted by the Republic of Korea in October 2015 – and subsequent message to the World Climate Conference in Paris. Lindon's essays in *Wildfire Magazine* reflect that not only is wildland fire science globalizing, but fire management, too.

In 2016, *Wildfire Magazine* and its academic sister, the *International Journal of Wildland Fire* (IJWF) celebrated their 25th Anniversary. In its December 2016 issue, the editors-in-chief of IJWF reminded us that IJWF is the only journal dedicated to publishing peer-reviewed research on all aspects of wildland fire, and thus being the voice of a rapidly globalizing wildland fire science. The motivation to launch the IJWF was not just for a family of scientists to "have their own journal," but to expand insight into the role of vegetation fires in the Earth System.

Two years before the launch of the journal, I recall that Andy Koonce, a wildland fire researcher at the U.S. Forest Service Pacific Southwest Forest and Range Experiment Station in Riverside who passed away several years ago, presented the visions and concept of the *International Association of Wildland Fire* to the international community.

That was in 1989, at the international conference *Fire in the Tropical Biota*, hosted by the Fire Ecology Research Group of Freiburg University, predecessor institution of the GFMC. This conference, including its resulting policy statement, the *Freiburg Declaration on Tropical Fires*, revealed, from an interdisciplinary point of view, that the so far less observed – not to say "forgotten" – regions of the world were playing a major role in the global wildland fire theater. Thanks to Jason Greenlee, the custodian of the world's largest wildland fire library, who served as its first editor, the IJWF was launched in 1991. *Wildfire Magazine*, as it celebrates this landmark anniversary, can be lauded for successively widening its original North America focus to global coverage over the past quarter-century.

The ice melts

In the late 1980s, the "Eastern" fire world was not yet on the screen of an emerging international community of wildland fire scientists and practitioners. No wonder – the *Cold War* had separated the world by the *Iron Curtain* leading to a separate evolution of fire science and fire management systems in both political hemispheres – without exchange and cross-fertilization. The fall of the *Berlin Wall* a quarter-century ago and the thawing

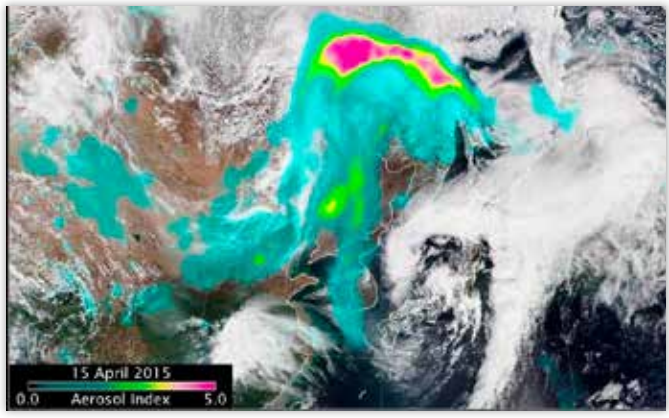
Why fires in temperate-boreal Eurasia have transboundary impacts

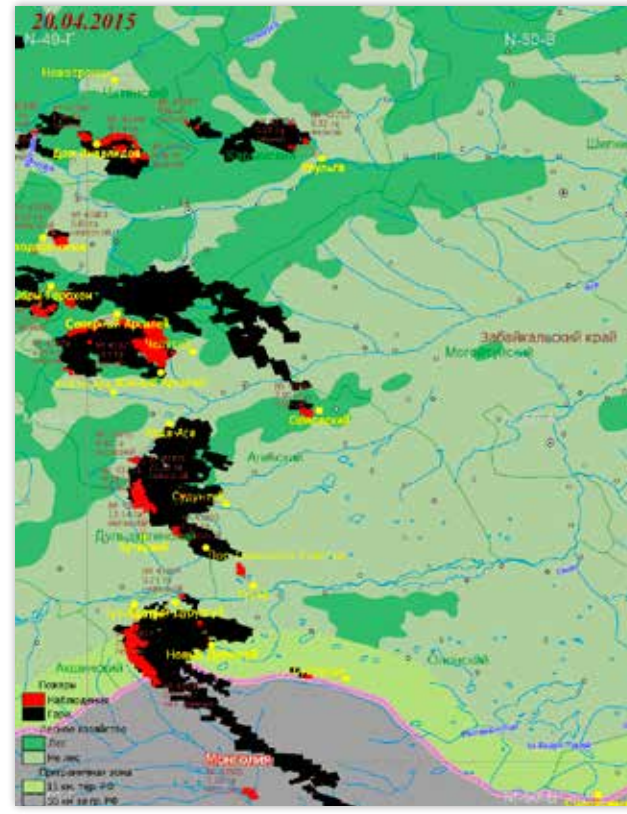
By Johann Georg Goldammer
Director, Global Fire Monitoring Center (GFMC)

of the political ice age, coincided with the advancement of satellite remote sensing capabilities. Indeed, insight from space with the increasing capacity and accuracy of satellite sensors paved the way towards a wildland fire *glasnost* in a region where the visibility and transparency of fires and fire regimes had been obscured.

