Predicted and observed climate-induced fire in the Altai-Sayan mountains, Central Asia, in the past, present and future

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Fire is largely under the control of weather and climate. Modern satellite and ground data show an increase in extreme fire seasons in Siberia, which coincides with the warmer and longer fire seasons of the contemporary climate. Ten of the last twelve years 1997-2008 have resulted in extreme fire seasons in Siberia. Under future climate change, fire frequency, fire severity, area burned and fire season length are predicted to increase in boreal regions. From paleontological data in the south of Siberia, large amounts of charcoal are found in deposits associated with large fires during forest-to-steppe transitions induced by climate warming in the past.

Our goal is to predict high fire danger periods in the past, present and future over a vast mountain country, Altai-Sayan and Central Asian,, using different climate change scenarios from 10000 years before the present (BP) through the present to 2080 AD.

In the past, climate change scenarios were derived from pollen-based reconstructuions of paleovegetation and climates for 10000 BP, 8000 BP, 5300 BP, 3200 BP. To define contemporary fire-weather relationships, daily satellite-based weather data are used to calculate daily fire weather maps for a two year period that represents a normal fire year and an extreme fire year. These maps are overlain with fire datato establish the relationship between fire activity and fire weather.. For the future, two International Panel of Climate Change (IPCC, 2007) climate change scenarios from the Hadley Centre HadCM3, which reflect the largest (A2) and lowest (B1) temperature increase by 2080, are used.

To estimate potential fire danger for past and future climates, a linear regression model (with a determination coefficient 0.52) was used that relates an annual number of days with high fire danger (Nesterov index is greater than 4000) to annual moisture index, a ratio between growing degree-days above $5^{o}C$ to annual precipitation, charaterising dryness/wetness of the climate.

In the past, between 8000-5300 BP, under warm and moist climates, forests covered about three quarters of the Altai-Sayan mountains, mainly in the northern half. About 30-40 high fire danger days occurred on 60% of the entire forest area and 40-50 days occurred on the area twice less those times (don't understand ?maybe "occurred on an area half that size"?). Between 10000 BP and 3200 BP, under colder and dryer climate, forests covered only 30% of the area and 30-40 high fire danger days occurred on about 55% of the forest area and 40-50 high fire danger days occurred on 35% of the forest area. In the future warmer and dryer climate, the propotionalnumber of high fire danger days would be opposite: the number of high danger days 40-50 would prevail on 60% (the B1 scenario) of the area and on 70% of the forest area in the A1 scenario.

Thus, in the future, fires are predicted to be more severe and extended than in the past, because future climates are predicted to be warmer and dryer, in comparison to the past warmer and wetter climate.