In 1991, scientific dialogue and technical cooperation in fire management between the East and the West finally commenced. Two years later, the first East-West International Conference *Fire in Ecosystems of Boreal Eurasia* was held In Krasnoyarsk in Central Siberia, followed by the *Fire Research Campaign Asia North* (FIRESCAN) with its *Bor Forest Island Experiment* (1), numerous bilateral and multilateral research projects in the years after and in 1996, the first-ever international conference addressing *Forest Fire and Global Change* was held in Shushenskoe, Siberia. Thus, another landmark anniversary of 25 years of East-West cooperation in fire research management and fire research was commemorated in September 2016 at the headquarters of the Aerial Forest Fire Center *Avialesookhrana* in Pushkino (Moscow Region) and the Sukachev Institute of Forests, Russian Academy of Sciences, Krasnoyarsk (Siberia). These numerous anniversaries bear testament that the late 1980s and the early 1990s saw an awakening and the promise of a globalization of fire science and fire management towards an unprecedented era of exchange and cooperation around the world.

Visual impressions from the wildfire assessment in Eastern Mongolia in May 2015 (above and left). Extended areas of steppe ecosystems, birch, pine and larch forests were affected by the fires. Intensive grazing in and around settlements resulted in low fuel loads and slowing down the wildfire intensity and thus many villages could be successfully defended. Photos: RFMC-CAR.





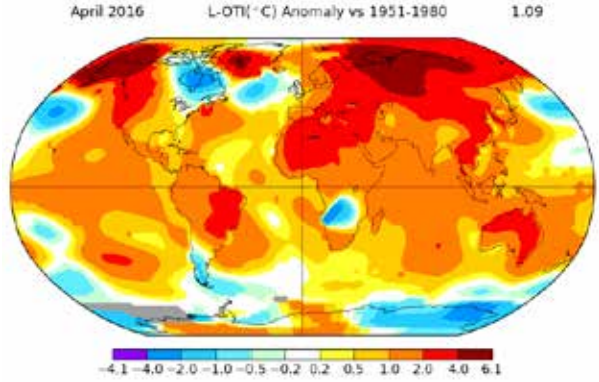
(LEFT) Smoke plumes of the wildfires in Central Asia were transported to the South (North and South Korea) and to the East (reaching the Canadian and the U.S. Pacific West Coast). Satellite observations show the Aerosol Index captured on 15 April 2016: The blue, green, yellow and orange colors show the aerosol concentrations associated with the smoke from the fires burning in Eastern Russia and Eastern Mongolia on 15 April 2015. Source: NASA. (RIGHT) Satellite tracking of wildfires crossing the border between the Russian Federation and Mongolia on 20 April 2015. Daily fire maps like this one are provided by the Sukachev Institute of Forest, Siberian Branch, Russian Academy of Sciences (SB-RAS) and its "Federal Krasnoyarsk Science Center SB-RAS."

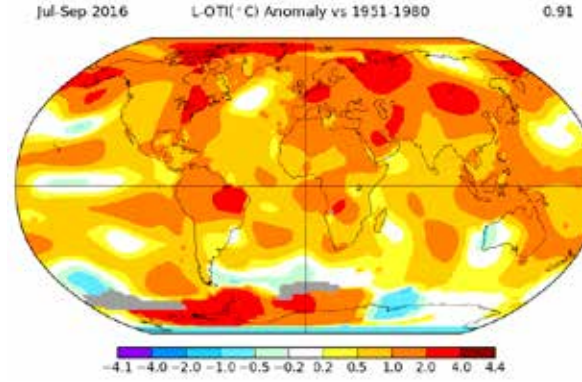
Eastern fires: Mongolia

The past year (2016) we again witnessed significant fire activity around the world. North America experienced wildfires with disastrous effects on local communities – from the devastating rampages of Fort McMurray fire in Alberta, to the tragic loss of life and dark skies over Gatlinburg, Tennessee. A comparatively small wildfire in Israel attracted an international crowd of firefighting airplanes and firefighters rushed in from all over the world. Again, after their response to the Mt. Carmel fires of 2010, Palestinian firefighters crossed the borders and assisted Israel to overcome the emergency – ignoring political and emotional boundaries and following only their mission and oath.

Urban wildfires and those burning at the fringes of urban and residential areas logically attract the attention of the media as human assets, health and lives are at risk. However, similar events in the remote regions of Central Asia did not make headlines.

For instance, in March 2015 wildfires burning in the Southeast of the Russian Federation, notably in *Zabaikal Krai*, claimed 34 lives, injured 7,500 people, destroyed over 1,400 homes and left 5,000 people homeless; by April, these fires had crossed the border into Eastern Mongolia. By the close of April, fires had scorched 5.5 million ha (13.6 million acres) of steppes, forests and pasture lands, killed several thousand livestock and burned down nomadic *gers* and injured several people over an area of more than 2000x (two thousand times) the size of the 2016 fire in Israel – or nearly as big as the entire country of Croatia (see prior pages and above, and online Gallery 1 and 2).





Climate Change Observed: Surface temperature anomalies for April 2016 and the Northern Hemispheric during Summer 2016 for Central Asia as compared to the baseline observations 1951-1980 reveal the above-average recorded temperatures and thus increased meteorological wildfire danger in the northern latitudes – and the need for enhanced preparedness. Source: NASA

The increasingly visible impacts of regional climate change have prompted the governments of Central Asia to take decisive steps to prepare for climate change including changing fire regimes, and to mitigate increasing wildfire threats. In 2015 the *Organization for Security and Cooperation in Europe* (OSCE) assisted Mongolia to set up the *Fire Management Resource Center – Central Asia Region* (RFMC-CAR).

With financial assistance from Switzerland through the OSCE and with technical support from the GFMC, the regional fire center was established at the National University of Mongolia in Ulaanbaatar with the aim to serve Mongolia and its Central Asian neighbors as an advisory and capacity-building center of excellence in fire management. The expertise of the Head of RFMC-CAR, Dr. Oyunsanaa Byambasuren, includes his responsibility as coordinator of the Regional Central Asia Wildland Fire Network and Deputy Chief of GFMC and, among other, as Secretary of the National Coordination Committee on Forest and Steppe Fire Protection (NCCFSFP), an inter-agency fire management coordination mechanism of the government of Mongolia. This is the third such Center since the establishment of two others in Southeast Europe / Caucasus in 2010 (based in Skopje, FYR Macedonia) and Eastern Europe in 2013 (Kiev, Ukraine). And in 2017, two more Regional Fire Management Resource Centers will be established in Southeast Asia (Indonesia) and Latin America (Brazil).(See below and online Gallery 3]

Eastern Fires: Russia

While the 2016 fire season gave Mongolia a break, Russia however, faced extended drought in Central Siberia and the Far East. Satellite imagery of wildfires and a satellite-derived map of aerosol emissions on 18 September 2016 North of Lake Baikal and the regional capital Irkutsk, gives an impression of the size of area affected by fire: The map of fire locations in Siberia and in the Russian Far East during the fire season of 2016 (Gallery 4) show that the territories affected by wildfires stretched from 60° to 135°E within a belt between 50° and 60°N, with main fire-affected regions around Baikal Lake and in the Amur region of the Far East. The preliminary evaluation of satellite data revealed that within Siberia about 14,000 fires burned a total vegetated area of 11.4 million ha (28 million acres), and in the Far East of Russia 4,800 fires affected 6.4 million ha (extent and boundaries of the regions – see map in Gallery 4). In both regions of Russia wildfires larger than 2000 ha affected 8.96 million ha (22 million acres) of forests.

These numbers do not distinguish the different types of fire management regimes in Russia. Since 2016 an amendment of the Federal Forest Code requires the Guidelines on Fire Management to be refined and obliges the regions of the Russian Federation to delineate in detail the different zones of fire response and fire management respectively. Depending on values at risk – economic and ecological values of forests, the socio-economic development of the areas and the natural fire danger risk – three types of fire protection zones will be distinguished:

- **Ground Fire Suppression Zones**: Forest fire suppression using ground resources is obligatory, currently covering ca. 80 million ha countrywide
- **Aerial Fire Suppression Zones**: Obligatory use of aerial firefighting resources in remote areas that cannot be reached by ground forces within 3 hours, currently covering ca. 503 million ha (fire suppression is obligatory)
- **Forest Fire Management (Controlled Regime) Zones**: Regional authorities may decide letting wildfires burn under a controlled regime, currently covering ca. 561 million ha of the country

Details of zoning in the regions are currently under deliberation. This process reflects the response of the government to reorganize and restructure fire management in Russia. In-depth discussions at the science-policy interface had been held over the last years: Two *International Fire Management Weeks* were held in Krasnoyarsk in 2012 and 2013. During these weeks, roundtables and discussion forums for fire scientists, practitioners and decision-makers fostered open discussions of state-of-the-art science, fire ecology and the implications for practical application and strategic planning.

The National Round Table of 2012 concluded that there is an urgent need to revise the policy and practice of fire management

The response: Establishment of the National Coordination Committee on Forest and Steppe Fire Protection in Mongolia, setting up the Regional Fire Management Resource Center and signing of a bilateral agreement between Mongolia and the Russian Federation on cross-boundary fire management, including regular consultations, exchange activities and exercises. Photos: RFMC-CAR.

The 2016 summary map of wildfires in Siberia and the Far East of the Russian Federation was prepared by the Federal Krasnoyarsk Science Center of the Russian Academy of Sciences. This is a pre-publication of the upcoming monograph "Monitoring of wildfires in Siberia: Dynamics of burning under the current climate, the spatial-temporal patterns, characteristics and forecasts", with the permission of the first author Evgenii Ponomarev (4). The publication contains the detailed methodology for satellite-derived data and the land cover and forest maps of Russia used.

in the Russian Federation, and agreed upon 10 recommendations – the *Krasnoyarsk 10-Point Programme on the Future of Fire Management in Russia*. Among other, it was recommended to further develop principles, capacity and apply the use of prescribed fire in Russia. In late 2013 the international congress *Forest Fire and Climate Change: Challenges for Fire Management in Natural and Cultural Landscapes of Eurasia* was held in Novosibirsk and addressed the consequences of climate change on fire regimes and fire management. The congress participants released a statement in which governments of the region were alerted and warned that the threat from wildfires in the region will become increasingly dangerous in the coming years as a consequence of climate change and socio-economic and demographic changes.

While there is a recognized need for enhancing the application of integrated fire management in Central Asia (i.e. the application of sound practices of prescribed burning and the integration of beneficial effects of natural wildfires) the vulnerability of the Eurasian landscape and their inhabitants is growing. The impact of air pollution generated by vegetation fire is one problem that is increasingly noted in many regions of the world. The severe fire and smoke episode in Western Russia in 2010, which affected the regional population through the interactions between extremely high temperatures and air pollution from the wildfires, may have contributed to the premature deaths of more than 2000 people in the Moscow region (2); globally the amount of premature deaths due to vegetation fire smoke is estimated to be in the range of 180,000 people annually (3). In September 2016, for the first time, a group of more than 3000 residents of the City of Bratsk went public and signed a petition under the headline *City of Bratsk is choking from smoke* asking President Putin and his Emergencies Minister for relief. (See above and online Gallery 4.)

The dark side of fire

The dark side of Eurasian fires is almost invisible. The fine particulate matter causing global transboundary headaches is called *Black Carbon (BC)*, also referred to as elemental carbon or soot. BC is microscopically small and primarily emitted by transport and industrial sources, but agricultural burning is emerging as a signifi-

cant yet little-understood source of anthropogenic BC emissions. Human health implications aside, BC particles have a severe environmental impact once deposited on Arctic snow and ice. Black carbon emitted from fires burning in North America and mainly from Eurasia, is transported to the Arctic environment by northerly flowing air masses. The fine particles change the albedo, i.e. the reflectance of incoming solar radiation. While the pristine white snow and ice cover reflects the incoming solar radiation back to space, a BC-darkened surface absorbs solar energy resulting in surface warming and accelerates the melting of snow and ice.

Smoke pollution episodes stemming from Eastern Europe and Russia have led to discussions of whether vegetation fire smoke may be tackled as part of the existing United Nations Economic Commission for Europe (UNECE) *Convention on Long-Range Transport of Air Pollution* (CLRTAP). Recently, this debate has emphasized BC pollution and particularly its effect on the Arctic. The Gothenburg Protocol of 1999 expanded the original 1979 CLRTAP to include numerous industrial pollutants and in 2012 this was amended to include BC as a short-lived atmospheric pollutant with significant climate forcing potential (online Gallery 5).

Apart of the impacts of gaseous and particulate emissions of vegetation fires on human health and climate, there are other collateral damages of wildfires – such as those burning on contaminated terrain, some of which are transboundary. The most dangerous fires are those burning on terrain contaminated by radioactivity and those burning on terrain contaminated by unexploded ordnance stemming from armed conflicts or military activities (online Gallery 7).

The promise of fire

Extended rural areas of temperate-boreal Eurasia are affected by land-use change and / or the abandonment of agricultural and pasture lands. This development is threatening the sustainability and survival of open cultural landscapes including habitats of open-space dependent species. Abandoned lands are undergoing rapid succession. Substitution measures, which are practiced in some places to counter succession and to maintain open space habitats, are often highly subsidized in Western European countries. Mechanical measures or targeted grazing, however, are limited by the sheer magnitude of land area to be treated and by rapidly increasing costs.

Since the 1990s, the use of prescribed fire is increasingly applied in Central and Northern Europe and is now being introduced in integrated fire management approaches for conservation purposes and wildfire hazard reduction in the temperate-boreal coniferous (pine and larch) forests. The rationale, principles and suggestions for the way ahead in the application of prescribed fire in the European biota have been expressed in the *White Paper on Use of Prescribed Fire in Land Management, Nature Conservation and Forestry in Temperate-Boreal Eurasia* and the monograph *Prescribed Burning in Russia and Neighbouring Temperate-Boreal Eurasia* (6). The *Eurasian Fire in Nature Conservation Network* is promoting the use of prescribed fire in conservation, forestry and landscape management and has organized numerous conferences, seminars and workshops addressing fire ecology and fire management throughout temperate-boreal Europe.

The very recent introduction of the use of prescribed fire in Eastern Europe and Russia is encouraging and reflected by the collection of visual impressions (see below and online Gallery 9).

What we've learned, what we need next: the search for common cross-border solutions

With this overview in "Eastern Fires" the GFMC intends to highlight – with emphasis on the Eastern part of the region – specific phenomena and problems of wildland fire in temperate-boreal Eurasia, including transnational issues, and the search for common solutions by cross-border cooperation in fire management.

In most countries of the region, financial support and human capacity for this work is unfortunately rather limited. Thus, networking, exchange and mutual assistance are imperative. These initiatives are coming from civil society – scientists and practitioners – and increasingly from governments. International organizations and frameworks such as the UN international Strategy for Disaster Reduction (UNISDR), the Organization for Security and

Cooperation in Europe (OSCE) and the Council of Europe through its Major Hazards Agreement in close cooperation with the Global Wildland Fire Network, have been essential drivers in this process.

UNISDR IWPM
International Wildfire Preparedness Mechanism

EuroFire

FOCUS on COOPERATION: In 2013 the UNECE Regional Forum on Cross-Boundary Fire Management, which was organized by the GFMC at the United Nations in Geneva, issued this key recommendation: "The cross-boundary effects of wildfires require jurisdictions at all levels to cooperate in fire management and to define collective solutions. While prime emphasis should be given to cooperation in fire management between jurisdictions sharing common borders, the long-range consequences of fire emissions are calling for strengthening existing and, if necessary, developing additional protocols addressing the reduction of adverse consequences of wildfire at international level."

REFERENCES

(1) FIRESCAN Science Team (Goldammer, J.G., Stocks, B.J., Furyaev, V.V. and Valendik, E.N., coord.) 2013. The Bor Forest Island Fire Experiment, Fire Research Campaign Asia-North (FIRESCAN). In: Prescribed Burning in Russia and Neighbouring Temperate-Boreal Eurasia (J.G. Goldammer, ed.), 149-231. Kessel Publishing House, 326 p. (ISBN 978-3-941300-71-2).

(2) Shaposhnikov, D., B. Revich, T. Bellander, G. Bero Bedada, M. Bottai, T. Kharkova, E. Kvasha, E. Lezina, T. Lind, E. Semutnikova and G. Pershagen. 2014. Mortality related to air pollution with the Moscow heat wave and wildfire of 2010. Epidemiology 25 (3), 359-364.

(3) Lelieveld, J., J.S. Evans, M. Fnais, D. Giannadaki and A. Pozzer. 2015. The contribution of outdoor air pollution sources to premature mortality on a global scale. Research Letter, Nature Vol. 525, doi:10.1038/nature15371

(4) Ponomarev, E.I., V.I Kharuk and E.G. Shvetsov. 2017. Monitoring of wildfires in Siberia: Dynamics of burning under the current climate, the spatial-temporal patterns, characteristics and forecasts. Nauka, Novosibirsk (in prep.)

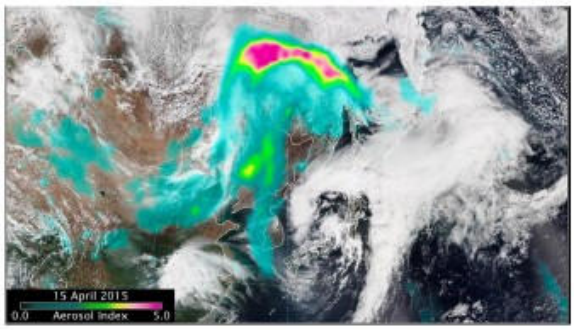
(5) Goldammer, J.G., E. Brunn, S. Hartig, J. Schulz, and F. Meyer. 2016. Development of technologies and methods for the application of prescribed fire for the management of *Calluna vulgaris* heathlands contaminated by unexploded ordnance (UXO): Problems and first experiences gained in a research and development project in Germany. Naturschutz und Biologische Vielfalt 152, 87-122. DOI 10.19213/973152; ISBN 978-3-7843-4052-4.

(6) Goldammer, J.G. (ed.) 2013. Prescribed burning in Russia and neighbouring temperate-boreal Eurasia. A publication of the Global Fire Monitoring Center (GFMC). Kessel Publishing House, 326 p. (ISBN 978-3-941300-71-2).

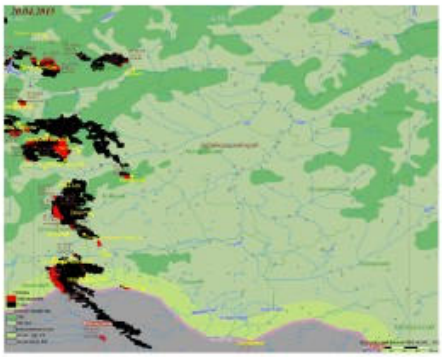
The aim of prescribed fire application in temperate-boreal Europe is to maintain biodiversity-rich open vegetation and landscapes that are home to species endangered by forest succession.
Networking and Exchange of Fire: Practitioners and targeted public relations work have proven essential in introducing prescribed fire in sustainable forest management and conservation in Mongolia, Ukraine, Russia and Poland. Examples include Pg 24, left: First prescribed burning training course for students in Mongolia, 2015. Pg 24, right: Training of prescribed burning practitioners and university students in Ukraine, 2015. Pg 25, left: First pubic demonstration to the media and practitioners of prescribed burning and underburning in Russia, 2012. Pg 25, right: A team of fire managers setting the first prescribed burn in Poland, 2015. Photos: A. Zamakhin and GFMC.

Eastern Fires, Western Smoke

*These **online galleries** expand on the article and share mores stories than could be published in the print version.* ***Text by Johann Georg Goldammer.***



Online Gallery 1. Wildfires in Central Asia 2015 with smoke plumes stretching to South Asia and across the Pacific. Smoke plumes of the wildfires in Central Asia were transported to the South (North and South Korea) and to the East (reaching the Canadian and the U.S. Pacific West Coast). Satellite observations show the Aerosol Index captured on 15 April 2016: The blue, green, yellow and orange colors show the aerosol concentrations associated with the smoke from the fires burning in Eastern Russia and Eastern Mongolia on 15 April 2015. Source: NASA.

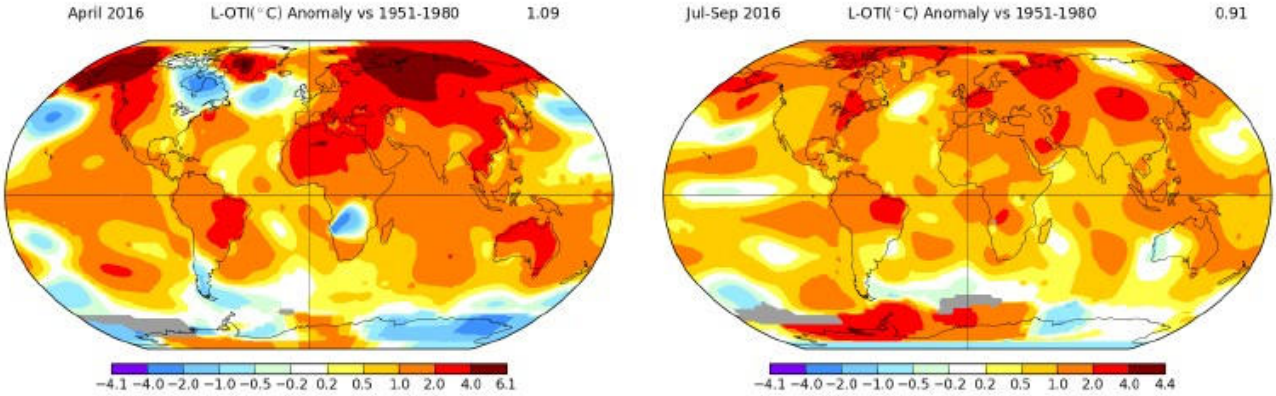


Left: Satellite tracking of wildfires crossing the border between the Russian Federation and Mongolia on 20 April 2015. Daily fire maps like this one are provided by the Sukachev Institute of Forest, Siberian Branch, Russian Academy of Sciences (SB-RAS) and its "Federal Krasnoyarsk Science Center SB-RAS." Right: On-site verification and ground verification of the wildfire impacts in Eastern Mongolia by the Fire Management Resource Center – Central Asia Region (RFMC-CAR), May 2015. Photo: RFMC-CAR.

Online Gallery 2. Wildfire assessment, Eastern Mongolia 2015. Visual impressions from the wildfire assessment in Eastern Mongolia in May 2015: Extended areas of steppe ecosystems, birch, pine and larch forests were affected by the fires. Intensive grazing in and around settlements resulted in low fuel loads and slowing down the wildfire intensity and thus many villages could be successfully defended. Photos: RFMC-CAR.

Eastern Fires, Western Smoke
Online Galleries

Online Gallery 3. Climate-change impacts on fire regimes of Central Asia and the response by governments.

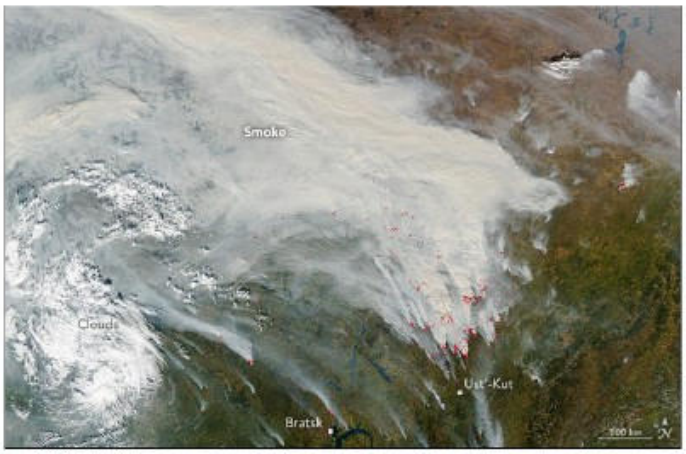


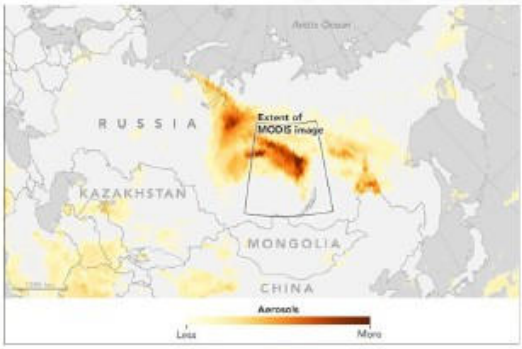
Climate Change Observed: Surface temperature anomalies for April 2016 and the Northern Hemispheric during Summer 2016 for Central Asia as compared to the baseline observations 1951-1980 reveal the above-average recorded temperatures and thus increased meteorological wildfire danger in the northern latitudes – and the need for enhanced preparedness. Source: NASA.

The response: Establishment of the National Coordination Committee on Forest and Steppe Fire Protection in Mongolia, setting up the Regional Fire Management Resource Center and signing of a bilateral agreement between Mongolia and the Russian Federation on cross-boundary fire management, including regular consultations, exchange activities and exercises. Photos: RFMC-CAR.

Online Gallery 4. Wildfires burning in the Russian Federation in 2016 – a year of severe drought.

Eastern Fires, Western Smoke
Online Galleries





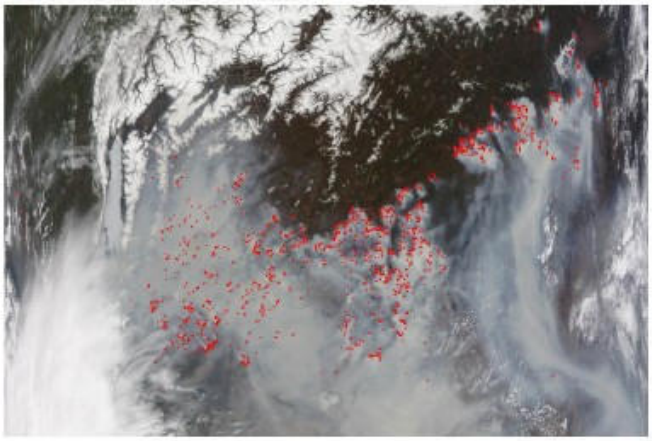
Wildfires depicted by the MODIS sensor and a satellite-derived map of aerosol emissions on 18 September 2016 North of Lake Baikal. Source: NASA.

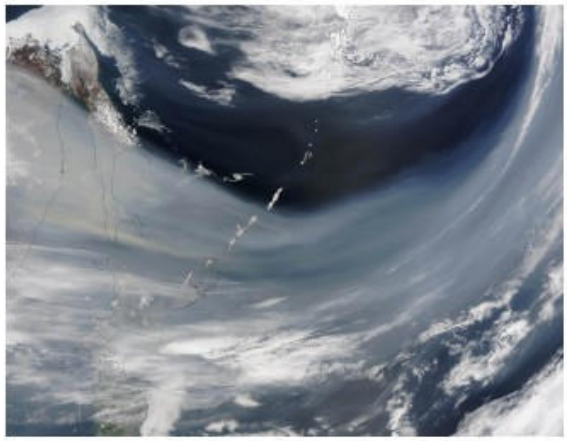
The **smokejumper team** of the Primorskiy *Avialesookhrana* Airbase (Aviabase) of Vladivostok – a regional elite airborne firefighting team of the Russian Federation under leadership of Vasiliy Medvedev (center, second row from the top) – was extremely challenged by multiple large fires in 2016. Photo: Primorskiy Air Base of *Avialesookhrana*

In order to **support regional aerial firefighting teams** the Federal Firefighting Reserve provided additional reinforcements. Chita, one of the regions east of Baikal Lake, was a hotspot in 2016. Photos: *Avialesookhrana*.

Online Gallery 5a: Cross-boundary pollution – the sources and the impacts. Left: Burning of agricultural residues and abandoned agricultural lands (fallow) is a common practice across Eastern Eurasia. Right: Open-land fires successively enter forest fringes resulting in gradual forest regression and decline – such as pictured here in the Irkutsk region, Russia. Photos: GFMC.

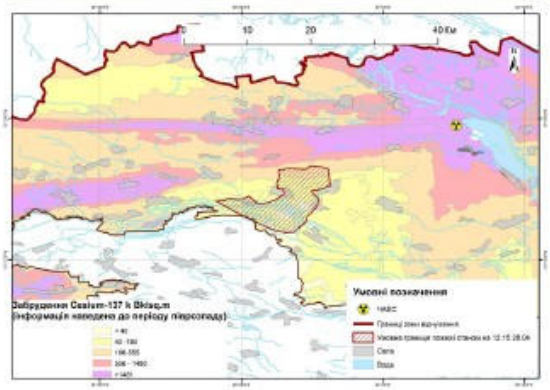
Eastern Fires, Western Smoke
Online Galleries





Online Gallery 5b: Cross-boundary pollution – the sources and the impacts Long-range transport of atmospheric pollutions: Grassland-burning is a common practice in Central Asia, resulting in smoke plumes stretching to the East, often crossing the Far East of Russia, Sakhalin, Japan, reaching to North America and finally traveling circumpolar back to Russia via Europe. Satellite images of May 2003: NASA.

Online Gallery 6: Wildfires burning on terrain contaminated by radioactivity.



Wildfires burning in the Chernobyl Exclusion Zone pose a high risk of secondary contamination of firefighters on the ground and through long-range transport of radioactive smoke. The upper left image shows a satellite-derived map with a fire burning on 28 April 2015, West of the reactor No. 4 which failed in 1986. On the right: Burned area on a map showing the concentration of Cesium-137 contamination. The lower satellite image shows a smoke plume traveling from another fire in the same area on 10 August 2015, stretching into neighboring territories of the Ukraine and the Russian Federation. The photo on the right shows the scrape yard of abandoned helicopters and fire engines that were contaminated during the first response to the nuclear accident in 1986. Satellite Images and map: NASA and Regional Eastern European Fire Monitoring Center (Kiev, Ukraine). Photo: GFMC.

Eastern Fires, Western Smoke
Online Galleries

Many cultural and natural landscapes of Eurasia are **contaminated by unexploded ordnance (UXO)** stemming from armed conflicts or military activities. In Central Europe, Southeast Europe and Eastern Europe wildfires burning on UXO contaminated terrain cover several hundred thousand ha of land in Germany and also pose a threat of uncontrolled explosions to firefighters throughout Eastern and Southeastern Europe and the South Caucasus. Armored fire suppression technology has been developed and prescribed burning on contaminated terrain have been executed by public-private partnerships in Germany (5). The pictures show a 125 mm grenade exposed (not exploded) by a low-severity surface fire in NNE Germany; the SPOT-55 fire suppression tank with 1,000 l water in action; and a BMP OT-R5 command tank converted for prescribed burning and suppression firing with a Pyroshot Green Dragon ignition sphere launcher and an ATV Drip torch. Photos: GFMC.

Online Gallery 8: Regional cooperation and policies. The OSCE, through its Office for the Coordination of Economic and Environmental Activities and the GFMC, are **addressing wildfire disaster risk reduction** in its Participating States. As a symptom of developments in Europe, the terms necessary and unnecessary burning in the agricultural sector in temperate-boreal northern Eurasia, have entered the wildland fire terminology. The photo shows an OSCE mission in the South Caucasus, monitoring landscape fires. The development of national fire management policies and related implementation strategies is the main aim of the OSCE approach. Photo: GFMC

Eastern Fires, Western Smoke
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Online Gallery 9: Use of prescribed fire in conservation and forestry. The aim of prescribed fire application in temperate-boreal Europe is to maintain biodiversity-rich open vegetation / landscapes, which are home to species endangered by forest succession. Photos: J. Prüter and GFMC.